natural scotland
SCOTTISH GOVERNMENT

Improving the physical condition of Scotland's water environment

A supplementary plan for the river basin management plans

contents

Contents

Executive summary

This plan identifies the work needed to deliver an improvement in the physical condition of Scotland's water environment. This will improve ecology and enhance the value of the resource for others, such as landowners, fishermen and the general public. Such improvements also have significant benefits for the wider environment, especially climate change adaptation and flood risk management.

Four principles were used to help define this plan's approach to restoration:

- Planning at the catchment scale.
- Allowing nature to do the work.
- Working in partnership.
- Supporting sustainable development.

Where improvements are considered proportionate, the following measures will be applied as appropriate:

- Provide support and encouragement for voluntary initiatives.
- Use regulatory powers under Controlled Activities Regulations (CAR) to deliver improvements to licensed structures.
- Develop asset management approaches with operators, to deliver improvements to non-licensed structures such as bridges, culverts and fords.

A combination of support, funding and regulatory actions are needed to deliver significant improvements in the following key areas:

- Removing barriers to fish migration (led by the Rivers and Fisheries Trusts of Scotland and the Scottish Environment Protection Agency (SEPA)).
- Improving rural rivers (led by SEPA in consultation with advisory group partners).
- Improving rivers in our towns and cities (led by local authorities with support from SEPA).
- Improving our estuaries and coasts (led by Marine Scotland and SEPA).
- Addressing flood risk in a way that delivers environmental benefits (led by local authorities with support from SEPA).

A number of organisations will have responsibility for delivering these actions, and oversight of this delivery will be provided at a national level by the River Basin Management Planning National Advisory Group and at a local level by the area advisory groups. Successful delivery of the actions will bring many benefits for Scotland, but can only be achieved through partnership working.

1. Introduction

The water environment is one of Scotland's great natural assets. It is part of our iconic landscape and it supports a rich and diverse wildlife. These environmental benefits are important in their own right, but the quality of our water environment also has important social and economic consequences.

Many recognise the amenity and recreational value of rivers, lochs, estuaries and coastal waters, and the important contribution they make to attracting tourists to Scotland. Perhaps more important, however, is the contribution that the quality of the environment makes to health and wellbeing.

Economically, water is essential for industries such as food, drink and agriculture, and a wide range of sectors are dependent upon Scotland's natural resources and the high quality reputation of Scotland's water environment.

Although much of Scotland's water environment is in a good condition, over a third of it does not currently meet the 'good ecological status' (or good ecological potential) objective[1] of the European Water Framework Directive. This is partly a result of changes to the physical condition of coastal areas, rivers and lochs, which affect a quarter of Scotland's water bodies.

Changes to the physical condition of the beds, banks and shores of rivers, lochs and coastal waters have historically been caused by engineering for urban development and rural land management. These include changes such as straightening, culverting, impoundment and alteration of bankside vegetation.

Scotland has a statutory obligation to deliver improvements in the condition of the water environment. This requires us to develop plans which will move the water environment towards good ecological status (or potential) and ensure that the water environment can deliver a full range of environmental and socio-economical benefits.

In 2009, Scotland published river basin management plans (RBMPs)[2] for the Scotland and Solway Tweed river basin districts. These plans set out objectives to improve the water environment, along with a programme of actions to deliver these improvements. Since then, the organisations involved in managing the water environment have developed supporting supplementary plans covering some of the more difficult areas of work. For example, a partnership approach has been essential in developing and delivering the rural diffuse pollution plan for Scotland (see Diffuse Pollution Management Advisory Group website).

Scotland needs to address the physical condition of its water environment in order to provide good habitats and a sustainable water environment, and deliver the RBMP objectives. This plan will help the Scottish Environment Protection Agency (SEPA), responsible authorities[3], land managers and other stakeholders take forward restoration measures which deliver a wide range of benefits in a proportionate way.

This plan will also help to inform the priorities and actions for the second RBMPs (for 2015 to 2021), currently under development. We will consult on proposals for the second plans in 2014.

Cross-border issues

This plan has been written to support and enable improvement of the physical condition of water bodies in Scotland. However, there are a number of rivers and coastal waters which cross the border between Scotland and England. There is already effective cross-border working between agencies on these water bodies. It is intended that the ideas in this plan will support discussions on how to deliver cross-border improvements in the condition of water environment.

To take this forward, SEPA and the Environment Agency will work in partnership to examine these issues on a catchment basis. The role of RBMP area advisory groups in the Tweed and Solway will be particularly important in making these links.

1 See ministers' policy statement Principles for setting objectives for the river basin management plan.

2 The Solway Tweed plan covers the border catchments (including those parts in England) and the Scotland plan covers the remainder of the country.

3 Scottish ministers have identified a number of responsible authorities to work alongside SEPA. They are Scottish Natural Heritage, Scottish Water, Forestry Commission Scotland, British Waterways Board, local authorities, district salmon fisheries boards and national park authorities.

2. Vision

Our vision is to improve the physical condition of Scotland's water environment, so that it can deliver a wide range of services to support people's health and enjoyment, sustainable economic growth, and wildlife. This will require:

- greater integration of policy;
- a clearer framework of action for organisations and land managers;
- integration of plans to inform local decision making;
- a greater pool of resources to drive action.

To support delivery of this vision, this plan sets out the work needed to deliver improvements to the physical condition of Scotland's water environment and meet our river basin management plan objectives. It discusses the key restoration challenges, and describes a phased and prioritised approach to achieve the environmental objectives set out in the river basin management plans in a proportionate way.

Principles

There are some key principles which are important when considering how to deliver improvements to the water environment:

- **Plan at the catchment scale.** Physical pressures on habitats operate at the catchment scale and therefore require solutions to be developed at a catchment scale.
- **Support nature to do the work.** In many cases the environment will improve by itself if the pressures causing harm are removed. A good example is the condition of eroding river banks which can stabilise if grazing pressure is reduced.

The sustainable land-use principles defined by the Scottish Government's land use strategy underpin the plan, in particular:

- promoting the delivery of multiple benefits;
- understanding the functioning of ecosystems, and working to maintain the benefits of ecosystem services;[4]
- defining a partnership approach to managing the water environment whilst underpinning this by a backstop of regulation to protect public interests;
- recognising the significance of the primary use of some land (for example food production, flood management);
- looking for opportunities to deliver climate change adaptation and mitigation;
- enhancing Scotland's rural landscape and providing opportunities to encourage access to the countryside;
- supporting the regeneration of urban derelict land.

Objectives

Improving the physical condition of the water environment will:

- progressively achieve the objectives and measures set out in the river basin management plans. Phased implementation will develop our understanding of priorities, constraints and techniques. This will allow us to refine the objectives for physical condition in future river basin management plans;
- promote the sustainable management of the water environment. Some rivers and coastal waters require ongoing maintenance by landowners because historic engineering or land use has led to exaggerated rates of erosion or sediment accumulation. A wider catchment-scale approach to sediment management can identify and remedy the underlying causes.

4 Defined by *Getting the best from our land - A land use strategy for Scotland* as 'the natural services that we need: goods such as food, timber, energy; services such as the purification of water and the regulation of the climate; and less tangible benefits such as opportunities for recreation, exercise, inspiration and reflection'.

In addition, through partnership working, this plan is also likely to achieve a wide range of environmental, social and economic benefits, as follows:

- Improve the biodiversity of the water environment and associated habitats (for example wetlands and woodlands) by promoting networks for wildlife along rivers, lochs, estuaries and coastal waters. This would contribute to the restoration and protection of aquatic sites designated for nature conservation, deliver the Scottish biodiversity strategy and link with local biodiversity action plans.
- Improve the fisheries of rivers and lochs by ensuring that habitats required for migratory fish species are protected and enhanced. Removing and modifying obstructions to fish migration caused by man-made barriers will be especially important.
- Reduce diffuse pollution from land use activities, such as farming and forestry, by improving the condition of riparian and coastal zones so that they intercept pollution more effectively.
- Contribute to climate change adaptation and mitigation by promoting habitat networks and promoting measures that absorb carbon. Make the water environment more resilient to the consequences of climate change (e.g. increased flooding and droughts).
- Reduce flood risk, particularly by contributing to natural flood risk management approaches identified by the national flood risk management planning process. Contribute to identifying and mitigating local flood risks affecting individual farmers and land owners.
- Contribute to improving the rural landscape and regenerating urban areas by improving the accessibility and quality of the water environment. Enhancing these green networks can increase people's quality of life, boost their physical activity and bring health benefits. This will link with approaches such as the Central Scotland Green Network and the Glasgow and Clyde Valley Green Network.
- Support sustainable economic growth in particular the development of rural businesses, by improving the condition of environmental resources upon which these businesses depend. More widely, improved physical condition will have benefits for water quality, and could keep water treatment costs down.

Policy integration

This plan is focused on achieving the objectives to improve the water environment set by the first river basin management plans in 2009. It facilitates the development of a common understanding of the actions required to improve the water environment. An integrated approach will be essential to ensure the most proportionate solutions are adopted which can collectively and consistently deliver Scotland's objectives for:

- the water environment, through the RBMPs;
- managing flood risk, through the flood risk management strategies and local flood risk management plans;
- decision-making in the marine environment, through a national marine plan and regional marine plans;
- sustainable development, through local authority strategic development plans and local development plans;
- conserving biodiversity through the refreshed biodiversity strategy.

The improvement of Scotland's water environment can also help to deliver against a wider range of national policy objectives, including those for regeneration, sustainable development, and climate change. At a local authority level, there are clear links with single outcome agreements, biodiversity duties and work on economic development, placemaking, access and green networks.

3. Taking action

This section outlines the general actions needed to achieve RBMP objectives for the restoration of Scotland's water environment. Later sections (5 to 9) set out more detailed actions to deliver targeted improvements to the water environment.

Taking a proportionate approach

The policy framework created to implement the RBMPs[5] provides a series of checks and balances for any action to deliver environmental improvements. The framework sets out a technically feasible and proportionate approach to prioritising improvements in the water environment. It would not be appropriate to seek to restore all water bodies to good ecological status (or potential) as that could have adverse social or economic consequences. The policy also notes that certain uses, such as hydropower or traditional flood alleviation schemes, may depend upon substantial physical alterations and that these water bodies can be designated as heavily modified. It is an important principle that objectives set for such water bodies should not result in a significant impact on their uses.

Before restoring a water body, there must be good reasons for doing so and all the consequences should be considered. Important benefits to society can be delivered whilst avoiding disproportionate adverse impacts upon landowners or operators, but this will rely on careful assessments with water supply, hydropower, recreation, land management and other sectors. In certain situations additional action may be required if, for example, improvements are required in respect of Natura protected areas[6] or for flood risk management.

Any new proposals for heavily modified water bodies (HMWBs) will be subject to full consultation as part of the development of the second RBMPs.

Working at a catchment level

Our overall approach for delivering improvements to the physical condition of the water environment will be to take a managed approach to identifying projects at a catchment level. Understanding the pressures and identifying solutions at a catchment scale is essential, as there are large-scale processes at work in a catchment. Sediment, in particular, moves at a catchment-scale or along coastal zones. Thinking on a catchment-scale enables decision makers to avoid transferring an erosion risk or reducing flood risk in one site but increasing it downstream. Only by taking a catchment approach can land managers be confident that the overall impact will be positive and multiple benefits achieved.

In addition, by taking a catchment approach, the plan will make a contribution to delivering the objectives defined by the Scottish Government's land use strategy:

1. Land based businesses working with nature to contribute more to Scotland's prosperity.
    - Reduce the costs of managing the water environment by tackling problems at source.
    - Support land based industries and communities to maximise opportunities provided by a good water environment, e.g. whisky industry, rural businesses.
2. Responsible stewardship of Scotland's natural resources delivering more benefits to Scotland's people.
    - Improve fisheries by improving the condition of rivers and fish passage.
    - Reduce flood risks by promoting natural flood management.
    - Development of buffer strips or green corridors along the sides of rivers which improve the wildlife and recreation value of our water environment.

