

# The Flood Risk Management (Scotland) Act 2009

## Delivering Sustainable Flood Risk Management



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## Ministerial foreword



The Flood Risk Management (Scotland) Act 2009 introduced a more sustainable and modern approach to flood risk management. It designated all local authorities, SEPA, Scottish Water and Scottish Ministers, as 'Responsible Authorities', and laid the duty upon us all to work to reduce flood risk. It placed a great deal of emphasis on the importance of partnership working and co-operation among authorities to help achieve the goal of reducing flood risk.

We can now look back on significant progress, facilitated by the Scottish Government in delivering an ambitious agenda. SEPA published the National Flood Risk Assessment in December 2012. This evidence supported the development of the Flood Risk Management Strategies and associated Local Plans. In implementing these, local authorities are being supported through investment in flood protection measures. SEPA's flood forecasting and warning service to the public has been extended, and the value of it was demonstrated by the preparedness and response of Scottish local authorities and emergency services during flood events. The Scottish Flood Forum has helped to support communities affected by flooding, and increased public awareness of action that can be taken by home owners to protect properties.

As we embark on the second cycle of flood risk management, we have gained valuable experience and knowledge, which will equip us well to pursue our goal to reduce overall flood risk in Scotland. This statutory guidance document has been updated to reflect that progress. No substantive changes in policy direction were required but progress and associate lessons learnt are included. Important amendments include stronger references to climate change based on latest scientific evidence, the addition of information on the increased risk of, and the need for management of coastal flooding and enhanced coverage of surface water management.

An independent assessment commissioned by the Scottish Government from the Adaptation Sub-Committee of the Committee on Climate Change shows that climate change is affecting Scotland now, with increases in seasonal temperatures, sea level and annual rainfall all being observed already. Future severe and disruptive changes in the climate during this century cannot be ruled out. Flood risk management is therefore a key part of the Scottish Government's response to climate change, as highlighted in Scotland's Climate Change Adaptation Programme.

I would like to thank all those who have contributed to the development of this guidance, and those who use it as the foundation upon which they deliver their duties. Scotland's collective effort in flood risk management continues to be of great importance to provide the basis for a fair and thriving society.

Roseanna Cunningham MSP,

Cabinet Secretary for Environment, Climate Change and Land Reform



## Statutory context

The production of this guidance is one of the duties of the Scottish Ministers set out in the Flood Risk Management (Scotland) Act 2009 (the Act). This guidance is issued by the Scottish Ministers to the Scottish Environment Protection Agency (SEPA) and the responsible authorities under section 2(5) and section 29 of the Act. The responsible authorities are local authorities, Scottish Water, Forestry Commission Scotland, Cairngorms National Park, Loch Lomond and the Trossachs National Park, and any other public bodies and office-holders designated as such by the Scottish Ministers.

Guidance is provided to SEPA and the responsible authorities on fulfilling their duties to:

- Act in the way best calculated to manage flood risk in a sustainable way; and
- Consider the social, environmental and economic impact of exercising flood risk management functions;

Guidance is also provided to SEPA on:

- Setting objectives and identifying measures for inclusion in flood risk management plans prepared under sections 27 and 28 of the Act. As required by section 29(2), the guidance addresses how the alteration and restoration of natural features and characteristics of the landscape should be considered.

The guidance is reviewed every six years or earlier if required to ensure continual improvement, and to reflect the experience and needs of those involved and assist further in delivering the main purpose of the Act, which is to reduce flood risk. This review was completed in June 2017.



## Summary

Climate change projections for Scotland suggest that the number and severity of storm events that could result in flooding are likely to increase. This could place pressure on our existing defences and reveal new areas at risk of flooding. To manage these risks, we must continue to improve our understanding of the causes and consequences of flooding and deploy more sustainable approaches to tackle flood risk and build flood resilience for both current and future climate.

This guidance complements the flooding legislation that was introduced in 2009, the Flood Risk Management (Scotland) Act 2009 (the Act). It sets out statutory guidance to SEPA, local authorities, Scottish Water, Forestry Commission Scotland, Cairngorms National Park, and Loch Lomond and the Trossachs National Park on fulfilling their responsibilities under the Act, and in particular on the steps that should be taken to manage flooding in a sustainable manner. The guidance is intended to ensure adoption of consistent principles and approaches based on good practice lessons in flood risk management.

In promoting a more sustainable approach to flood risk management, the guidance reaffirms the six following overarching outcomes for Scotland:

- 1. A reduction in the number of people, homes and property at risk of flooding as a result of public funds being invested in actions that protect the most vulnerable and those areas at greatest risk of flooding.**
- 2. Rural and urban landscapes with space to store water and slow down the progress of floods.**
- 3. Sustainable surface water management that decreases burdens on our sewer systems while also delivering reduced flood risk and an improved water environment.**
- 4. Coasts and estuaries managed in a way which aims to reduce flooding, respects the changing nature of the coast and takes into account potential impacts of interventions on flooding and erosion in adjacent areas.**
- 5. A well informed public who understands flood risk and takes actions to protect themselves, their property or their businesses.**
- 6. Flood management actions being undertaken that will stand the test of time and be adaptable to future changes in the climate.**

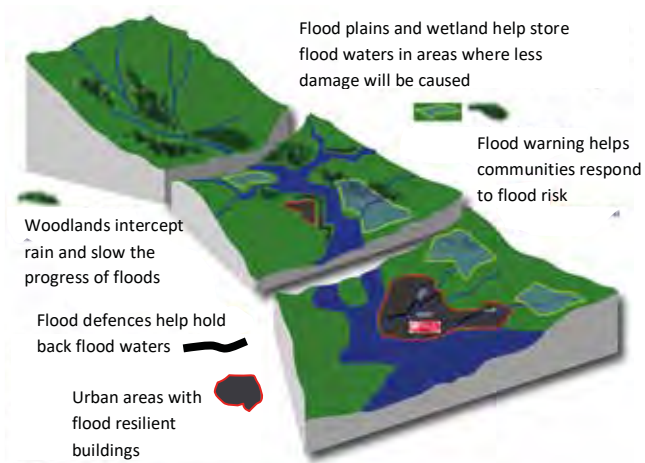
Guidance to support delivery of these outcomes is provided through seven themed sections, which cover topics like understanding flood risk, catchment flood management and selecting and implementing sustainable actions. Technical guidance on appraising flood management options is provided separately.

The guidance was developed in close collaboration with SEPA, responsible authorities, Scottish Water and a wide range of stakeholders representing Scotland's public bodies, flood risk management professionals and other interested parties.



## Introduction

Flooding can endanger lives and livelihoods, and disrupt the services that support our health, social and economic wellbeing. Although it will never be possible to eradicate flooding, a wide range of actions can be taken to reduce the likelihood and manage the impacts of flooding (Figure 1).



**Figure 1** Examples of actions to tackle flood risk

The Flood Risk Management (Scotland) Act 2009 (the Act) has created a framework for the assessment and management of flood risk, which is supported by new responsibilities on the Scottish Environment Protection Agency (SEPA), local authorities, Scottish Water, Forestry Commission Scotland, Cairngorms National Park, Local Lomond and the Trossachs National Park, and other designated responsible authorities.

*Delivering sustainable flood risk management* provides statutory guidance to these organisations on fulfilling their responsibilities under the Act. It also provides contextual information on how these responsibilities align with the

Government's wider policy framework for reducing flood risk and improving how flood risk is managed.