5 See: www.scotland.gov.uk/Resource/Doc/173709/0048450.pdf

6 See: www.snh.gov.uk for more detail of these protected areas.

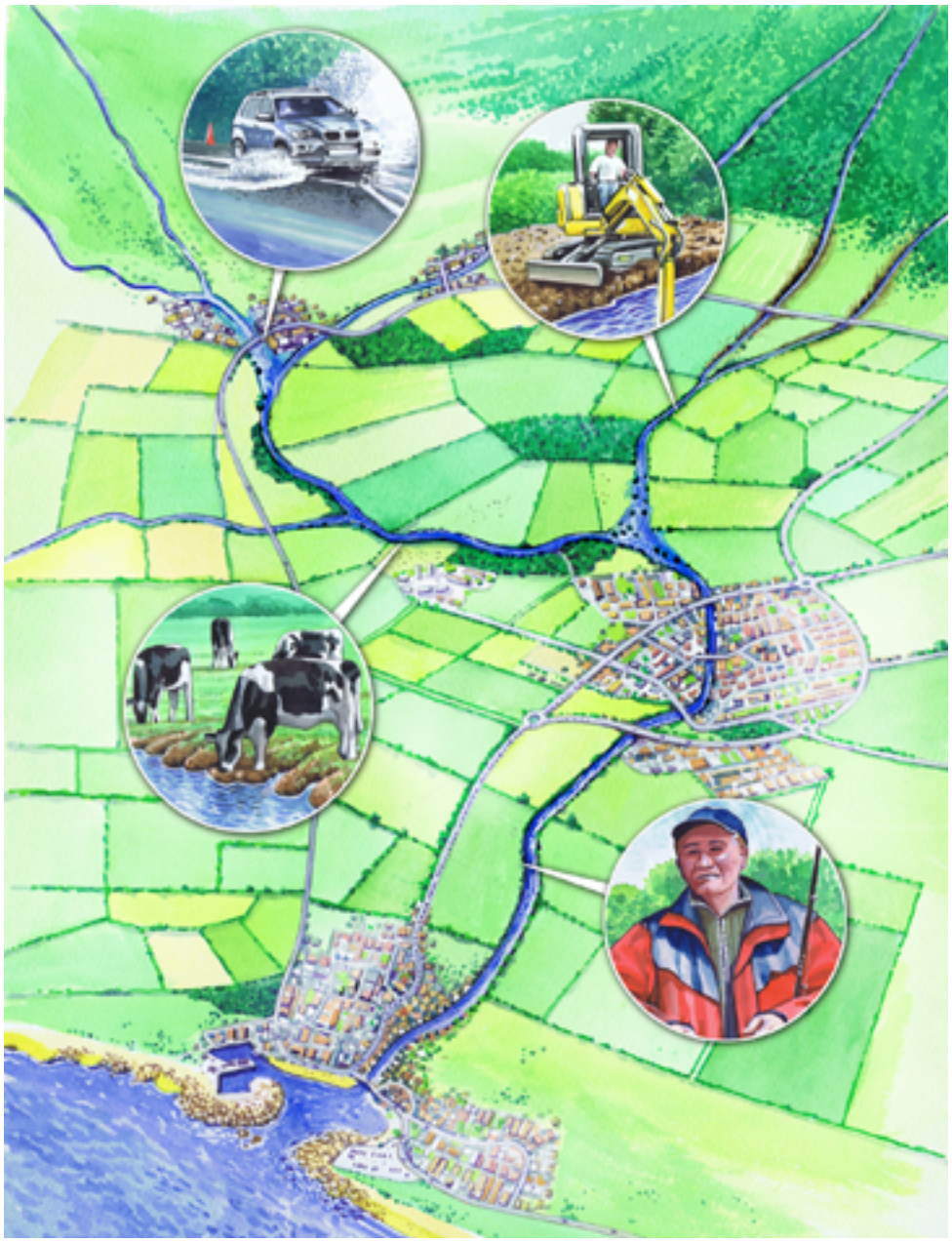
3. Urban and rural communities better connected to the land, with more people enjoying the land and positively influencing land use.

   - Create green corridors along rivers which provide the potential to improve access to the countryside thereby improving the welfare of people who live in Scotland's villages, towns and cities.
   - Support the restoration of derelict land within urban areas to provide greenspace for people to enjoy.
   - Contribute to integrated habitat networks, which will help to protect biodiversity, offer opportunities for amenity and deliver local biodiversity action plan and forestry and woodland strategy objectives.

To help deliver this catchment approach, the second river basin management plans will draw together the successful programme started to tackle diffuse pollution with a catchment approach for restoration of physical condition.

Figures 1a and 1b show how this type of catchment approach can result in a range of social, economic and environmental benefits.

Figure 1a: Physical condition of a catchment before improvement



The illustration shows:

- Rivers draining the hills with poor bank vegetation cover and, as a result, the banks are rapidly eroding. The silt is carried downstream and the deposited in the river once the river gradient flattens. The farmer has to regularly dig the silt out of the river, incurring maintenance costs.
- Fishing in the river is poor. A combination of pollution, damage to spawning beds and barriers to fish migration has compromised fish populations.
- Farming up to the edge of the river damages bank vegetation and does not provide a barrier to pollution passing from the land to the river. The river no longer looks attractive and does not contribute to a diverse landscape. Pollution and damage to the river banks reduces the biodiversity and amenity value of the river.
- The tributary above the village has been straightened and drained and in some places flood embankments have been constructed. As a result river levels increase very rapidly during heavy rain and this leads to flooding of the village roads adjacent to the river.

Figure 1b: Physical condition of a catchment after improvement

The illustration shows:

- Upstream tree planting and the protection of the river banks from grazing and trampling by stock have reduced erosion and downstream pollution.
- Providing more space for rivers has allowed the construction of access paths along the river. This allows cycling and walking, with benefits for health and quality of life, reduced traffic congestion, and potential to develop rural businesses.
- The removal of barriers to fish migration and habitat improvement has led to the recovery of fish populations. The increased value of the fishery generates more income for landowners and local businesses.
- Riparian woodland, restoration of meanders and wetlands, and removal of redundant flood embankments means that water moves more slowly through the catchment, reducing the frequency and severity of downstream flooding.

Setting priorities

Within the catchments prioritised in the second river basin management plan, the aim will be to target where actions will achieve the greatest benefits and to encourage and support voluntary initiatives in these areas. The area advisory groups set up as part of the river basin management planning process will make an important contribution to facilitating this process, and wider partnership work and awareness raising will also be needed.

Using voluntary approaches

Within catchments, we will encourage action through a voluntary approach, supported by good communication of the multiple benefits which can be gained from restoration.

The primary approach to improving physical condition will involve supporting those who have a role in managing the water environment, by identifying actions which will deliver improvements and bring wider benefits. SEPA may also contribute (via the Water Environment Fund[7]) by funding catchment-scale studies to identify where action can be taken to restore natural processes which can lead to reduced intervention for managing flooding or erosion. This information will help land managers reduce the work required to manage rivers while improving the environment.

There are a range of grants, including the Scotland Rural Development Programme (SRDP) and Water Environment Fund, which can help landowners undertake work to deliver environmental and other benefits. Partner organisations will also need to work together to ensure that their grant application processes are aligned with the objectives of this plan, and SEPA will work to ensure that links are made with other policy drivers such as the EU Birds and Habitats Directives and the Scottish forestry strategy. Partner organisations could also work jointly to apply for additional sources of funding, such as European funding, to deliver major improvement programmes.

Using regulatory action where appropriate

Regulatory action will form part of the approach, where appropriate, to ensure that action is taken to deliver prioritised improvements. For instance, SEPA will use the CAR regulatory regime to review existing authorisations covering impoundments and engineering work to require removal or modification of barriers to fish migration.

Where structures (such as bridges and culverts) impact on the physical condition of the water environment, asset owners are expected to include any mitigation measures in their asset replacement and maintenance programme. SEPA will develop an asset management approach which works with these operators to identify proportionate approaches for improving physical condition. Scottish ministers are considering the development of restoration powers[8] which would enable SEPA to require mitigation measures for assets which are causing environmental problems. It is likely that these powers could be used to require modification of physical structures (such as bridges and culverts) which are causing an adverse impact on the water environment.

7 See: www.sepa.org.uk/water/restoration_fund.aspx for details of this fund, established by SEPA and Scottish Government.

8 Under Section 22 of the Water Environment and Water Services (Scotland) Act 2003.

4. Where should we focus our efforts?

Overall scale of the restoration task

In Scotland, around one in four surface water bodies are affected by changes to their physical condition, resulting in failure to reach the river basin management plans' objective of good ecological status / potential. Alterations to beds and banks, such as straightening, culverting or embankments, downgrade the ecological status of 17% of water bodies, while 12% are affected by barriers to migratory fish. Table 1 shows the proportion of surface waters in Scotland affected by physical alterations.

Table 1: Summary of pressures affecting Scotland's surface water bodies[9]

	Total number of surface water bodies	Percentage of number of surface water bodies
Surface water bodies in Scotland (excluding groundwater)	3233	100%
Surface water bodies at less than good ecological status / potential	1261	39%
Water bodies at less than good ecological status / potential because of physical changes (including changes to beds and banks, and fish barriers)	830	25%
Water bodies at less than good ecological status / potential because of changes to physical condition of beds and banks	546	17%
Water bodies at less than good ecological status / potential because of barriers to fish migration.	375	12%

Key morphological pressures upon the water environment

Table 1 and Figures 2a and 2b show that morphological impacts affect a significant proportion of Scotland's water bodies in catchments throughout Scotland. Tackling these should bring a range of benefits. This plan sets out the approach for delivering improvements in the following key areas:

- **Barriers to fish migration.** Barriers have a large impact upon the environment and have social and economic consequences. These issues are discussed in Section 5.
- **Rural rivers and lochs.** Agricultural and forestry land management result in straightening and dredging of rivers and damage to riparian vegetation. These issues are discussed in Section 6.
- **Rivers in our towns and cities.** In urban areas, development of residential and industrial areas, resulting in culverting and hard engineering alterations to river banks. These issues are discussed in Section 7.
- **Estuaries and coastal waters.** Land reclamation and infrastructure for navigation and ports have affected morphology. These issues are discussed in Section 8.
- **Addressing flood risks in a way that delivers environmental benefits.** Pressures that contribute to flooding can often be closely associated with pressures which affect the status of rivers. Consequently, it is especially important that this plan considers how to deliver morphological restoration which links as closely as possible with flood risk priorities. This is discussed further in Section 9.

9 Data from 2008 classification, as published in 2009 RBMPs. Some water bodies are affected by both changes to beds, banks and shores, and barriers to fish migration, so the total of figures in rows 4-5 do not equal the totals in row 3.

Figure 2a: Water bodies at less than good ecological status / potential because of morphology pressures (excluding fish barrier pressures)

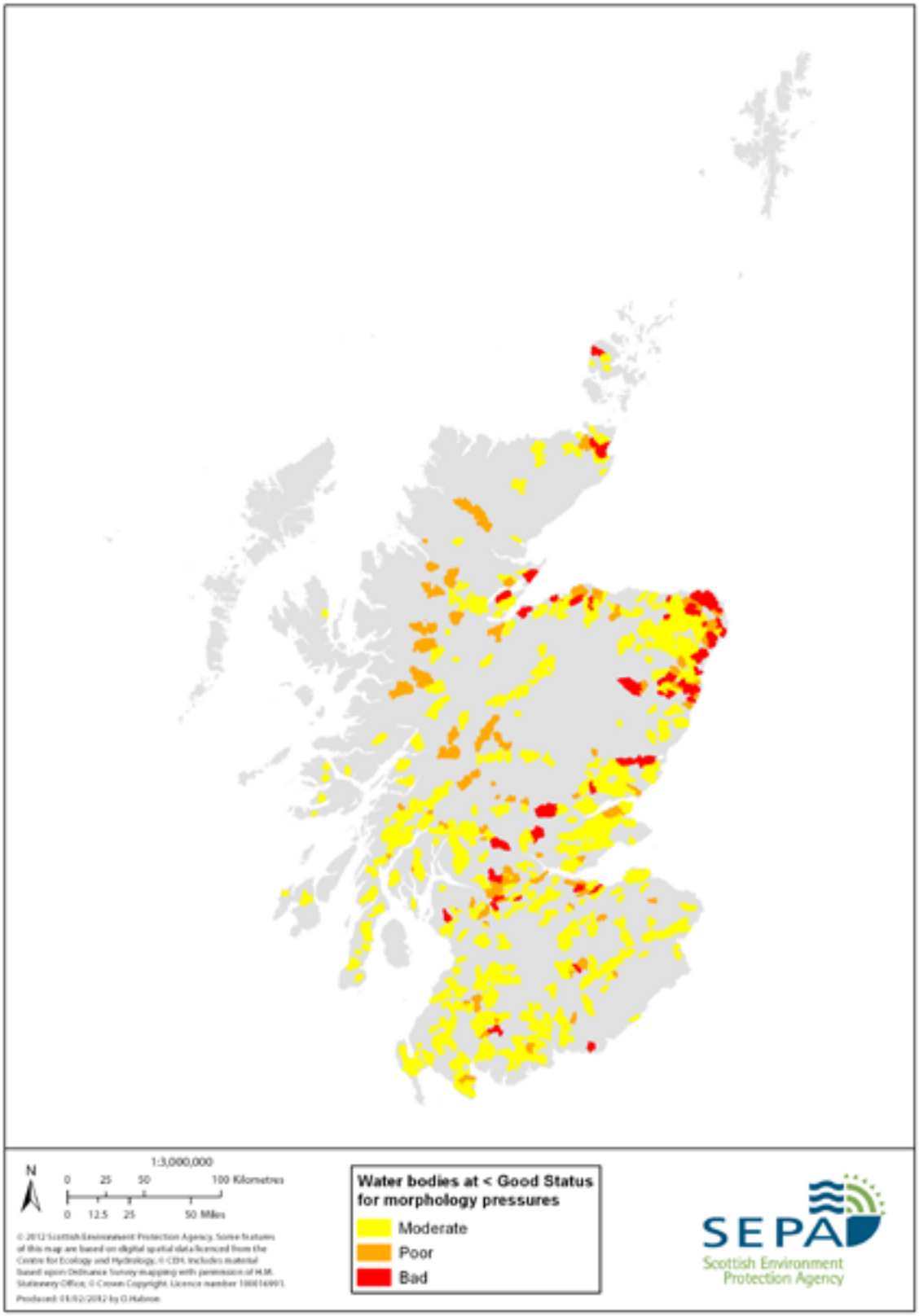
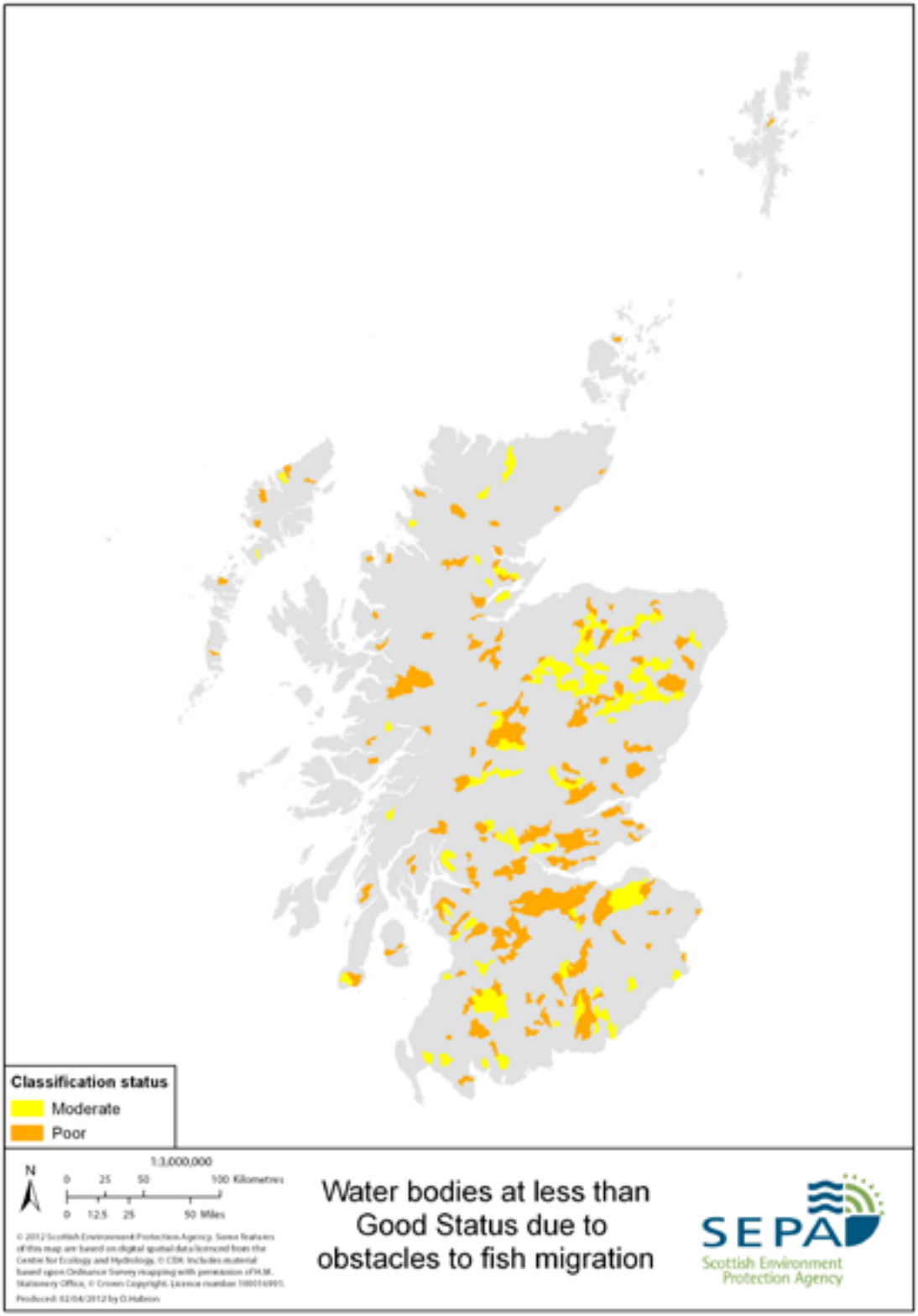


Figure 2b: Water bodies at less than good ecological status / potential because of fish barrier pressures



5. Barriers to fish migration

Scotland's freshwater fisheries have an international reputation for salmon and sea trout fishing. There are also a number of other migratory fish, including eels and lamprey, which have important nature conservation value and potential economic value.

The numbers of migratory fish have fallen over the past 200 years. This decline has been caused by a combination of factors within freshwater and at sea. A contribution to reversing this decline can be made by addressing physical barriers to migration and restoring spawning, and nursery habitat lost through morphological impacts. This can be combined with measures such as riparian woodland to improve fish habitat, and bring a range of multiple benefits.

Our approach to delivering improvements

The removal of barriers to fish migration (either through complete removal or modification to enable fish passage) can be straightforward and cost effective, and has an immediate benefit for fisheries. This is demonstrated by the Water Environment Fund programme of work to improve fish passage which has addressed problems at around 24 barriers to date.[10]

When considering options to enable fish passage, it is important to recognise that these structures may be of natural or built heritage value, or be valued for recreation and local amenity. Any proposals should be developed in consultation with Historic Scotland, Scottish Natural Heritage and local authorities, with wider community and user consultation as appropriate.

It will also be important to assess the catchment wide impacts of barrier removal or modification, and SEPA will work with other organisations to ensure that impacts on sediment transport and flows are assessed as part of any barrier project.

There are three types of barrier to fish migration:

- Dams and weirs in use.
- Dams and weirs not in use.
- Barriers associated with culverts and bridges.

Dams and weirs in use

Many impoundments serve a particular purpose and are assets delivering a social or economic function. For example, there are a large number of dams and weirs that are used to store water or facilitate abstraction for purposes such as hydroelectricity generation, public water supply or drinks manufacture.

These assets are authorised under CAR, and SEPA's register of licensed structures lists over 800 dams and weirs in use in Scotland. SEPA will work with the operators to develop options for allowing fish migration where necessary.

The benefits delivered by options will then be considered alongside the impacts on the use of the structure. There will be situations where it will not be proportionate to retrofit fish passes.

Any necessary remedial action will be progressed through SEPA's programme of CAR licence reviews, scheduled between now and the end of the third RBMP cycle in 2027. This process of CAR reviews will include some dams not currently in use but which remain assets of Scottish Water, distilleries or hydropower generating companies. As part of this CAR review process, SEPA will make links with operator asset investment programmes, such as the Scottish Water Quality and Standards programme, as appropriate.

Dams and weirs not in use

These are normally structures which no longer serve an economic or social function: for example, weirs created for industrial processes which no longer exist. Under these circumstances, the ownership of the weir often rests with the adjacent landowners. Many of these 'abandoned' structures are not licensed under CAR, and SEPA currently estimates that there may be around 1800 unlicensed dams and weirs.

10 See *Review of progress, October 2011* report at: www.sepa.org.uk/water/restoration_fund.aspx

This category of barrier will be progressed by a partnership between the Scottish Fishery Boards and Trusts, co-ordinated by Rivers and Fisheries Trusts of Scotland (RAFTS) and SEPA. The boards and trusts will identify the landowner(s) responsible for a barrier and initiate a dialogue about how the problem could be addressed. This will lead to initiation of a scoping study which will identify costed options for allowing fish passage. An application for funding to support scoping studies and any necessary work can be made to the Water Environment Fund. This process will ensure that landowners can deliver the necessary environmental improvements.

Barriers associated with culverts and bridges

The footings of some bridges consist of concrete aprons on the river bed. These can be difficult for fish to negotiate, especially at low flows. Culverts can also be problematic, as these structures often have a step between their entrance and the river downstream. Where this is the case, fish may be unable to enter and swim through the culvert. Some culverts also conduct water through pipes which are too small, too lengthy, or have too shallow a depth of water for most of the time, for migrating fish to use.

Initial work to ascertain the extent of this problem has identified almost 14,000 bridges, and 130km of culverts. However, only a small proportion of these represent barriers to fish. SEPA has also estimated that there are at least 130 barriers associated with roads, and around 10 associated with rail crossings in Scotland. These are likely to be underestimates, and further discussion is needed with Transport Scotland, Network Rail and local authorities.

These barriers are normally assets which deliver a particular social or economic function and are typically owned by local authorities, Transport Scotland, Network Rail or private landowners. Asset owners are expected to include any mitigation measures in their asset replacement and maintenance programme. Where appropriate, SEPA will meet with asset owners to develop such a programme. In many cases, mitigation measures may reduce the sediment and general maintenance requirements for owners, as well as assisting with flood risk management, so it is expected that a proportionate programme of asset mitigation can be agreed.

Scottish ministers are considering the introduction of new legislation that would give SEPA powers to require improvements where asset owners do not take the necessary improvement action.

How we will prioritise where improvements are delivered

The Rivers and Fisheries Trusts of Scotland (RAFTS) is working with SEPA to co-ordinate the identification and assessment of barriers to fish migration. There is an expectation that the Fish and Fisheries Advisory Group will play a role in this process in the future. This exercise will provide the basis upon which work to address these barriers can be prioritised. Two priority lists will be created:

- A priority list of individual barriers will be produced which will allow action to be directed towards barriers which individually have a large impact upon migration.
- A list of key catchments where catchment-scale action is required to tackle multiple barriers.

Prioritisation is taking account of the:

- improvement in ecological status of water bodies which would be achieved if the barrier was addressed;
- area of habitat which would become accessible;
- quality of that habitat for fish production;
- likely importance of the fish population concerned in environmental, social and economic terms;
- potential multiple benefits associated with the overall improvement in ecological status, including recreation, sport and amenity.

This prioritisation exercise is using improved methods for assessing the extent to which in-stream engineering structures individually and cumulatively impede fish migration.[11] Among other things, this work will help identify at a catchment scale how to secure effective fish passage.

11 See research report produced by SNIFFER for SEPA at: www.sniffer.org.uk

These priority lists will be further developed by wider consultation and will form part of the consultation on the second river basin management plans for Scotland.

What action will be taken to deliver improvements?

The key actions are summarised in Table 2. The primary responsibility for managing in-stream structures lies with owners and operators, who should manage them in a way which is environmentally sensitive and in compliance with legislation. SEPA, with the fishery boards and trusts, will be responsible for driving many of the actions described in Table 2.

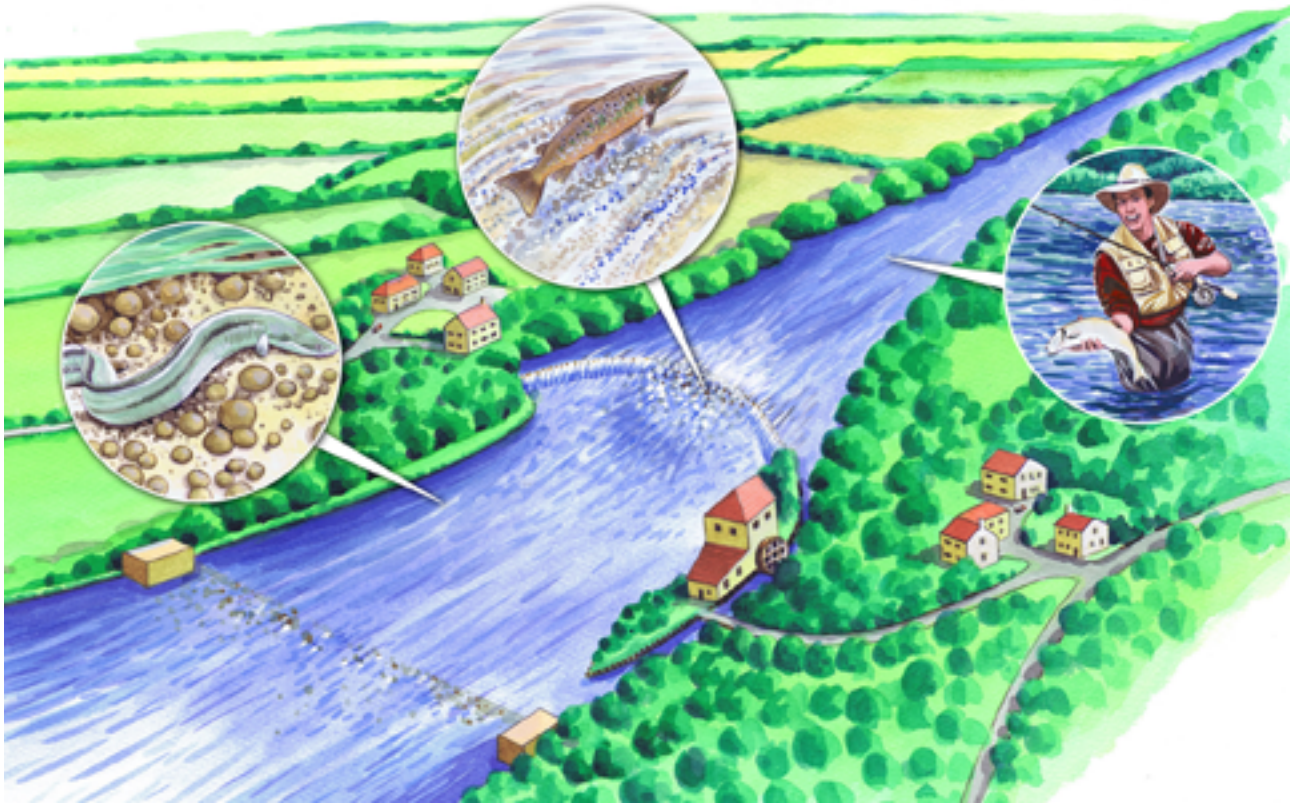
Table 2: Summary of actions to improve fish passage

Issue	Action	Responsibility
Prioritising action on barriers	Identification and prioritisation of barriers to fish migration and identification of proportionate mitigation options. A report on this methodology will be published during 2013, and the lists will be subject to full consultation.	SEPA / fishery boards and trusts / operators / Fish and Fisheries Advisory Group
Restoring fish passage at weirs and dams in use	Develop asset to allow fish passage in line with CAR authorisation.	Owner or operator
Restoring fish passage at weirs and dams not in use	Discussions with landowners about how barriers to fish migration can be addressed. Support landowner with application for CAR licence and applications for funding.	Fishery boards/trusts
	Provision of funding to support scoping studies and engineering works required to provide for fish passage.	SEPA
	Where voluntary approach has not been successful, SEPA will require the provision of fish passage using restoration notices or licences as appropriate.	SEPA
Restoring fish passage at bridges and culverts	Prioritised asset investment by business or organisation responsible for the asset.	Asset owner
	Where voluntary approach has not been successful, SEPA will require the provision of fish passage using restoration notices or licences as appropriate.	SEPA

The potential for delivering improvements by the removal of barriers to fish migration is illustrated in Figures 3a and 3b.