## Why we need this new approach

In the past, development on flood plains and along coasts took place with less knowledge of the risks associated with such development than we have available to us today. In places, this has left us with a complex and difficult legacy to manage.

Some past interventions also mean that we have lost features of our natural landscape that can help store and slow flood waters, including flood plains, saltmarshes and wetlands. In urban settings, a similar trend has occurred as our towns have expanded and green spaces, gardens and other natural drainage features have been lost.

Climate change predictions suggest that, in future, summers may be drier in Scotland, winters are likely to be much wetter, and we can expect to experience more extreme weather events. Many parts of the coast will also experience rising sea levels. In combination with continuing urban creep (the loss of permeable surfaces within urban areas leading to increased runoff), this is placing increased pressure on our existing defences and potentially revealing new areas at risk of flooding.

To deal with current and future flood risk, we need to continue to improve our understanding of flood risk and deploy more sustainable approaches to tackling these risks. This means managing whole flooding systems, be they catchments or coastlines, in a way that takes account of all interventions that can affect flood risk.



## Delivering the Outcomes

This guidance is part of the Scottish Government's work to improve flood risk management across Scotland. The changes the Government wishes to bring about are set out in the following six long term key outcomes:

### **1. A reduction in the number of people, homes and property at risk of flooding as a result of public funds being invested in actions that protect the most vulnerable and those areas at greatest risk of flooding**

The long-term aim must be to reduce the risk of flooding from all sources as far as is reasonable, taking full account of environmental, economic and social priorities. This means moving away from short-term reactive decisions and embracing proactive planning and investment decisions.

### **2. Rural and urban landscapes with space to store water and slow down the progress of floods**

Our urban and rural landscape can play an important role in storing and slowing flood waters. Consideration has to be given to the competing demands on our finite land resources. Therefore, SEPA and the responsible authorities should work closely with land managers to consider how to maximise the reduction in flood risk that can be achieved through these processes. This will not only help to reduce flood risk, it will promote the healthy functioning of Scotland's environment and the wildlife it supports.

### **3. Coasts and estuaries managed in a way which aims to reduce flood risk, respects the changing nature of the coast and takes into account potential impacts of interventions on flooding and erosion in adjacent areas.**

Managing flood risk in one part of the coast or an estuary can have consequences elsewhere. Disrupting the natural movement of sediment can lead to changes in patterns of erosion and the associated flood risk. Flood management at the coast should be planned and coordinated in a way that takes account of natural processes and considers the impact of interventions to manage risk on adjacent areas.

### **4. Sustainable surface water management that decreases burdens on our sewer systems while also delivering reduced flood risk and an improved water environment**

In both rural and urban areas, rainfall and resultant surface water run-off should be managed before it enters sewers and watercourses by allowing for increased capture and reuse of water; increased absorption through the ground; and more above-ground storage and safe conveyance of flood waters.

### **5. A well informed public who understands flood risk and adopts actions to protect themselves, their property or their businesses**

Individuals, business and communities can play a role in helping to reduce the risks they face. This must be supported through improved awareness and access to information on flood risk and on simple actions individuals and businesses can take to protect themselves and others from the impacts of flooding.



This will build on and enhance the benefits of actions taken by public bodies for example: - through provision of flood warning, development planning, improvement of infrastructure and the active management of “at risk” sites by undertaking and maintaining flood protection work.

## 6. Flood management actions undertaken that will stand the test of time and be adaptable to future changes in the climate

Decisions taken today will have a profound impact on the likely flood risks that future generations will need to manage. Our strategies and actions to manage flood risk must reflect the needs of future generations and be adaptable to a changing climate.

### Purpose of the guidance

**Delivering sustainable flood risk management** is statutory guidance issued under the Act. It explains to SEPA and the responsible authorities how they should fulfil their duty to:

*Act in the way best calculated to manage flood risk in a sustainable way.*

Guidance is provided on steps that should be taken to ensure full consideration of the social, environmental and economic impact of actions taken to manage flood risk. Guidance is also provided to SEPA on setting objectives and identifying actions for inclusion in flood risk management strategies and local flood risk management plans.

**Delivering sustainable flood risk management** is not an operational manual and it is not intended to prescribe how SEPA and the

responsible authorities should fulfil their duties. It is, however, intended to ensure the adoption of consistent principles and approaches based on good practice lessons in flood risk management. The guidance is divided into the following topics:

1. Understanding flood risk
2. Understanding catchments and coasts
3. Integrated approach to flood risk Management
4. Surface water management
5. Selecting and implementing sustainable Actions
6. Engaging with the public
7. Delivering responsibilities collectively

The guidance is updated regularly to promote continuous improvement. Supplementary guidance notes may be published from time to time to further expand or update the guidance or related policy matters. These may address feedback on how the policy is being implemented, or to reflect changes to wider policies, such as climate change adaptation or planning policy.

The guidance has been prepared for a professional audience with knowledge of the topics covered. Although its main users will be SEPA and the responsible authorities, aspects of the guidance will be relevant to other public, commercial and voluntary organisations, as well as the public.





# 1. Understanding flood risk

## Introduction

**Flood risk is a measure of the likelihood that a flood will happen and of its potential adverse consequences. The long term aim of the Scottish Government is to reduce this risk.**

Robust and reliable information on the causes and consequences of flooding are needed to promote well-informed decisions on how to tackle flood risk.

## Sources of flooding

This guidance covers most potential sources of flooding in Scotland. Exceptions are floods caused by the sudden failure of infrastructure such as dams and those caused solely by a failure in or blockage of a sewerage system. Scottish Water has statutory responsibilities for maintaining the sewerage network. Floods caused solely by a failure in or blockage of a sewerage system should be dealt with through this existing channel. Under the Reservoirs (Scotland) Act 2011, SEPA regulates reservoirs to ensure they are safe and well maintained to reduce the risk of an uncontrolled release of water from these structures.

In fulfilling their flood risk management responsibilities, SEPA and the responsible authorities should focus on the sources of greatest risk.

- **River (fluvial) flooding** - this occurs when the water draining from the surrounding land exceeds the capacity of the watercourse.
- **Coastal flooding** – is caused by high sea levels, waves overtopping defences or the inundation of low-

lying land at the coasts or in estuaries. Coastal flooding is often linked to coastal erosion.

- **Surface water (pluvial) flooding** - is caused when rainfall water ponds or flows over the ground before it enters a natural or man-made drainage system or watercourse; or when water cannot enter the drainage system because the system is already full to capacity.
- **Groundwater flooding** - this occurs when water levels in the ground rise above surface levels.
- **Sewer flooding** - this occurs when combined sewers are overwhelmed by heavy rainfall. Sewer flooding is often closely linked to surface water flooding, and may contain untreated foul water.

## Characteristics of a flood

The causes and consequences of flooding can only be fully understood when the characteristics of a flood are examined. The Act specifies particular flood hazard characteristics that must be assessed and mapped, which are described in more detail in Table 1. Flood hazard maps will show where flooding has the potential to do harm. Where necessary, additional factors included in Table 1 may be considered to give a full picture of the likely impacts resulting from a flood.



Table 1 Flood hazard characteristics

Characteristic	Significance
Extent	Helps show where flood waters will penetrate and what may be affected.
Depth	Helps understand the potential impacts of a flood. For instance, extensive shallow water flooding is likely to be less damaging than more localised areas of deeper water
Duration	The duration of a flood can have an impact on the damage caused, for example long duration flooding can increase impacts to crops and services.
Velocity/ flow	High velocity flood waters can increase risk to health and safety and cause greater damage.
Water environment	Floods that carry pollutants, for instance sewer flooding often carries a greater risk to health and safety as well as the potential to cause greater economic damage.
Sediment content	Flood waters with a high sediment or debris content can create additional risks to health and safety, and may increase the risk of damage to infrastructure (e.g. bridges).