Figure 3a: River with barriers to migratory fish, before restoration
Several impassable weirs prevent fish access, with economic consequences in the upper reaches of the river.

Figure 3b: Restored river, with fish barriers removed or modified
Two weirs have been removed, and a fish pass has been added to a historic mill weir, allowing fish access to the whole river.



6. Improving the condition of rural rivers and lochs

This section describes how to improve the physical condition of river and loch habitats[12] affected by rural land management. Maximising the area of productive land has led to huge improvements in the quality and quantity of food and timber production. In some situations this has led to the use of land up to the edge of rivers and lochs with adverse consequences for the wider environment and society. We need to get the balance right between maximising the area of productive land and ensuring that rivers can deliver a full range of services to the environment and society.

Agriculture

Farmers have straightened rivers to make them easier to manage, deepened them to drain land more efficiently, and constructed embankments to reduce the frequency of flooding. In turn this means that ongoing maintenance such as dredging and bank reinforcement is needed. This historical practice can have implications for the habitat quality of rivers and lochs, as it reduces fish numbers and damages the wildlife value. It can also lead to problems of siltation and flooding for downstream landowners.

Forestry

The first phase of forestry expansion (1960s to 1990s) sometimes led to coniferous planting right up to the banks of rivers and lochs. Once the tree canopy closed, shading prevented the growth of bankside vegetation. Where forestry drainage channels were on high gradient slopes, these combined with unprotected and unstable banks to create high levels of erosion. This reduced the value of rivers and lochs for wildlife and caused problems to downstream land managers because of increased siltation. Current forestry guidelines ensure that this type of planting no longer occurs.

Our approach to delivering improvements

SEPA will work with rural land managers and other stakeholders (such as local authorities) to consider the costs of improvements and the range of benefits which can be achieved, and identify ways forward which are feasible and proportionate.

The key aim will be to explore how to reduce impacts on the water environment, while ensuring there is no significant adverse effect on agricultural or forestry production. SEPA will take account of this core principle in identifying where rural rivers and lochs should be designated as heavily modified water bodies, and setting priorities for improvement.

These proposals will be subject to consultation during the development of the second RBMPs.

Many actions will provide direct benefits to individual land managers, and there is also a range of financial support available to help them manage their land in a way that improves the condition of rivers. Most importantly, funding via the Scottish Rural Development Programme (SRDP) may be available to help land managers with the creation and management of buffer strips that are wider than two metres. This can include funding for tree planting and for fencing.

The next SRDP is being developed, and it will be important to ensure that options which improve the water environment are included, that a catchment wide view is taken and land managers are encouraged to work together to deliver the improvements required.

Other sources of funding, such as the Water Environment Fund and the Scottish Water Sustainable Land Management Incentive Scheme, provide funds for projects to improve the water environment. For example, Scottish Water's Sustainable Land Management Incentive Scheme offers funding in specified catchments for measures such as 'naturalisation of watercourse morphology' and stock fencing.

There are also funding streams for access, recreation and green networks, such as the Active Places Fund and Central Scotland Green Network Development Fund, which can be used to support access and green network provision around the water environment.

12 The impacts upon estuaries and coastal waters are covered in section 8.

In order to deliver improvements in the way rivers are managed, the Scottish Government, SEPA, Scottish Natural Heritage and other government bodies will provide advice and support for land managers to help them identify the best management techniques for delivering environmental improvements, whilst protecting their interests and protecting the interests of their neighbours and other users of the water environment. River basin management plans can help to prioritise these efforts.

Many land use activities are already subject to controls to ensure any likely adverse effects are minimised. For example:

- Land managers are required to comply with CAR general binding rules covering the cultivation of land and the keeping of livestock. These rules are primarily designed to protect the water environment from diffuse source pollution but some will also protect the physical habitat of rivers, e.g. through the establishment of a buffer strip between the water environment and land used for agriculture or forestry.

- Forest design and felling plans are controlled by legal requirements, and additional good practice required for forestry grants, which ensure that watercourses are protected. Forestry guidelines and grants encourage naturally regenerated forestry, or riparian broadleaf planting, which can help to stabilise banks and contribute to riparian restoration.

Tables 3a and 3b set out a possible hierarchy of options for improving rivers and lochs affected by land use pressures. It is intended to illustrate the type of actions which would deliver improvements in the management of rural rivers and lochs. The intention is to maximise the benefits provided by the water environment whilst minimising impacts upon agricultural or timber production. Further discussion will be required with stakeholders to define the different scenarios and proportionate approaches set out in the following tables.

Table 3a: Indicative approaches for prioritising and delivering improvements in agricultural rivers where water bodies are at less than good ecological status

Scenario	Key objectives	Possible approach
High value agricultural land, where improving physical condition will have significant adverse impacts on land use.	Reduce impacts on the water environment, while ensuring there is no significant adverse effect on agricultural production.	Such areas may be considered appropriate for designation as HMWB. If designated, best practice mitigation measures are required to meet good ecological potential.
High value agricultural land, where improvements to physical condition will not have significant adverse impacts on land use. (May have problems of erosion, siltation and flooding. Regular maintenance required to control erosion and river depth.)	• Use catchment restoration approaches to improve physical condition of river and reduce sediment management requirements. • Control diffuse pollution. • Improve the wildlife value of rivers and lochs. In particular, improve and protect Natura habitats/ species. • Find and prioritise opportunities to give rivers more space to provide corridors for wildlife and for recreation and enjoyment.	• Deliver compliance with General Binding Rules protecting bankside vegetation. • Look for further opportunities to intercept diffuse pollution, for example, by developing riparian woodland or the potential greening options alongside rivers/ditches. Make links with LBAPs, Forestry Commission Scotland woodland opportunity mapping, and forestry / woodland strategies. • Catchment-scale intervention to reduce sediment siltation and other pressures.
Moderate value agricultural land. (May have problems of erosion, siltation and flooding. Regular maintenance required to control erosion and river depth.)	• Find and prioritise opportunities to give rivers more space to provide corridors for wildlife and for recreation and enjoyment. • Use catchment restoration approach to improve physical condition of river and reduce sediment management requirements. • Control diffuse pollution. • Improve the wildlife value of rivers and lochs to improve and protect Natura habitats/species.	• Deliver compliance with General Binding Rules protecting bankside vegetation. • Identify further opportunities to intercept diffuse pollution, for example, by developing riparian woodland or locating the potential greening options alongside rivers/ditches. Make links with LBAPs, Forestry Commission Scotland woodland opportunity mapping, and forestry / woodland strategies. • Catchment-scale intervention to reduce sediment erosion and therefore siltation. May involve re-engineering some sections of river to ensure more sinuous and stable channels. • Look for possible opportunities to allow flooding to protect higher value land.

Continued over the page

Scenario	Key objectives	Possible approach to delivering improvements
Low value agricultural land. (May have problems of erosion, siltation and flooding. Regular maintenance required to control erosion and river depth.)	• Give rivers more space to provide corridor for wildlife and for recreation and enjoyment. • Use catchment restoration approach to improve physical condition of river and reduce sediment management requirements. • Control diffuse pollution • Improve the wildlife value of rivers and lochs, in particular improve and protect Natura habitats/ species.	• Deliver compliance with General Binding Rules protecting bankside vegetation. • Look for opportunities to intercept diffuse pollution, for example, by developing riparian woodland alongside rivers/ditches. Make links with LBAPs, forestry and woodland strategies. • Catchment-scale intervention to reduce sediment erosion and therefore siltation. May involve re-engineering some sections of river to ensure more sinuous and stable channels. • Look for possible opportunities to allow flooding to reduce downstream flood risk. • Look for possible opportunities to move straightened channels to gently meandering channels with wider riparian corridor. Make links with LBAPs.

Table 3b: Indicative approach for prioritising and delivering improvements in afforested catchments where water bodies are at less than good ecological status

Scenario	Key objectives	Possible approach to delivering improvements
Commercial forestry plantation, with planting up to rivers.	• Give rivers more space to provide corridor for wildlife and for recreation and enjoyment. • Use catchment restoration approach to improve physical condition of river and reduce sediment management requirements. • Control diffuse pollution. • Improve the wildlife value of rivers and lochs, in particular improve and protect Natura sites/species.	• Deliver compliance with General Binding Rules protecting bankside vegetation. • Ensure that planting is moved back from rivers as part of the forest design of second cycle replanting to provide a riparian corridor. • Look for possible opportunities to allow flooding in areas to reduce downstream flood risk. Make links with LBAPs. • Intervene where necessary to speed up restoration of riparian vegetation. • Look for opportunities to restore riparian and wetland habitats as part of forest design of second cycle replanting to improve riparian and wetland habitat networks. Make links with LBAPs and forestry opportunity mapping. • Identify drainage ditches etc that are no longer needed, and block as part of forest design of second cycle replanting to reduce silt input.

Prioritising where improvements are delivered

Agricultural catchments

Efforts to tackle diffuse pollution problems are being driven by the Diffuse Pollution Management Advisory Group[13] for Scotland, and are focused on a series of catchments known as diffuse pollution priority catchments. In the short term, SEPA may include advice on improving the physical management of rivers as part of its communications with land managers in these priority catchments.

The second river basin management plans will build on the successful catchment approach for managing diffuse pollution by considering how best to incorporate actions for improving physical condition. Engagement with stakeholders on a new list of priority catchments and proposed ways of working will start in the autumn of 2013, as part of consultation on the second RBMPs.

Forested catchments

Forestry Commission Scotland has identified where forests have been planted up to the edge of rivers and lochs. These problems are addressed as part of the cycle of felling and replanting of forests, and through the system of licenses and grants for forestry. The *Forests and water guidelines* provide the basis upon which dense planting of conifers is avoided round rivers. In addition, these encourage use of riparian planting which can benefit biodiversity and sediment management. Forestry Commission Scotland's opportunity mapping work has begun to explore how woodland creation can be used to improve water quality and reduce flood risk at a catchment level. This type of riparian woodland creation could play a strong role in delivering improvements in physical condition.

What action will be taken to deliver improvements?

The key actions are summarised in Table 4. The primary responsibility for managing rivers and lochs and ensuring no further deterioration lies with land managers who should manage them in a way which is environmentally sensitive and in compliance with legislation. The SEARS[14] partners will be responsible for driving many of the actions described below in partnership with land managers, but intermediaries such as agricultural advisors and catchment officers may also have an important role to play. The work will be overseen by SEPA, in consultation with DPMAG[15] and other RBMP advisory groups.

13 Further information at: www.sepa.org.uk/water/river_basin_planning/diffuse_pollution_mag.aspx

14 Scotland's Environment and Rural Services – see: www.sears.scotland.gov.uk/

15 The Diffuse Pollution Management Advisory Group, a partnership that focuses on improving Scotland's water environment by reducing rural diffuse pollution. More information at: www.sepa.org.uk/water/river_basin_planning/diffuse_pollution_mag.aspx

Table 4: Summary of actions to improve rural water environment affected by land management

Issue	Action	Responsibility
Setting priorities and aligning funding streams	Develop a hierarchy of options for delivering improvements which take account of land values, food production, catchment flood risk, climate change adaptation, potential impacts on Natura sites and biodiversity and wider benefits.	SEPA, land managers, SNH and AAG partners
	Identify priorities for action, set targets and monitor progress.	AAGs and land managers
	Identify options for delivering catchment-scale improvements in the water environment for inclusion in the next SRDP.	Scottish Government, AAG partners
Restoring damaged bank side vegetation	Ensure compliance with CAR general binding rules for the application of fertilisers, keeping of livestock, and the cultivation of land.	Land managers and SEARS partners
	Ensure compliance with standards for Good Agricultural and Environmental Condition (GAEC) for bankside vegetation.	Land managers and SEARS partners
	Encourage the use of wider buffer strips to allow opportunities for access provision around rivers and lochs, using SRDP and recreation / access and other funding.	Local authorities, green network partnerships, sportscotland
	Provide access to the Scotland Rural Development Programme funding for fencing or planting associated with buffer strips wider than General Binding Rule obligations and other relevant options.	Scottish Government
	Explore development of Water Environment Fund, National Lottery or EU funding as part of larger scheme to deliver environmental improvements which go beyond General Binding Rule obligations.	SEPA, FCS, SNH and local authorities
	Provide access to Sustainable Land Management Incentive Scheme funding in specified catchments to protect banks and improve physical condition of watercourses.	Scottish Water
	Deliver awareness raising events, demonstration sites, case studies and farm visits to provide information on how to create environmental improvements and support compliance with CAR general binding rules.	Diffuse Pollution Management Advisory Group
	Use forestry grant schemes to encourage improved bank-side forestry management (compliance with Forest and water guidelines) and design (forest design plans).	Forestry Commission Scotland
	Ensure that conditions of approval of felling licences and forest plans protect and improve the water environment.	Forestry Commission Scotland
Restoring deepened straightened river channels	Identify appropriate methods for sediment management taking account of land values, catchment flood risk, climate change adaptation and potential impacts on Natura sites and biodiversity	SEPA, Scottish Natural Heritage, AAG partners
	Identify options for delivering improvements by developing scoping studies, catchment scale sediment audits, demonstration sites and research and development.	SEPA/Scottish and Northern Ireland Forum for Environmental Research (SNIFFER)
	Provide Scotland Rural Development Programme funding for buffers and associated fencing or planting for buffer strips wider than General Binding Rule obligations.	Scottish Government
	Provide Water Environment Fund, National Lottery or EU funding as part of larger scheme to deliver options for delivering improvements.	SEPA, SNH and local authorities
	If linked to a flood protection scheme, use powers to secure implementation of morphological improvements.	Local authorities

The potential benefits of restoring the land immediately adjacent to rivers are illustrated in Figures 4 and 5.