## Likelihood of flooding

For flood mapping purposes, the Act requires three flood scenarios to be assessed.

- High likelihood: A flood event is likely to occur in the defined area on average once in every ten years (1:10). Or a 10% chance of happening in any one year.
- Medium likelihood: A flood event is likely to occur in the defined area on average once in every two hundred years (1:200). Or a 0.5% chance of happening in any one year.
- Low likelihood: A flood event is likely to occur in the defined area on average once in every thousand years (1:1000). Or a 0.1% chance of happening in any one year.

A variety of methods can be used to estimate the probability of flooding. SEPA should take a lead role to support and disseminate guidance on how to apply appropriate methods to analyse flood probabilities, including techniques to examine multiple or combined sources of flooding

In many instances, different sources of flooding can combine to intensify a flood. For example, high tides in estuaries can occur simultaneously with high river levels. Understanding these interactions (including their likelihood) will be an important part of understanding and managing flood risk.

## Assessing the impacts of flooding

A wide range of impacts to society, the economy, the environment and cultural heritage should be assessed where appropriate, including those set out in Table 2.

To gain a fuller appreciation of the impacts of flooding, SEPA and the responsible authorities should also consider the following factors:

- **Exposure** - what will be exposed to the flood;
- **Vulnerability** - the vulnerability of those things that are exposed to the hazard; including the ability to recover, which may include the availability of insurance;
- **Value** - the value of things exposed to the hazard, which could include costs or how critical the item is.



**Table 2** Measuring the impacts of flooding

Impact	Categories and descriptions
Human health (social)	<i>Human health:</i> includes immediate or consequential impacts.
	<i>Community:</i> impacts to emergency response, education, health and social work facilities.
Environment	<i>Water body Status:</i> permanent or long-term impacts to ecological or chemical status of surface water bodies.
	<i>Protected areas:</i> adverse permanent or long-term impacts to protected areas or water bodies.
	<i>Pollution sources:</i> sources of potential pollution in the event of a flood, such as IPPC and COMAH installations, or point or diffuse sources.
	<i>Wider environment:</i> Other potential permanent or long-term environmental impacts, such as those on soil, biodiversity, flora and fauna, etc.
Cultural heritage	<i>Cultural assets:</i> permanent or long-term impacts to cultural heritage, which could include archaeological sites / monuments, and architectural sites.
Economic	<i>Property:</i> impacts to property, which could include homes, insurance availability
	<i>Infrastructure:</i> impacts to infrastructural assets such as utilities, energy generation and transmission, transport, storage and communication.
	<i>Rural land use:</i> impacts to uses of the land, such as agricultural activity (livestock, arable and horticulture), forestry, mineral extraction and fishing.
	<i>Economic activity:</i> impacts to other sectors of economic activity, such as manufacturing, construction, retail, services and other sources of employment.

elderly, frail or sick can be more susceptible to injuries or loss of life. Resilience is a measure of the ability of something to recover from a flood. For instance, businesses can be more resilient to flooding through the use of insurance. Buildings can be made more resilient through the use of water resilient materials in construction.

In particular, measuring the impacts on and potential benefits to the environment poses a significant challenge, and methods to help account for these should be explored and drawn into the flood risk management planning process.

The indirect impacts of flooding can also cause problems. For example, the costs of disruption to transport and power supplies or the costs to emergency services. It is important that these indirect impacts are included wherever practical to do so.

SEPA and the responsible authorities should take account of the outputs from the Mapping Flood Disadvantage 2015<sup>1</sup> research commissioned by the Scottish Government. Flood disadvantage occurs where vulnerable communities coincide with areas which may be exposed to flooding. Identifying flood disadvantage is a useful framework for planning actions in anticipation of the increased risk of flooding and developing recovery strategies in the aftermath of flooding (e.g. considering the social characteristics and flood vulnerabilities of each neighbourhood).

Wherever possible, both aspects of vulnerability should be considered - *susceptibility* and *resilience*. Susceptibility is a measure of how prone to impacts particular elements will be during a flood. For example, the

<sup>1</sup> <http://www.gov.scot/Publications/2015/12/1746>

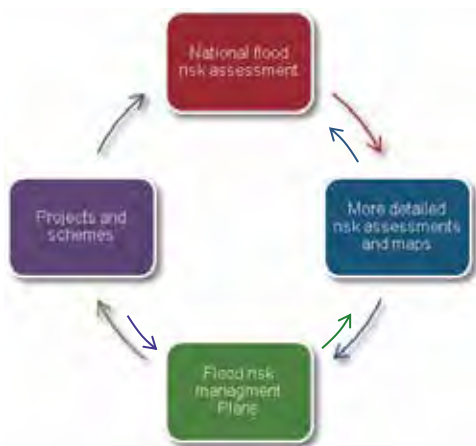


## Analysing flood risk

### *An integrated approach to assessing risk*

Many of the assessments undertaken by SEPA will be strategic level assessments that will support the preparation of flood management plans. These assessments will also identify where more targeted or detailed assessment should be carried out by responsible authorities and other organisations that can contribute to the management of floods.

Ultimately this should form a cyclic process where information and knowledge is built up over planning cycles (Figure 2).



**Figure 2** Cycle of information and knowledge growth

To support the delivery of this integrated approach to assessing and managing flood risk, SEPA should:

- Make use of available historic flood and gauging data;
- publish and maintain advice on assessing, modelling, mapping and sharing data. In doing so, SEPA should work alongside the responsible authorities and other organisations to ensure that the

information meets the needs of all relevant organisations;

- take all practicable steps to ensure that national assessments, including the national flood risk assessment and national flood maps, thoroughly consider and reflect local risks and issues;
- ensure that information generated on flood risk can be used in a consistent way at all stages of the flood risk management planning process, and in particular in the appraisal of actions to manage flood risk;
- create and manage an Observed Flood Events database in order for information to be shared with the responsible authorities and other interested parties. The responsible authorities should provide active support and information to help SEPA in this work. Where necessary, the Act provides SEPA and local authorities with powers to request information and to seek assistance.

### *Residual risk and the effectiveness of actions*

Residual risk is the risk that remains after management actions have been taken. Residual risks often have a low probability of occurrence, although the impacts can be severe. Residual risk should be considered in flood management decisions. Home and business owners should be encouraged to insure themselves against the residual risk where possible and all actions to manage flooding should include arrangements to deal with residual risks. Flood resilient property repairs can play an important part in managing residual risk.



Understanding the effectiveness of existing actions and residual risk is an important step in identifying management actions. For example:

- How well are flood defence structures performing against their initial design standard?
- What difference does flood warning make to public safety?
- What are the consequences of an event exceeding the design standard?
- Is insurance available to cover the residual risk?

It is important that existing actions to manage flooding and their effectiveness are taken into account wherever it is practical to do so, particularly when undertaking work that will influence investment decisions, e.g. assessing areas vulnerable to flooding or preparing flood risk management strategies or local flood risk management plans.

### Source-pathway-receptor-impact model

Data on historical flood and gauge data are essential to build up a picture of what contributes to flooding in a catchment or on the coast. Additional information can be used to build a good understanding of the links between the sources and impacts of flooding. This will help identify the right combination of actions to tackle particular flooding problems. For instance, where high rates of run-off in upland areas is contributing to flooding problems, actions to store or slow run-off could be considered, including re-vegetating a hill slope to increase the interception of rainfall and increase the roughness of the land surface, thereby slowing runoff.

The same principles apply in urban areas, where an understanding of the sources and pathways of flood waters can help identify sustainable flood risk management actions.

To help understand the interaction of different actions across catchments and coasts, SEPA and the responsible authorities should adopt the source – pathway - receptor - impact approach.

The approach is a well-established framework in flood risk management. It provides a basis for understanding the causal links between the source of flooding, the route by which it is transmitted and the receptor, which suffers some impact:

- *Sources* are the weather events or conditions that result in flooding (e.g. heavy rainfall, rising sea level, waves, river flows etc);
- *Pathways* are routes between the source of flood waters and the receptor. These include surface and subsurface flow across the landscape and urban drainage systems;
- *Receptors* are the people, industries and built and natural environments that can be impacted upon by flooding;
- *Impacts* are the effects on receptors. The severity of any impact will vary depending on the vulnerability of the receptor.

### Quantifying flood risk

Risks are evaluated by combining the likelihood and consequence of flooding. This can be achieved in a variety of ways, and the approach adopted should reflect the purpose of the assessment, the scale of the assessment and the data available.



There will be times where risk thresholds will need to be set, for instance, when undertaking the national flood risk assessment and designating potentially vulnerable areas. Risk thresholds are highly subjective and can be influenced by societal preferences, values and opinions of acceptability. SEPA and the responsible authorities should present a consistent opinion of flood risk and its significance or acceptability. This must be done within the context of Government guidance and policy on these matters.

### **Climate change and other long term trends**

Testing proposed flood management actions against long term trends is essential to selecting sustainable actions that will stand the test of time. SEPA and the responsible authorities should continue work to examine future scenarios which can be used to consistently assess the effectiveness of flood risk management decisions and how these should be applied. Wherever possible, a range of future scenarios should be examined, including a 'worst case' scenario.

Climate change is likely to have a substantial impact on flooding. SEPA in collaboration with the responsible authorities, and relevant UK and Scottish Government bodies should work to improve information and guidance on the effects of climate change on flood risk. This should include using information gathered over implementation cycles to detect changes in flood patterns, and applying methods to detect and assess trends, and developing new projections for how climate change may affect the likelihood and severity of flooding.

Other long term trends that could have a measurable impact on flood risk should also be considered. Scotland should expect and plan for a change in flood risk as a consequence of population growth and demographic change, as well as from urban creep and changes in land-use.

### **Dealing with uncertainty**

Floods are infrequent phenomena for which it is difficult to predict future events. Uncertainties can be divided into four main areas:

- natural variability, which can be subdivided into natural variability in time and natural variability in space;
- knowledge uncertainties that come from a lack of knowledge, for example about the behaviour of defences;
- modelling and data uncertainties in the quality of models or data that supports assessments, design and appraisal;
- fundamental uncertainties about things we cannot know, for example how changes in society and technology may affect future greenhouse gas emissions and the level of climate change that occurs.

Uncertainty should be clearly presented in flood risk assessments showing what approaches have been used to quantify them and how decisions have been influenced by uncertainties. Any assumptions made should be clearly set out.



## 2. Understanding and working with catchments and coasts

### Introduction

**Actions that affect one part of a river, coast or estuary can have consequences elsewhere. This means that flood management actions are most effective when they are planned and coordinated within catchments and along coasts in a way that is uninhibited by administrative boundaries.**

Adopting a catchment approach to flood risk management requires an appreciation of catchment and coastal processes, and an understanding of how best to manage the sources and pathways of flood water. This includes looking at how the timing, magnitude and duration of a flood can be managed, e.g. by creating, restoring and enhancing natural features and characteristics of the landscape, including wetlands, woodlands, vegetation, functional flood plains, saltmarshes, beaches and dunes.

This section provides guidance on:

- setting appropriate units of management;
- the application of a source-pathway-impact approach to flood risk management;
- the role of land use and natural flood management in managing flood risk including actions in urban areas;
- promoting and balancing the needs of those living and working in rural areas.

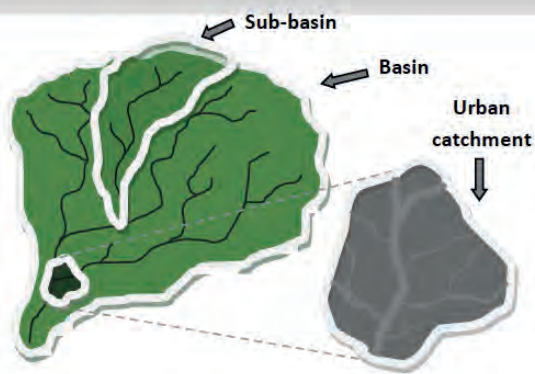
### Catchment management units

SEPA and the responsible authorities must coordinate their actions to tackle flood risk across catchments. In most cases this will require coordination of actions at the scale of the river basin or sub-basin- i.e. a catchment that drains to the sea (Figure 3). At the coast, flood risk management should be planned and coordinated within coastal cells.

This move away from an approach based on administrative boundaries has been successfully promoted by SEPA and the responsible authorities. Primarily this has been through the Local Plan District Partnerships and led to the publication of the Flood Risk Management Strategies in December 2015 and Local Flood Risk Management Plans in June 2016. The catchment and coastal cell approach should be further developed and strengthened through the implementation of flood risk management actions and the land use planning process.

In some cases it may be appropriate to sub-divide river basins into smaller catchments (also referred to as sub-basins) to allow for more detailed assessment and analysis of management options. When assessing options to tackle urban surface water flooding, urban drainage catchments can be defined to promote detailed analysis of the urban landscape as long as it is considered as part of the wider catchment.

Where river basins are separated into smaller catchments, the interactions, physical and ecological, with the larger river basin in which they are located must be understood.



**Figure 3** Basins, sub-basins and urban catchments

SEPA should work closely with the other responsible authorities to identify the appropriate spatial scales and catchments around which flood risk management efforts should be targeted.

### Understanding catchments

Our natural landscape can play an important role in managing flood risk. Over time, human activities have altered the character of our landscape and affected the timing, magnitude and duration of floods. For example, urban creep, loss of natural floodplains, compaction of soils, changes in land cover and increased field drainage can all increase run-off and peak flood flows.

Creation, restoration and enhancement of natural features of the landscape (e.g. floodplains, wetlands and forests) can help to restore more favourable run-off patterns and reduce flood risk whilst at the same time providing widespread multiple benefits beyond flood risk management.

These more natural techniques typically aim to protect, emulate or restore the natural processes which regulate flooding and erosion, often by keeping water in areas where it will cause less damage. Examples include:

- improving water storage and capturing run-off by restoring,

protecting or enhancing soil condition and woodland areas;

- reconnecting floodplains, restoring wetlands or creating ponds and reservoirs to help store flood waters;
- planting vegetation and managing hill slopes to help slow run-off;
- restoring watercourses to a more natural channel form by removing culverts and other structures that constrain channels and can contribute to flooding during high flows.

In urban areas, green roofs, permeable paving, flood and surface water attenuation ponds, opening up and realigning watercourses, and establishing green spaces and blue corridors are equivalent examples.

To provide insights into the causes of flooding and the types of management options available, SEPA, in close collaboration with the responsible authorities and other organisations with an interest in catchment management, should work to develop an improved understanding of the hydrological, ecological and geomorphological condition and functioning of Scotland's catchments. This should include assessments of the effects of human interventions on flooding processes.