Figure 4a: Rural land use – pressures on riparian vegetation

This illustration shows how using land up to the edge of rivers can contribute to erosion and diffuse pollution, as well as reducing the physical quality of the river bed and banks.

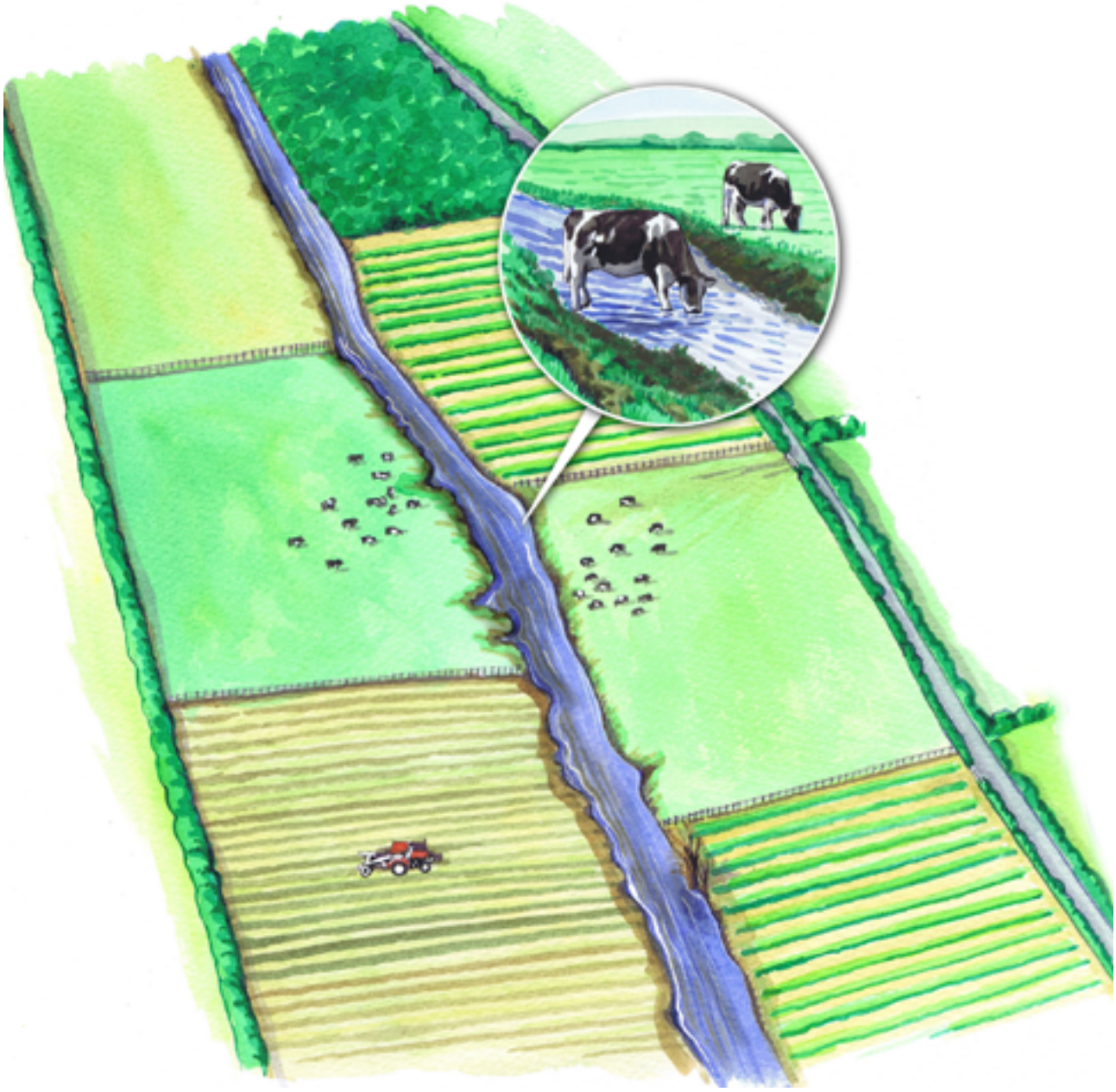


Figure 4b: Rural land use – improvements to riparian vegetation

This illustration shows potential benefits for wildlife and ecological status (compared to Figure 5a) if riparian vegetation is protected.

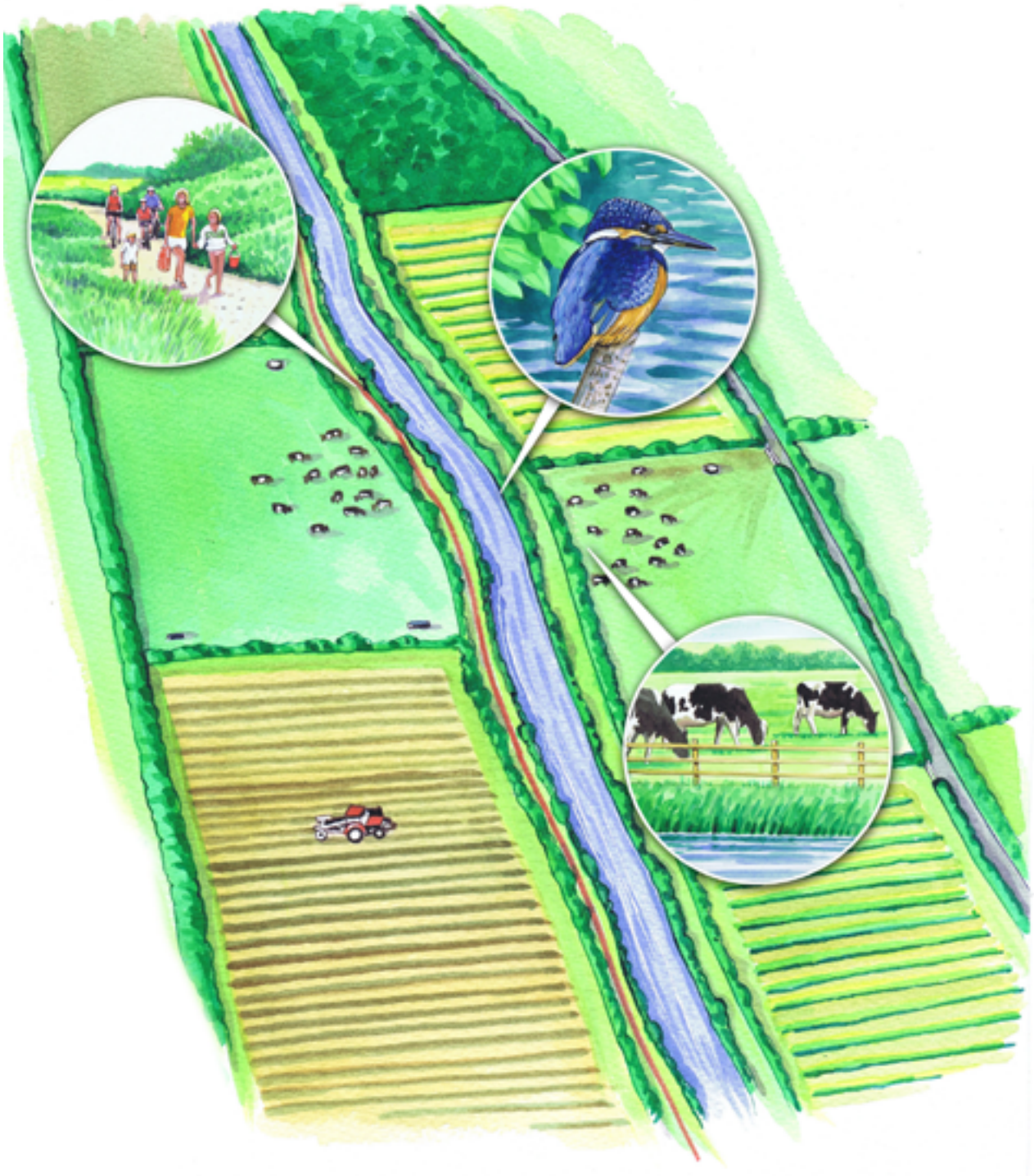


Figure 5a: Rural land use – flooding and erosion

This illustration shows how straightening and engineering of channels can contribute to sedimentation and flooding, while reducing access and requiring ongoing maintenance.

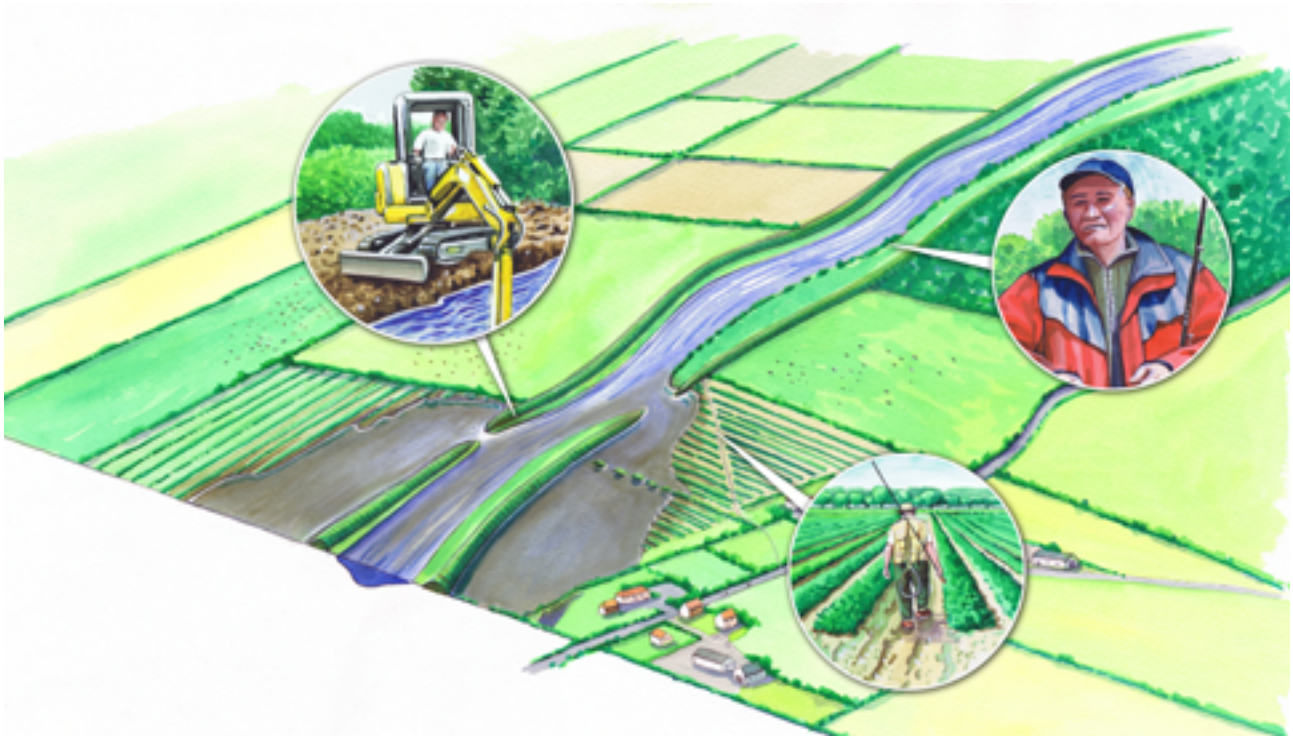
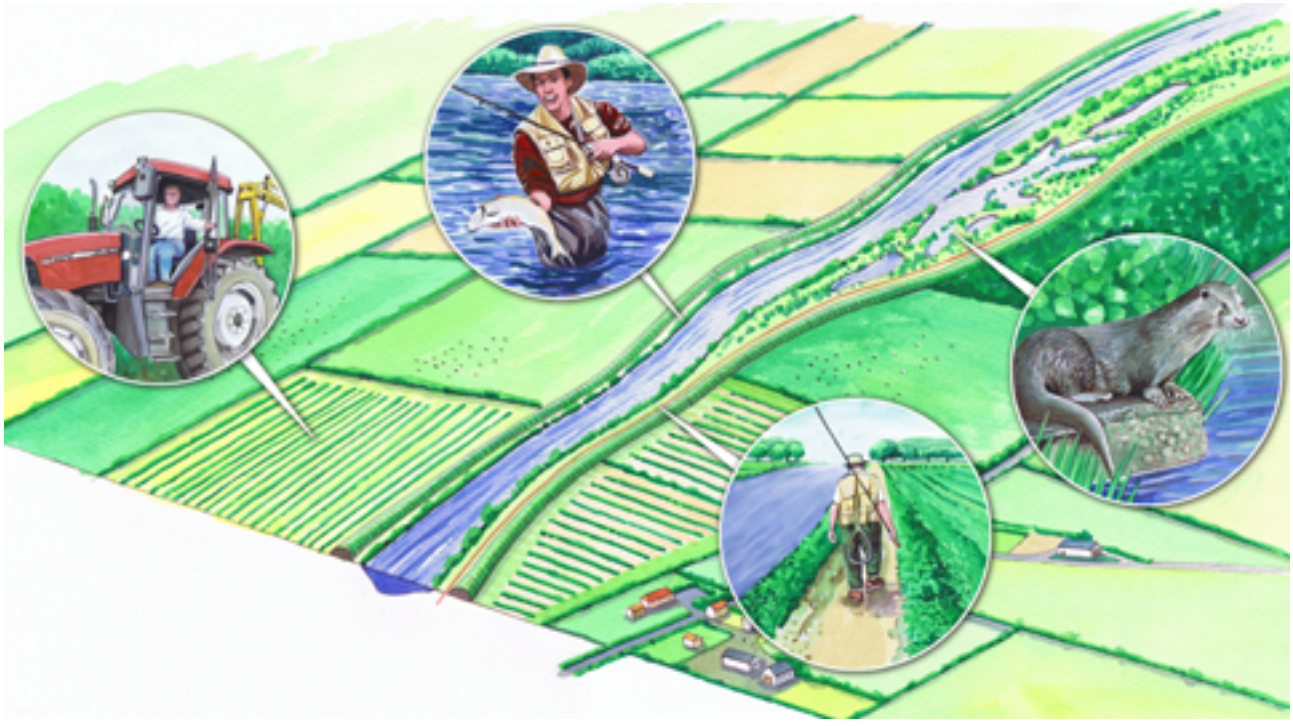


Figure 5b: Rural land use: improvements to reduce flooding and erosion

This illustration shows how managed creation of space around rivers can help to protect high value agricultural land and reduce the requirement for sediment maintenance, while offering benefits for wildlife and access.