The condition of our soils, our water resources and the health of our ecosystems are all influenced by processes that occur within and across catchments. Understanding and managing these interactions will create opportunities to invest in actions that can simultaneously reduce the risk of flooding, while also improving the quality of our natural and urban environment. SEPA should ensure that information generated on catchment





characteristics and natural features can assist with the selection and design of environmentally sensitive defences or other actions. Further, this information can be used to support other work areas, including river basin management planning, biodiversity, benefits for amenity and people, and landscapes as well as providing greater resilience to future change.

SEPA is also responsible for assessing how the restoration or enhancement of natural features and characteristics of catchments could contribute to managing flood risk. SEPA has published maps<sup>2</sup> showing the areas where implementing natural flood management techniques could be most effective. These maps will help to inform flood risk management decisions and should be used in conjunction with other relevant information and more detailed site specific assessments.

SEPA should develop guidance for responsible authorities to help them identify any additional costs or benefits that can be delivered from these actions, thus ensuring that the full value of these options can be considered.

## Understanding coasts and estuaries

Attempts to interfere with the changing nature of the coast and to fix its position have been made in the past with varying degrees of success. Built structures can lead to enhanced erosion further along the coast or just offshore. This is due to an interruption to the natural supply of sediment or

alterations to currents and waves. Coastal flood and erosion risk must be managed in a way that takes account of natural coastal processes and how the wider coast will respond to the impact of such works.

The risk of coastal floods will increase as the sea rises higher up the foreshore or onto existing defences. In areas of shallow water, rising sea level will also be accompanied by increases in the height and energy of waves that reach the shore. Climate change impacts on coastal flooding could in future be greater than for river or surface water flooding.

Accelerated coastal erosion that accompanies these conditions can remove protective beaches and increase the risk of flooding by allowing larger waves to approach the shore. Coastlines such as sand and shingle beaches can however be resilient to climate change if there is enough space to allow the natural cycle of erosion and deposition to take place.

Enhancing existing natural features or natural processes can help to reduce flood and erosion risk in a way that has less adverse impacts to adjacent areas and has wider environmental and societal benefits. Examples include transferring additional sediment to a beach, re-profiling a beach to maximise its potential to absorb wave energy and creating saltmarsh in estuaries.

It is vital that the best understanding is developed on coastal flood and erosion risk, how that risk may change over time and how it should be best managed in a sustainable manner.

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<sup>2</sup> <http://map.sepa.org.uk/floodmap/map.htm>



## State of knowledge and using reliable science

The state of knowledge on natural flood management techniques has progressed and continues to improve. SEPA should draw on its broad scientific expertise to advise its partners and the wider stakeholder community on the benefits and role of these techniques. This should include supporting research and promoting demonstration projects to validate the research work.

The uncertainties associated with using more natural approaches have been greater than those for more traditional engineering. These uncertainties are diminishing as the evidence base expands. It is important to take a pragmatic and proportionate approach to deal with uncertainty. Uncertainty should not be a barrier to adopting these techniques where it is appropriate to do so. For example, where uncertainty is around the scale of flood risk benefits that can be achieved, and no adverse impacts have been identified, it would be appropriate to proceed with implementation on a 'no regrets' basis.

Natural flood management techniques which seek to restore the landscapes ability to reduce runoff to store flood water and to absorb wave energy at the coast have multiple benefits for the water environment, associated habitats and for people. Interventions should however be designed and implemented in a manner so that flood risk is not inadvertently increased.

SEPA and the responsible authorities must ensure that these uncertainties are examined and communicated to those who may benefit or be affected by the use of these techniques.

## Flood risk management and adaptation

Due to the likely impacts of climate change, in some locations, it may become increasingly difficult both technically and financially to maintain current levels of flood risk and erosion protection.

It is important that long term plans are made to determine how best to respond to changes in flood risk. Strategies can allow for continued protection from flooding in the short to medium term, but in parallel may need to develop longer term proposals to move critical infrastructure and development away from areas at increasing risk of flooding and erosion. Taking early decisions, informed by the best science, can allow for greater flexibility in terms of future management and adaptation to coastal change. To this end the National Coastal Change Assessment<sup>3</sup> maps historic rates of erosion and accretion along our coastline and projects these rates forward to a future coastline for 2050 and 2100.

Adaptive actions such as relocation will not be easy to implement and it is important that any affected communities, businesses, land and asset managers are fully engaged in developing a common understanding of the pressures facing rivers and the coast and in developing adaptive strategies for the future. Based on experience elsewhere in the UK and across the world, the coast is the area where the greatest need for adaptation will be in the future.

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<sup>3</sup> <http://dynamiccoast.com/>



## Promoting and balancing the needs of rural areas

Rural land use is important to a successful Scottish economy. There are many and varied demands already placed on land managers, and rural land use contributes to delivering many wider economic, environmental and social benefits, with a large number of people directly employed in these sectors. A large proportion of Scotland's land is under agricultural production and the sector is responsible for much of Scotland's domestic food supplies and exports.

Some of the greatest opportunities to restore our landscape's natural capacity to cope with floods are in rural areas. In preparing flood risk management strategies and local flood risk management plans, SEPA and local authorities should consider carefully the views and needs of land owners and rural businesses so that the correct balance is struck between all competing demands on rural areas.

It is important that land management changes are focused at a scale/ distance that is relevant to the area at risk of flooding.

The Scottish Government provides funding to enable local authorities to deliver general duties under the Act, including, where appropriate, natural flood management. Traditionally, some funds are available to support voluntary action, including the Scotland Rural Development Programme (SRDP) and the Water Environment Fund. The SRDP supports actions that reduce the effects of pollution, deliver biodiversity benefit, flood risk management and other societal and environmental benefits. Funding opportunities may

change as the UK's relationship with the European Union evolves.

SEPA and the responsible authorities should consider carefully how the range of existing funding routes and instruments can be used to support flood management and wider restoration initiatives and, in particular, how local authority powers under the Act can be used to deliver flood risk reductions through land management. For example, in allocating funding for environmental improvements SEPA should give consideration to promoting projects that deliver coincident flooding and environmental benefits.

Where land management and restoration forms part of a flood protection scheme, local authorities have a new wide range of powers to compensate land managers. Options include one off payments, service agreements and compulsory land purchase. In all cases voluntary action or voluntary agreements should be pursued. However, the voluntary agreements still need to be set down in a legal framework which gives both parties security.

The Scottish Government will continue to work with stakeholders and local authorities to ensure that local authorities have access to a toolkit of options for delivering improved flood risk management and a reduction in flood risk. Particular attention will be paid to any limitations of current instruments and to instruments that encourage land owners to participate through voluntary actions<sup>4</sup>.

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<sup>4</sup> [Assessing the mechanisms for compensating land managers](#)



### 3. An integrated approach to flood risk management

#### Introduction

**Flood risk management is the process of assessing, organising and implementing actions to deal with flood risk. The main outcome of the flood risk management planning process should be a set of sustainable actions being taken to reduce overall flood risk across Scotland.**

Multiple organisations are involved in managing flood risk. It is therefore essential that an integrated approach, that balances national consistency and strategic decisions with local knowledge and accountability, is adopted.

This section provides guidance on:

- principles that should be adopted to deliver an integrated approach to flood risk management;
- the interaction of flood risk management with other land and water management decisions;

#### **Flood risk management strategies and local flood risk management plans**

The preparation and implementation of flood risk management strategies<sup>5</sup> and local flood risk management plans is at the heart of Scotland’s efforts to tackle flooding. The Act sets out a flood risk management planning process that ensures that long-term and nationally-

focused objectives are balanced with local knowledge and priorities. Table 4 summarises the key steps in preparing these strategies and plans, and Annex 1 provides further information on key milestones in the development of the documents for 2021 and 2022 respectively. The strategies and plans are reviewed and updated every six years.

**Table 4 Key steps in preparing flood risk management strategies and local flood risk management plans**

<b>National flood risk assessment – by 22<sup>nd</sup> December 2018</b>
The national flood risk assessment (NFRA) provides a broad-scale picture of the causes and impacts of flooding across Scotland. It is important to regularly update the NFRA to consider new data and modelling techniques. The assessment leads to the review and identification of Potentially Vulnerable Areas, which is used to help target actions and investment to reduce flood risk.
<b>Flood risk management strategies – by 22<sup>nd</sup> December 2021</b>
Building on the NFRA, a strategic assessment of flood risk management actions and the analysis of recent more detailed local flood studies, the next generation of flood risk management strategies will be prepared to coordinate actions across catchments post 2021. Flood risk management strategies support targeted investments and better decision-making to reduce flood risk.
<b>Local flood risk management plans – by June 2022</b>
Local plans supplement the strategic objectives and actions identified in the strategies. They translate the strategies into an implementation plan to reduce the impacts of flooding with more detail on local delivery including timing, funding and coordination arrangements.

The principal output of the planning process should be a set of sustainable actions to manage flood risk across Scotland. These actions should be selected following the guidance set out in this document.

The Act establishes lead roles for all the key steps in preparing and implementing flood risk management plans, although cooperation between SEPA and the responsible authorities will be required at all stages.

<sup>5</sup> These are the Flood Risk Management Plans referred to in the Act.



Scottish Ministers have asked SEPA to ensure that the most sustainable measures are identified and included within flood risk management strategies. These strategies are a key step in the flood risk management process. The strategies, and the actions which follow, drive national investment decisions in each 6 year cycle and are subject to approval by the Scottish Ministers.

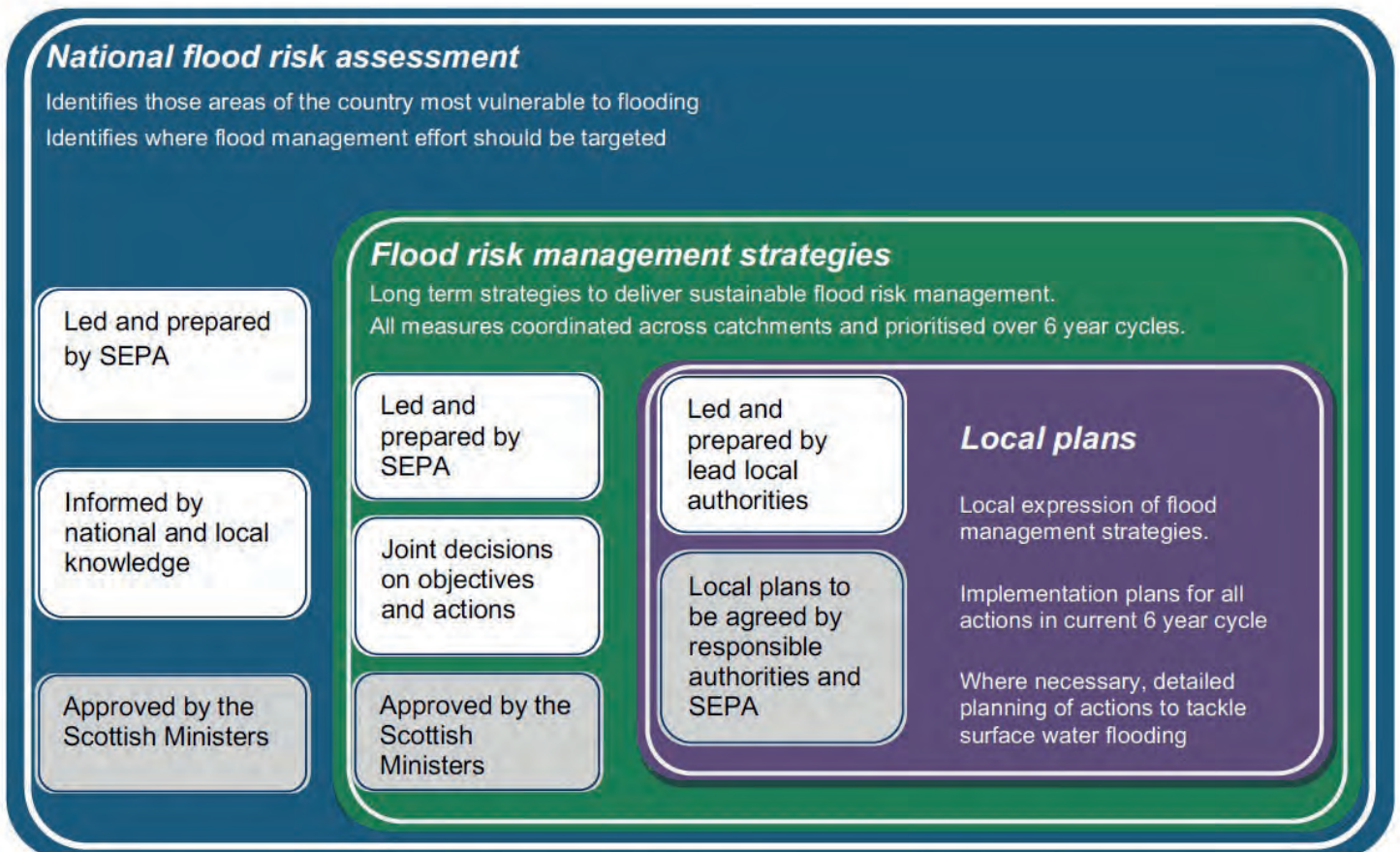
### Flood risk management actions

The lead local authority for each local plan district leads on coordinating the agreement of the funding routes and timetables by which actions will be taken forward locally. The Scottish Ministers, SEPA and the responsible authorities are responsible for implementing the agreed actions and reducing flood risk.

The strategies and local flood risk management plans must not be developed in isolation (Figure 4).

SEPA and the responsible authorities must ensure that systems are in place to manage interdependencies, while also ensuring that the national exercises being undertaken, such as the national flood risk assessment, take account of local knowledge and priorities. Chapter 7 provides further information on working in partnership.

Although developed through an integrated process that will lead to a set of coordinated objectives, measures and actions for Scotland, information will need to be presented in the two closely related sets of plans prepared by SEPA and local authorities (Figure 4).



**Figure 4** Roles and responsibilities in preparing flood risk management strategies and local plans



The flood risk management strategies will be prepared and published by SEPA. These strategies set the overall direction of flood risk management across Scotland. They also fulfil the reporting requirements of the EU Floods Directive<sup>6</sup>.

SEPA is responsible for reviewing and updating the flood risk management strategy for each local plan district. This is done by working closely with the lead local authority and other responsible authorities relevant for that district.

The local flood risk management plans are led by lead local authorities. In addition to providing a local expression of the strategies prepared by SEPA, these 'tactical' plans include a summary of how actions will be implemented in each local plan district. Local flood risk management plans support engagement with local communities and should also contain surface water management actions and any other additional actions and information that they believe is necessary to support local needs.