7. Improving the condition of rivers and lochs in towns and cities

Rivers and lochs in many towns and cities provide a focus for the urban landscape. They have the potential to provide very valuable amenity and recreational opportunities, but many are neglected and underused assets. There are, therefore, very positive benefits in restoring urban rivers and enhancing the contribution that they can make to the quality of life.

The type of benefits which can be delivered by improving urban water environments include:

- reducing flood risk and helping to deliver flood risk management planning;
- creating opportunities to access the natural environment, providing new open spaces for amenity and recreation, and green networks for wildlife and people;
- reducing urban water pollution by incorporating sustainable drainage schemes (SUDS) and remediating contaminated land;
- improving fish passage and in-stream and riparian habitats.

Delivering these benefits can have wider socio-economic consequences as they:

- create an attractive environment which encourages recreation;
- boost physical and mental health;
- encourage business investment and tourism;
- enhance property values.

This contributes to green infrastructure, local biodiversity action plans, wellbeing and regeneration goals.

Our approach to delivering improvements

Restoration of urban watercourses is often constrained by lack of space, but there can be potential to deliver some improvement in physical condition, along with significant environmental and social benefits, sometimes using innovative approaches.

Towns and cities are continually changing and it is this process of change which provides the opportunity for restoring river and loch environments. For example, there may be opportunities to remove redundant structures and buildings, and restore derelict land alongside rivers in order to improve local amenity and environment.

There is also the opportunity to make large-scale improvements in the urban environment associated with major urban regeneration projects, as set out in the Scottish Government's regeneration strategy (2011). Indeed, because of the amenity and landscape benefits provided by rivers, their restoration is often central to urban regeneration schemes. These opportunities are recognised in the National Planning Framework (NPF2), and approaches such as the Central Scotland Green Network and proposed National Ecological Network.

Restoring the water environment in urban areas has very important links with flood risk management (discussed further in section 9) and with local planning. Local authorities can use the land use planning processes to deliver improvements to urban rivers, lochs and coastal waters. Strategic development plans and local development plans, including supplementary planning guidance and action plans, are produced by planning authorities with input from a wide range of stakeholders. They can identify aspirations and assist delivery of restoration, and offer an important opportunity for interested parties to become involved in the decision making process.

A range of complementary land use planning measures can help to progressively improve the water environment's contribution to the quality of the urban environment:

- Development plan policies can enable protection and improvement of the urban water environment. For example, policies which require use of SUDS, require buffer strips or promote deculverting of watercourses.

- Development plan settlement strategies and statements can identify opportunities to protect and enhance the water environment, for example by leaving space around straightened channels or removal of redundant structures.
- Where development plans identify masterplans to be required for certain areas, elements to be included within masterplans should include enhancement and removal of redundant structures.
- Development plan action plans and supplementary guidance can identify RBMP restoration measures relevant to settlement strategies.
- Development management can take opportunities to deliver RBMP restoration through planning applications, including use of planning conditions and developer contributions. Where there is scope, it may be possible to investigate use of obligations to provide cumulative developer contributions to fund RBMP restoration. This approach could be strengthened if SEPA works with development management officers to identify water bodies downgraded for morphology, and are consulted if a development is close to a water body downgraded for morphology.

Delivery of many of these measures, particularly relating to developer contributions, will be contingent on supportive policies at national and local level, and clear guidance on what restoration approaches would be relevant and proportionate as part of a development.[16] Specific advice for developers on issues such as buffer strips, and case study examples, could help to drive this. Additional work with community planning partnerships and community groups could also help to create support for such measures.

There are also important links between restoration and local authority open space, green infrastructure or green network strategies. These strategies often require a proportion of open space in developments. If well designed, this open space can create green networks for morphological restoration, wildlife and people.

Greenspace around watercourses can also contribute to sustainable urban drainage schemes (SUDS) and improve resilience to flooding. Well planned and designed development can achieve elements of all these benefits. In addition, urban forestry and woodland strategies can also play a strong role in improving the physical condition of the water environment, while securing regeneration and other benefits.

Finally, there are opportunities to restore aspects of urban rivers and lochs as part of watercourse maintenance work undertaken by local authorities together with their landscape management functions. Typically this involves delivering small-scale improvement:

- in the landscaping of rivers;
- by the removal of redundant structures (such as culverts) so as to reduce flood risk, with attendant benefits of improved biodiversity and reduced pollution;
- by reinstating structures with greener alternatives.

Prioritising where improvements are delivered

The potential for delivering urban river and loch restoration is largely driven by opportunities created by development proposals as managed by the land use planning system. We will seek to facilitate and influence these opportunities by: working with all area advisory group local authority partners to clarify, agree and prioritise measures which will improve the physical condition of the urban water environment:

- working with all area advisory group local authority partners to clarify, agree and prioritise measures which will improve the physical condition of the urban water environment;
- ensuring that development planning policies, supplementary planning guidance and open space policies recognise and support opportunities for delivery of morphological improvements;
- contributing information on morphological pressures and how these could be improved as part of responses to development plans, masterplans, development management and open space or green network strategies and plans;
- sharing geographical information systems (GIS) data and other information relating to the water environment with local authorities, to allow integrated consideration of morphological issues and development opportunities;
- identifying multiple benefit restoration opportunities, such as those piloted in the Forth and Clyde river basin planning advisory group areas.[17]

16 Developer contributions and agreements must meet the conditions laid down by the Scottish Government. See: www.scotland.gov.uk/Publications/1998/02/circular-4-1998/circular-4-1998-circular, www.scotland.gov.uk/Publications/2012/12/1885

17 See the Forth and Clyde Area Advisory Group web pages at: www.sepa.org.uk/water/river_basin_planning/area_advisory_groups/clyde.aspx and www.sepa.org.uk/water/river_basin_planning/area_advisory_groups/forth.aspx for details of these pilot studies.

What action will be taken to deliver improvements?

The key actions are summarised in Table 5. Local authorities will have a significant role in driving forward action.

Table 5: Summary of actions to improve the urban water environment

Issue	Action	Responsibility
Improving physical condition of the water environment when new development is being planned	Apply planning policies, objectives and advice notes to progressively improve the contribution made by rivers to the quality of the urban environment. These include the National Planning Framework, Scottish planning policies, consolidated water planning advice note, circulars, strategic and local development plans. Develop specific guidance on this topic.	Scottish Government, local authorities, SEPA
	Ensure that EU, Scottish Government and other funding provides support for delivering environmental improvements as part of urban regeneration.	Scottish Government, SEARS partners
	Ensure that Water Environment Fund provides targeted support for urban river restoration. Other sources of funding may be identified or sought for large scale projects.	SEPA
	Offer technical advice and case studies on restoration of urban rivers and promotion of recreation and amenity use.	SEPA and SNH
	Use development management mechanisms to improve land adjacent to rivers where development is underway.	Local authorities, SEPA
	Use core path plans, open space, green network, access and woodland strategies to create space for wildlife and people adjacent to rivers.	Local authorities, SEPA
	Use CAR regime to ensure that new engineering work in rivers contribute to delivering improvements.	SEPA
Improving physical condition of the water environment when river maintenance is being carried out	Ensure local authority policy and guidance which provides the context for progressive improvement in rivers where this is proportionate. SEPA will work with local authorities to plan and prioritise where improvements are needed.	Local authorities, SEPA
	Use CAR regime to ensure that engineering work in rivers contributes to delivering improvements.	SEPA

The potential advantages of restoring urban rivers are illustrated in Figures 6a and 6b.

Figure 6a: Urban river before restoration

This illustration shows an engineered and culverted river, which does not function as a social, economic or environmental asset for the urban area, and contributes to localised flooding.

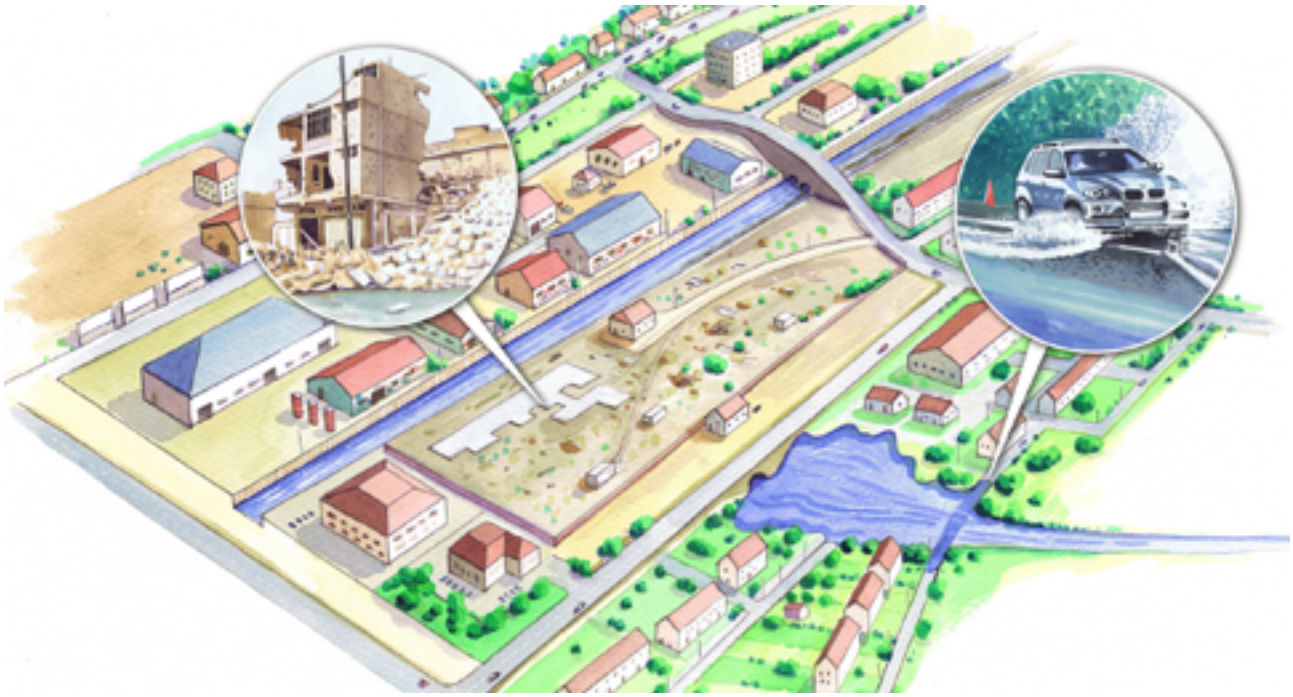


Figure 6b: Urban river after restoration

This illustration shows how 'daylighting' of a culverted watercourse has been linked with regeneration and creation of open space, resulting in an improved local environment for housing, amenity, wildlife and sustainable flood management.

8. Improving the physical condition of estuaries and coasts

Scotland's rich and biologically productive marine and coastal environment has immense economic and iconic value.[18] Scotland's estuaries and coastal waters provide:

- food;
- energy sources (wind, wave and tidal power, minerals and fossil fuels);
- ports and harbours for shipping;
- tourism and recreational opportunities;
- sites of cultural and historical interest.

The salt marshes and sea grasses of the world's oceans cover around 0.5% of the sea bed, but account for over half of the carbon storage in ocean sediments.[19] Coastal areas also contain distinctive and important habitats and support a diverse range of species which we need to protect, conserve and where possible enhance. Restoration of estuaries and coasts offers a number of long term benefits, such as sustainable coastal flood risk management, improved fisheries, marine habitat enhancement, economic and recreational benefits.

Around 6% of the Scottish coastline has been modified by coastal defences, and Scotland's river basin management plans have identified that around six coastal and seven estuarine water bodies are affected by issues relating to flood defence and land claim (see Figure 7). Many of the impacts to morphology in the marine environment relate to urbanisation, port and harbour development and land claim associated with past agricultural improvements.