SEPA and local authorities should integrate as far as practical the presentation, publication and consultation of their strategies and plans.

In urban areas, the coordination of actions to tackle surface water flooding presents a unique set of challenges. Local authorities are expected to lead on the coordination of actions to deal with surface water flooding. This work should be coordinated and presented within local flood risk management

plans. Surface water management and drainage are examined further in chapter 4.

Implementation of the actions must be reviewed regularly. The lead local authorities prepare an interim report between 2018 and 2019 and a final report at the end of each flood risk management cycle (2022) on the progress of tackling flood risk and implementing actions.

### **Delivering integrated FRM planning**

Multiple organisations are involved in managing flood risk. It is therefore essential that a fully integrated approach, that balances the need for national consistency with local knowledge and accountability, is adopted. A top down approach that disengages local authorities and local communities from decision making must be avoided.

#### *National consistency*

Adoption of consistent principles, approaches and methods at each step in the process of managing flood risk will ensure a nationally comparable risk-based approach informs management and investment decisions. Areas where consistency will be particularly important include methods adopted to assess flood risk, approaches to considering future challenges (such as climate change, societal, cultural and political changes), and techniques adopted to appraise management options (Table 5).

SEPA should lead on ensuring the appropriate level of national consistency is delivered. Guidance documents to support national consistency are summarised in Annex 3.

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<sup>6</sup> [http://ec.europa.eu/environment/water/flood\\_risk/](http://ec.europa.eu/environment/water/flood_risk/)



Table 5 Areas where consistency should be promoted
Assessing and quantifying flood risk
Considering the full range of social, economic, environmental impacts of floods
Examining current and future risk based on climate change scenarios and other long term trends
Promoting and adopting a source-pathway-impact approach to assessing and managing flood waters
Considering a full range of actions, paying particular attention to those that restore a catchment's ability to slow or store flood water
Communicating flood risk and engaging with the public

*Balancing local and national needs*

A balance must be struck between national strategies and priorities and local decision making and accountability. This requires close collaboration and a structured planning process that creates the space and time needed to consider any competing needs and reach informed decisions.

The flood risk management strategies should establish the overall approach, for instance by identifying the most sustainable and most appropriate combination of actions. Where these actions, for example a flood protection scheme, require significant public expenditure, more detailed design and appraisal work will be required to ensure that the best option and design is selected and tailored to suit local needs.

*Joint ownership of strategies, local plans and actions*

The identification and delivery of sustainable flood management actions requires close collaboration between SEPA, responsible authorities and other stakeholders. Ultimately, there must be joint ownership of the

strategies, local plans and the actions set out therein.

Wherever necessary, SEPA should ensure that decisions on setting objectives and identifying actions are taken jointly with the responsible authorities, as well as with others who could contribute to delivering actions and could be affected by decisions. Where agreements on objectives and actions cannot be reached, SEPA will have to set out any difficulties in reaching agreement in their report to the Scottish Ministers, who can then approve the strategies, or require SEPA to undergo further consultation before it is approved.

The same principles apply to local authorities when developing the local plans. Where agreements cannot be reached on how actions will be implemented, the Scottish Ministers will determine the content of the implementation plans.

*Creating efficiencies in the development of actions*

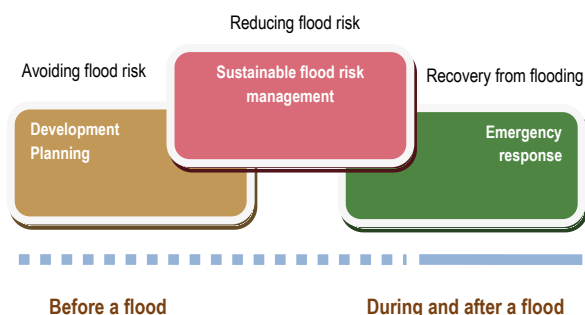
The promotion of joint working and sharing of skills and expertise is often challenging but should lead to efficiencies of time and resources between SEPA and the responsible authorities. Importantly, the process of preparing flood risk management strategies and local flood risk management plans should assist in the process of taking forward and implementing a flood protection scheme or other actions. For example, the information generated by SEPA should fulfil, at least in part, early option appraisal stages of scheme development, while also supporting subsequent, more detailed assessments and appraisals.



## Interactions with other issues

There needs to be close coordination of flood risk management planning work with other areas which affect, or are affected by flood risk management, including the land use planning system, infrastructure planning, coastal erosion, insurance provision and emergency response (Figure 5).

Land-use planning decisions can be one of the most powerful tools available to manage flood risk. This concept is set out in Scottish Planning Policy 2014, which states that the planning system should prevent development which would have a significant probability of being affected by flooding or would increase the probability of flooding elsewhere. Where redevelopment occurs, the planning system can identify opportunities to build flood resilient structures, sustainable urban drainage and flood management actions that are integrated into the fabric of our urban landscapes. SEPA has been developing its guidance to planning authorities on how flood risk should be taken into consideration in the land-use planning process.



**Figure 5** Three elements of flood risk management

Flood risk management strategies and local plans produced under the Act provide additional information to enable planning authorities to plan and

consider future development with a more complete picture of current and future flood risk.

The strategies and local plans include a series of land-use planning related actions, which can help guide the management of flood risk within the Development Plan area. They include nationally applicable land-use planning actions, as well as actions specific to potentially vulnerable areas that may have influence on land use matters. The Development Plan process will be the mechanism for delivering these actions.

Planning authorities should review the actions in each of the potentially vulnerable areas in their Development Plan area in order to identify any opportunities to help deliver them through the planning process.

Scottish emergency planning and response is founded on the concept of Integrated Emergency Management (IEM). Under IEM, preparation and response to emergencies focus on the effects of events rather than their causes. Close ties between emergency planning, the Scottish Flood Forum and flood risk management planning are needed to coordinate actions and to manage the effects of flooding, including where restoration and repair of homes and properties is being undertaken once the flood waters have receded. It is important to build community and property resilience to reduce the impacts of flooding.

## Integrated land and water management

As far as is practicable, an integrated approach to land and water management should be pursued. When developing flood risk





management strategies and local flood risk management plans, early links must be made with other relevant aspects of water and land management. In turn the findings from flood risk management planning should influence other planning processes or activities in an interactive and iterative cycle. Making these links helps to identify opportunities to deliver multiple benefits from flood risk management actions.

Examples of relevant policy areas include:

- National land-use planning policy
- Local and strategic development plan;
- River basin management plans;
- Coastal erosion and shoreline management plans;
- Marine spatial plans;
- Green networks;
- Emergency response;
- Economic development plans;
- Asset management and investment plans;
- Protection of critical national infrastructure;
- Community resilience
- Curriculum for Excellence
- Climate change adaptation and mitigation.

This is not an exhaustive list. The important point is that connections and dependencies should be considered early, so as to allow links and synergies to be established and accounted for.

## Links with river basin management plans

River basin management planning, which is led by SEPA, takes a source-to-sea approach to integrating land and water management to improve the quality of Scotland's water environment.

The Act requires consistency and coordination between river basin planning and flood risk management.

Examples of where SEPA should ensure consistency and coordination include:

- where possible not undermining the objectives of one, when addressing the other;
- operating its monitoring regime so as to provide information about flooding;
- managing data to allow flood risk management and river basin management to exchange information easily and take advantage of opportunities for coordination of objectives and actions;
- managing advisory groups and consultation activities to reduce consultation fatigue.

The information, knowledge and structures created to support flood risk management should also be used to support continued improvements to river basin planning.