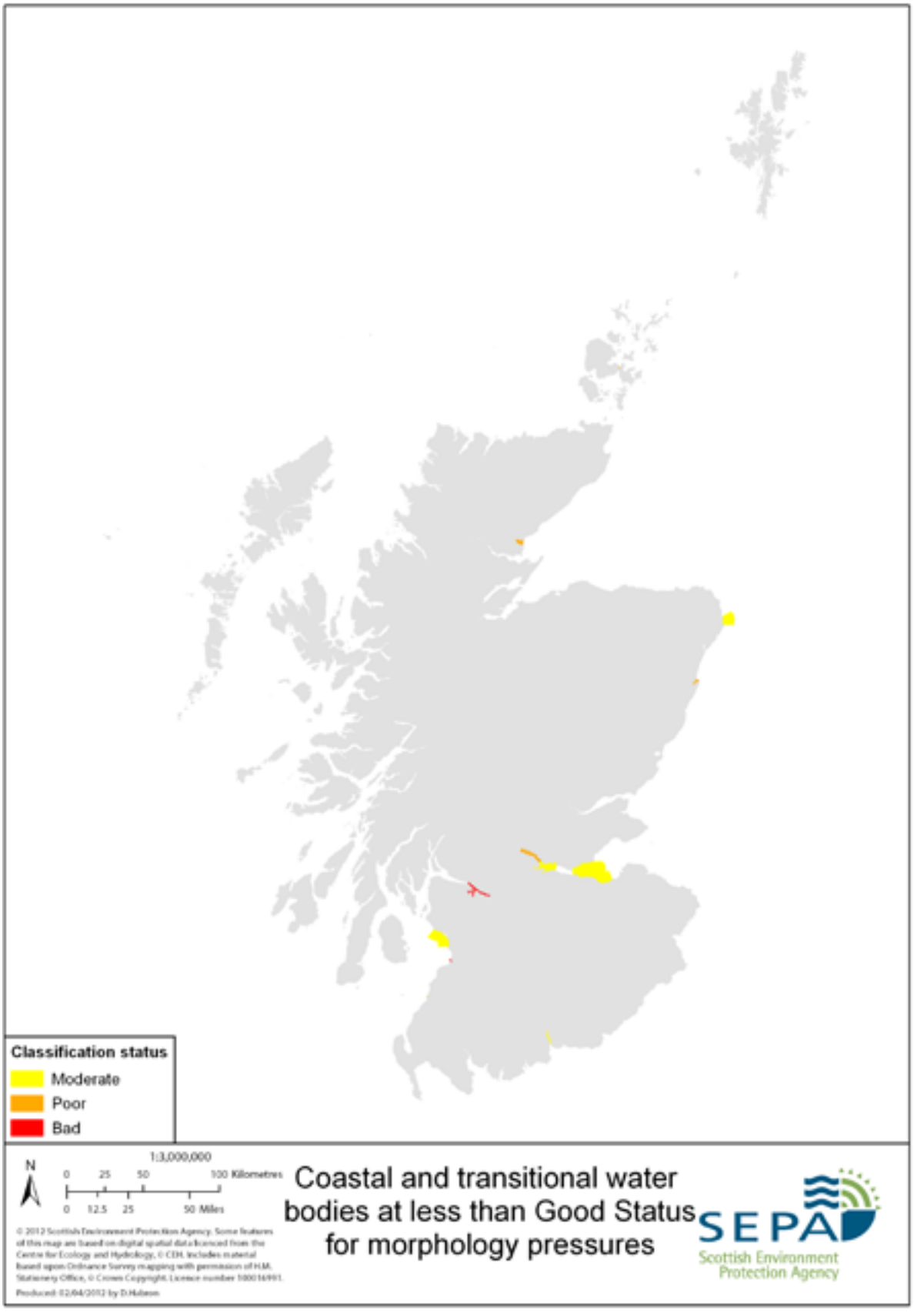
Much of this effort has been vital to Scotland's social and economic development. However, the presence of coastal defence structures, flood defence embankments and flow and sediment manipulation structures along some stretches of coast can interrupt the supply and transport of sediment. In some cases this can lead to problems of erosion along adjacent stretches of coastline, and damage to intertidal habitats and structures.

The Scottish coastline will face major pressures in the coming decades, particularly from rising sea levels and climate change, and continuing development pressures relating to urban, marina and port development, new investment in coastal and flood defence structures and renewable energy development.

18 See Scotland's Marine Atlas: www.scotland.gov.uk/Topics/marine/science/atlas

19 See the Blue Carbon Project: www.grida.no/publications/rr/blue-carbon, which identifies opportunities for climate change adaptation and mitigation through restoration of blue carbon sinks.

Figure 7: Map of coastal water bodies affected by physical changes



Our approach to delivering improvements

Appropriate management may offer opportunities to enhance both biodiversity and other ecosystem services through applying sustainable management options, including:

- allowing intertidal habitats room to migrate inland with rising sea levels in order to mitigate coastal squeeze;
- managing sediment supplies by allowing erosion to contribute new sediment to the coast, and allowing natural sediment transport processes to proceed where possible, e.g. encouraging the beneficial reuse of dredged sediment to restore sediment supplies;
- maintaining or encouraging natural formation of early successional habitats where these are threatened or have disappeared, e.g. strandline management plans (see Shetland Council website for more information);
- initiating management practices that support the recovery of carbon sinks, such as salt marshes and sea grasses.

Other restoration techniques include:

- the removal of redundant structures;
- no active intervention or defence abandonment where maintaining existing defences will be too costly;
- sand dune fencing;
- beach nourishment to restore eroding beaches and sediment supplies.

An additional sediment supply management option is to allow erosion to contribute to new sediment in the coast and allow natural transport processes to proceed where possible. Figures 8a and 8b show some coastal restoration approaches and their impacts.

Case study – Landscape scale restoration in the upper Forth estuary

The Firth of Forth Futurescapes Project, a project led by RSPB Scotland in partnership with a number of statutory and non-statutory organisations including SEPA, is looking at opportunities for landscape scale restoration along the upper Forth estuary. In its initial phase, the project identified an area of around 600 hectares where improvements might be possible through managed realignment and habitat management. As well as improving water environment habitats, the project would contribute to achieving more sustainable management of flooding, in particular buffering the effects of sea level rise on the estuary. The project has recently received further funding.

Image: RSPB Scotland

Figure 8a: Coastal area before restoration

This illustration shows how coastal defences are being 'squeezed' by rising sea levels, while dredged material is dumped at sea, resulting in loss of sediment supply. Beach erosion and sand dune instability contribute to further habitat loss and risk to infrastructure.

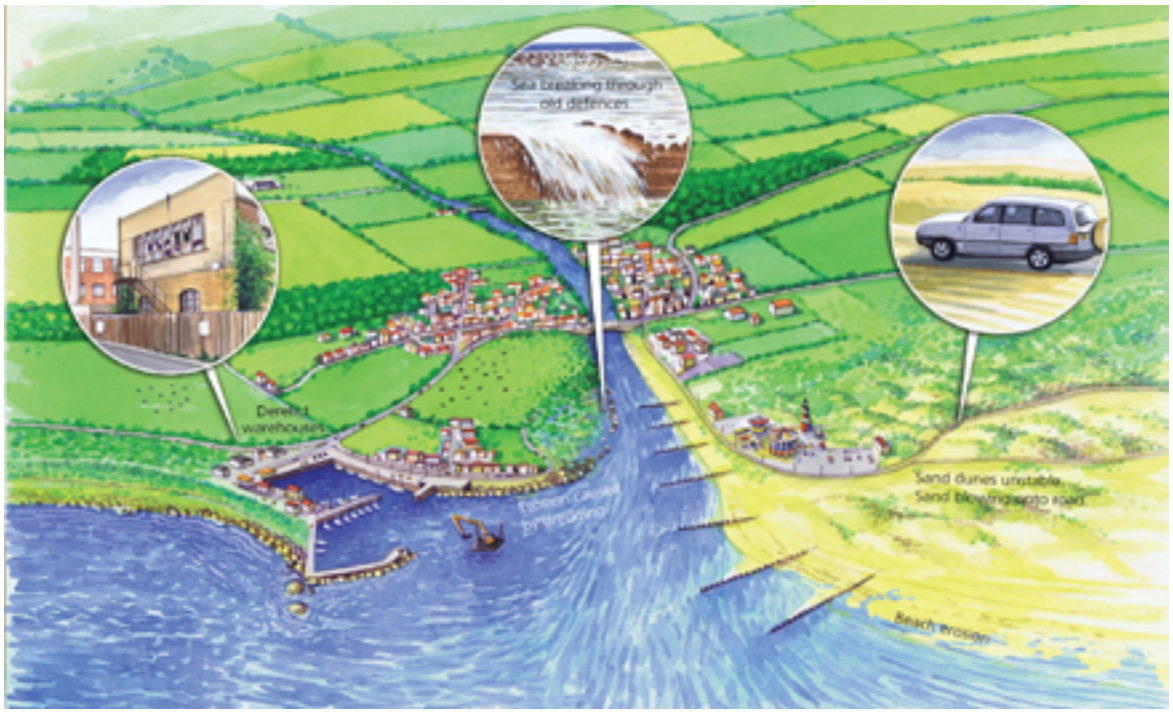


Figure 8b: Coastal area after restoration

This illustration shows how intertidal habitat can be allowed to migrate inland where coastal defences are failing, creating new saltmarsh habitat which acts as a carbon sink. Dredged sediment is used to recharge eroding beaches, and the beach and sand dunes have been fenced to reduce erosion and restore sediment supplies.

Prioritising improvements

Under the Marine (Scotland) Act 2010, a new statutory marine planning system to manage the increasing, and often conflicting, demands on our seas will introduce for the first time, a strategic framework - a national marine plan. Regional marine plans will follow.

This layered planning system will guide and direct decisions in the marine environment, providing a key mechanism by which we can identify the improvements which we want to make in the condition of coastlines. Links can also be made with local authority planning systems, and shoreline management plans.

To support this, SEPA will highlight coastal and estuarine water bodies which are below good status (or potential) and identify where structures could be removed or modified. Additional data gathering may be required to detect changes in coastal sediments and habitats and inform adaptation strategies. It will be important to link this work with local authority responsibilities on shoreline management plans, as well as integrated coastal zone management approaches and work by coastal partnerships.

Data on coastal areas which are potentially vulnerable to flooding should be linked with information on intertidal areas which are at risk of deterioration, or already below good ecological status for morphology. Carefully targeted investment in flood risk management could offer multiple benefits here. In addition, there may be localised opportunities for restoration on privately owned land where existing flood defences and coastal protection measures have become economically unviable. SEPA will then consider areas which are potentially vulnerable to coastal flooding for managed realignment or other restoration options as part of the flood risk management approach.

Area advisory groups can play a strong role in helping to identify and prioritise such opportunities, and could work with coastal partnerships and national agencies to set up projects and seek funding for improvement of physical condition.

At a more strategic level, management should also be based on an ecosystem services approach to further enhance gains in biodiversity and other services. Links must also be made to the *Marine and fisheries sector action plan* in Scotland's climate change adaptation framework.[20]

20 www.scotland.gov.uk/Topics/Environment/climatechange/scotlands-action/adaptation/AdaptationFramework/SAP/MarineandFisheries

What action will be taken to deliver improvements?

The key actions are summarised in Table 6. Marine Scotland and SEPA will be responsible for driving many of the actions described below.

Table 6: Summary of actions to improve the coastal water environment

Issue	Action	Responsibility
Improving physical condition of coastal waters through development and policy	Planning policies, development plans, shoreline management plans, access strategies and LBAPs can progressively improve the physical condition of coastal areas, reduce flood risk and promote biodiversity and recreational use of coasts. SEPA will work with other agencies to agree a prioritised approach to improve the physical condition of coastal water bodies.	Scottish Government, local authorities, SEPA
	Set national marine plan and regional marine plan objectives to progressively improve the condition of coastal areas.	Marine Scotland
	Identify opportunities for restoration as part of flood risk management plans.	SEPA and local authorities
	Use powers to require implementation of flood protection schemes to drive improvements.	Local authorities
	Clarify the mechanisms which can be used to deliver managed realignment	SEPA and Scottish Government
Improving physical condition of coastal waters through opportunistic improvements	Provide SRDP funding for managing coast and creating salt marsh.	Scottish Government
	Secure Water Environment Fund, National Lottery or EU funding as part of large prioritised scheme to deliver environmental improvements.	SEPA, SNH and Marine Scotland
	Identify opportunities for coastal restoration, particularly where this links with multiple benefits. Develop partnership projects.	Non-governmental organisations, coastal partnerships, AAGs
	Provide technical advice on restoration of coastline and promotion of recreation and amenity use.	Marine Scotland, SEPA and SNH
	Use marine licensing of engineering activity as an opportunity to deliver environmental improvements.	Marine Scotland

9. Restoration and flood risk management

Introduction

Fluctuating water levels are a natural function of the water environment, but become problematic when they impact on people. Past approaches to flood risk protection have focused on flood defence structures such as embankments and coastal protection, which can have impacts on the physical condition of the water environment, as well as wider implications for habitats, flows and sediment. Flood risk management in Scotland now places an emphasis on managing flood risk sustainably, and considers all sources of flood waters, whether from rivers, groundwaters, coastal areas or overwhelmed drainage and wastewater networks in urban areas.

Our approach to delivering improvements

Flood risk management includes a range of measures including natural flood management techniques to reduce flood risk from all sources. Natural flood management includes looking throughout river catchments, coastlines and our urban areas and identifying where restoration and enhancement of natural features and characteristics of a landscape can have a role in managing flood risk. It also offers opportunities to promote improvement of the morphological conditions of rivers or coasts, such as:

- setting flood embankments back from rivers to protect surrounding land from flooding, while improving the physical condition of river beds and banks. This type of restoration is appropriate where flood protection is needed, and the river currently has embankments close to the edge of the river channel which have a high risk of failure;
- restoration of natural river flood plain. It may involve the restoration of wetlands by blocking drainage channels and removing flood embankments or the planting of flood plain woodland;
- restoration of coastal areas through natural flood management techniques such as managed realignment;
- in urban areas, to manage the risk of surface water flooding, measures may include de-culverting, river restoration and use of sustainable urban drainage systems (SUDS).

As described in Sections 6 and 8, SEPA will also work with landowners to address flooding as part of the process of delivering improvements in the condition of rivers and coastlines. There are strong links to be made with green network strategies, local authority work on flood risk management, and the use of sustainable urban drainage systems (SUDS).

In order to develop a better understanding of natural flood management opportunities, SEPA will develop maps showing where natural flood management could make a contribution to reducing river and coastal flooding. These maps will be published in December 2013 for all catchments and coastal areas that have been identified as containing areas at significant flood risk and include a high level appraisal that will inform the setting of objectives and measures in SEPA's flood risk management strategies. This will include an assessment of opportunities to deliver towards WFD objectives and delivery of other environmental and social benefits. Final agreements on measures to reduce flood risk will be agreed for each six year planning cycles with local authorities and other responsible authorities in local flood risk management plans in 2016 and implemented thereafter.

Flood risk management and river basin planning processes are closely linked through their planning cycles and supporting legislation. As part of the work to link the morphological improvements needed under RBMP and the flood risk management measures required under the Flood Risk Management (Scotland) Act 2009, SEPA is delivering a funded pilot catchment project (discussed elsewhere in this document) which aims to work with local landowners and land managers on a voluntary basis to demonstrate how we could combine improvements to river habitats, with measures that will help to reduce flood risk, whilst ensuring proper consideration of existing land use. Earlier demonstration work on Eddleston Water and Allan Water has also explored links between natural flood management and RBMP objectives.

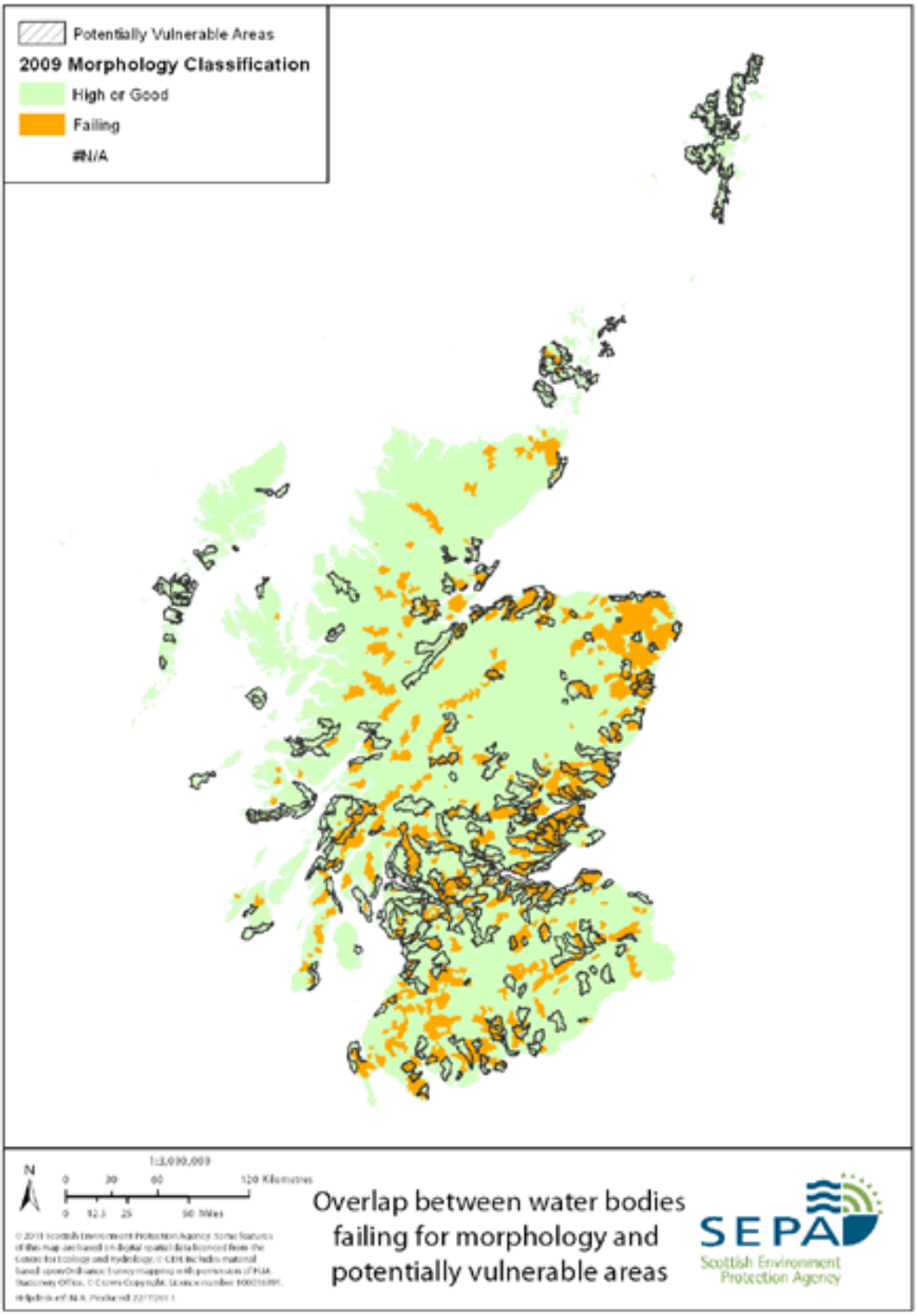
Prioritising where improvements are delivered

SEPA is responsible, under the Flood Risk Management (Scotland) Act 2009, for identifying areas where it considers there to be a significant flood risk. These areas are called 'potentially vulnerable areas' and are where effort to reduce flood risk will be prioritised. The process of identifying potentially vulnerable areas is not designed to pick up localised flooding experienced by farmers or other landowners.

SEPA has identified 243 areas across Scotland which are potentially vulnerable to flooding. Around 35% of these contain water bodies where restoration will be needed to achieve good ecological status (127 water bodies in total, see Figure 9). There are also significant numbers of water bodies in the catchments upstream of these areas that also require restoration that could contribute to reducing flood risk.

As part of the flood risk management planning process, SEPA will work in partnership with local authorities and others to develop flood risk management strategies which will be published in December 2015. These will include an assessment of where natural flood management techniques could help reduce flood risk (published in December 2013). Local authorities will lead on identifying measures to manage surface water flood risk through surface water management planning, which will be co-ordinated through the flood risk management strategies.

Figure 9: Map of potentially vulnerable areas, and rivers affected by changes to physical condition



What action will be taken to deliver improvements?

The key actions are summarised in Table 7. SEPA and local authorities will be responsible for driving many of the actions described.

Table 7: Summary of actions to link physical improvement and flood risk management

Issue	Action	Responsibility
Improving physical condition of the water environment in urban, rural and coastal areas affected by flooding	Identify opportunities and priorities for action through flood risk management planning.	SEPA, Scottish Water and local authorities
	Develop flood risk management measures which minimise harm to the water environment and look for opportunities to deliver improvements.	Local authorities, SEPA and Scottish Water
	Use CAR regime to ensure that engineering work in rivers prevents deterioration in the quality of rivers and contributes to improvements where possible.	SEPA
	Develop communications to clarify the role that sediment management can play in flood risk.	SEPA
	Use flood risk management measures to reduce flood risk, while preventing deterioration to physical condition and securing improvements where possible.	Local authorities, Scottish Water, SEPA
	Assess catchment-scale solutions to problem flooding and identification of opportunities to deliver environmental benefits, including links with LBAPs and green networks.	SEPA, RBMP Area Advisory Groups, Flood Risk Management Local Advisory Groups
	Provide Water Environment Fund support for proposals to reduce local flood risks whilst delivering environmental benefits.	SEPA
	Identify opportunities for natural flood management.	Local authorities, SEPA, advisory groups

10. Implementing this plan

This plan has set out an approach to achieve improvements in the physical condition of the water environment, through partnership working, setting priorities, and the use of a carefully managed and incentivised voluntary approach. As described, if undertaken at the catchment scale, improving the physical condition of the water environment should deliver a range of multiple benefits.

Delivery at a national level

SEPA will work with the identified partners to promote and deliver restoration activity in line with the priorities outlined in this plan. In order to ensure resources are effectively allocated to the greatest national priorities, SEPA will also take a broad view on whether any particular pressure should be given increased focus.

A range of national bodies will be involved in delivery of this plan, and the National Advisory Group will have oversight of delivery to ensure that it is consistent and efficient, and that appropriate policy and funding links are made. Specific advice may be sought from relevant sub-groups relating to the development and delivery of particular topics discussed.

For example, because of synergies between diffuse pollution and morphology pressures, the Diffuse Pollution Management Advisory Group[21] may offer advice on integrated approaches for diffuse pollution and morphology pressures affecting rural rivers. The Fish and Fisheries Advisory Group[22] should advise on the process of delivering environmental improvements which will improve fish populations, such as the prioritisation of fish barrier projects.

Implementation of this plan will be monitored and evaluated through the wider RBMP monitoring and reporting process.

Delivery at area advisory group level

Area advisory groups[23] have been established to help drive the local delivery of RBMP targets. These groups bring together partners, including responsible authorities and key stakeholders for each area, and offer an important forum for addressing pressures on the water environment through partnership approaches. Area advisory groups are working closely with flood risk management local advisory groups, which have a statutory role in providing advice on the links between flood risk management and river basin management planning.

Area advisory groups and their members will play an important role in helping to deliver the actions identified in this plan and taking action to deliver partnership work and secure funding. Local partnership work will be vitally important in informing an integrated catchment approach, and helping to identify the extent of morphological pressures and set priorities. It is also key to developing an approach which secures multiple benefits and engages with relevant partners and funding streams.

A range of common objectives, relating to green networks, flood risk management, biodiversity, regeneration and climate change adaptation can be achieved through restoring the physical condition of the water environment. These links must be identified, emphasised and developed. Multiple benefits approaches, such as opportunity mapping piloted in the Glasgow and Clyde Valley[24] and Forth[25], will be used more widely.

There may also be increasing opportunities to work locally with the private and commercial sector to improve the water environment. Catchment partnerships and local environment groups have been successful in obtaining funds from wind farm developers, landfill and aggregate companies, and making links with corporate social responsibility initiatives. There is scope to develop these approaches through area advisory group partnerships.

21 www.sepa.org.uk/water/river_basin_planning/diffuse_pollution_mag.aspx

22 www.sepa.org.uk/water/river_basin_planning/fish_and_fisheries_ag.aspx

23 www.sepa.org.uk/water/river_basin_planning/area_advisory_groups.aspx

24 www.sepa.org.uk/water/river_basin_planning/area_advisory_groups/clyde.aspx#pilot

25 www.sepa.org.uk/water/river_basin_planning/area_advisory_groups/forth/forth_multiple_benefits_projec.aspx

Future opportunities for policy alignment

There are important policy and funding developments which could help the delivery of physical improvements at a catchment scale. These include:

- current proposals for reform of the Common Agricultural Policy, including options for 'greening';
- ongoing work to develop the next SRDP. This could ensure that options to support restoration of the water environment are included, that a catchment wide view is taken and land managers are encouraged to work together to deliver green networks;
- work by the Woodland Expansion Advisory Group on options to meet Scottish Government's woodland expansion targets. There are clear gains to be made from using native woodlands to help improve the physical habitat of our rivers and lochs. Pilot work and opportunity mapping is underway;
- the development of the forthcoming National Planning Framework (NPF3) and the consolidated water planning advice note. These strategic documents will help to guide land use planning, green network development and delivery and regeneration. They have potential to secure benefits for the water environment, and support the restoration of physical damage;
- the Land use strategy regional pilot work, where it is proposed to look at land and water use, and ecosystem services, in an integrated way;
- the ecosystems approach pilot work which is being carried out in the Carse of Stirling by SEPA and SNH, which aims to take an ecosystem approach to land management decision making. In the future, such ecosystem approaches could help to prioritise opportunities to improve physical condition, and to secure multiple benefits;
- an increasing focus on climate change and the recognition of carbon storage potential associated with habitats such as wetlands, peatlands and marine and coastal vegetation. This will lead to increased restoration efforts for these environments which will improve the condition of rivers, lochs and coastal zones.

Work which is delivering physical improvements

A number of projects to deliver improvements in physical condition of the water environment are already underway. Current and developing work includes:

- the pilot project initiated by the Scottish Government and SEPA in four catchments (Dee, Glazert Water, Nith and South Esk) to demonstrate how improvements to the physical condition of these catchments can be combined with measures which will help to reduce flood risk.[26] This work will be undertaken with local land managers, and any measures will be delivered on a voluntary basis;
- work on the River Almond and River Don to assess and prioritise fish barriers, so that fish habitat can be maximised throughout the catchments;
- catchment level studies of the Ugie, South Esk, Dee and Maltkin Burn, to demonstrate how physical condition can be improved through restoration.

These are important steps in moving towards a catchment approach, but to achieve the required improvements in physical condition, it is recognised that a step-change in delivery is required. The findings from these projects will help to inform the approach for the second RBMPs.

26 More information at: www.sepa.org.uk/water/river_basin_planning/implementing_rbmp.aspx

Conclusion

This document has set out how improvements in the physical condition of the water environment can be delivered through partnership working, setting priorities, and the use of a largely voluntary approach. The principal responsibility for delivering objectives often lies with land managers themselves, who will also benefit from many of the improvements. However, there is also a strong role for the Scottish Government and its agencies in supporting actions that deliver improvements.

The focus on catchments, and the need for partnership working, will grow in emphasis as Scotland moves towards the second river basin management plans. Working with land managers, local authorities, and other partner organisations is fundamental to this approach. Strengthening partnership links at a catchment level will be key for achieving multiple benefits, both in delivering current river basin planning work, and in the development of Scotland's second river basin management plans.

The second river basin management plans will be informed by the successful programme introduced to tackle diffuse pollution, the pilot projects and other demonstration sites, enabling the development of a more comprehensive catchment approach for restoration. Engagement with stakeholders on a new list of priority catchments and proposed ways of working will start in the autumn of 2013. It is recognised that different catchments will require different governance structures, levels of improving baseline environmental data and different measures to deliver solutions. So it is likely that the catchment approach ultimately introduced will provide a framework which can be adapted to suit the specific requirements of different catchments.