The greatest opportunities are likely be in the areas of diffuse pollution, water resources and hydro morphology, all of which should benefit significantly from the information, tools and knowledge that will be generated through the preparation of flood risk



management strategies and local plans.

SEPA will work towards supporting integration of River Basin Planning and Flood Risk Management Planning to develop a joined up approach to protecting and managing Scotland's water environment.

### **Involving stakeholders**

SEPA, and the responsible authorities will need to work in partnership with communities, businesses and land managers to help them understand flood risk, while encouraging them to become involved in decision-making and flood management actions. This will include giving communities a bigger say in what action is taken and a more active role in decisions on local funding priorities. Ultimately, SEPA, and the responsible authorities should be accountable for the decisions they take.



## 4. Surface water management

### Introduction

**Urbanisation has altered the natural drainage process. Rain falls everywhere, so all features of our urban landscape, by design or otherwise, influence surface water run-off and flooding. Surface water flooding is often a complex interaction of many sources of flooding, including flooding from piped systems when their capacity is exceeded, small urban watercourses and direct inundation from surface water run-off.**

It is widely recognised that sustainable surface water management ensures that above and below ground parts of the drainage system can work in concert to deliver benefits for flood risk management, people, the water environment and biodiversity, while also making our urban areas more adaptable to future changes and more resilient to climate change.

This section provides guidance on:

- delivering a sustainable approach to surface water management with a focus on urban areas in particular;
- inclusion of surface water management within the preparation of flood risk management strategies and local plans;
- interactions with other processes to deliver multiple benefits.

### Surface water drainage and flooding

Surface water management involves the interaction of many different components of above-ground and below-ground drainage systems. Following a rainfall event, surface water runoff will normally flow above-ground until it reaches a receiving body (storage pond, stream or low point in the catchment), or it enters the below-ground piped drainage system, typically through a series of gullies, eventually making its way to a receiving body of water or a wastewater treatment works.

These systems are not designed to deal with severe storms and can never be built large enough to accommodate the most extreme rainfall events. This means heavy rainfall events can cause flooding which is often a complex interaction of many sources including:

- direct inundation from surface water run-off;
- the capacity of part or all of the drainage system is exceeded, which can include:
  - capacity of the below-ground system is overwhelmed by the rate of flow;
  - surface runoff cannot enter the below-ground drainage system due to limited capacity of drainage inlets (by design or through poor maintenance);
  - systems cannot drain effectively because they cannot discharge at their downstream outfall, possibly due to high levels in receiving waters;
- flooding from small urban watercourses.

# FLOOD AHEAD

Where run-off is conveyed through combined sewers, as is the case in older developments, a mixture of surface water and untreated sewerage discharges can spill out from the system if it becomes overwhelmed.

Potentially hazardous contaminants can also enter the system at several points and lead to pollution of land and receiving watercourses. Under the Controlled Activities Regulations, all new developments must drain surface water through Sustainable Urban Drainage systems (SUDs) before it enters receiving watercourses.

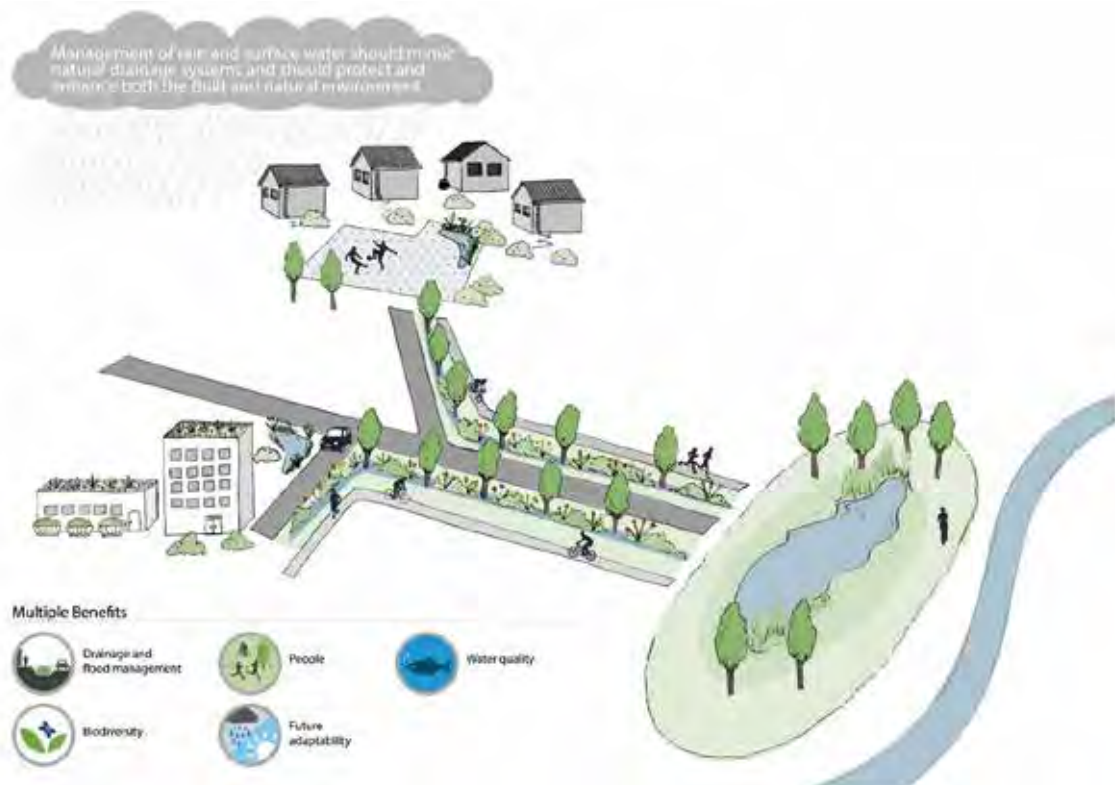
A number of factors can, if uncontrolled, place additional pressure on urban drainage, potentially resulting in increased flood risk and pollution. For instance increases in the proportion of impermeable surfaces in existing developments as new roads and car parks are constructed and people pave over gardens. Likewise climate change is likely to place increasing pressure on existing

drainage systems and increase the risk of surface water flooding. It is also important that land use planning policies are adhered to and new development is not at risk of flooding and does not increase flood risk elsewhere.

## Sustainable surface water management

The long term answer to urban surface water drainage is not the perpetual upgrading of sewerage infrastructure, for instance by creating ever larger pipes and subsurface storage, as this is impractical and prohibitively expensive.

Instead, a sustainable approach to surface water management that takes account of all aspects of the urban drainage systems and produces long term and sustainable actions must be deployed. This requires examination of the sources, pathways and receptors of flood





waters to ensure that during any event the flows created can be managed in a way that will cause minimum harm to people, buildings, cultural heritage the environment and businesses.

A key component of this approach is to mimic natural drainage systems by managing rainfall and surface water above ground, maximising the use of permeable surfaces and planted landscapes. Surface water should be conveyed to watercourses using the natural topography. Increasing surface water in the sewers should be avoided as this can lead to flooding elsewhere. Surface water in the sewers should be reduced where possible.

This approach not only helps reduce surface water flooding. With coordination between authorities using multidisciplinary teams (including landscape architects), it will also help to realise multiple benefits including, integrating with and enhancing the urban landscape to provide better places for people, reducing surface water in the sewers (reducing sewer flooding and spills from sewer overflows), improving the quality and physical habitat of watercourses, increasing biodiversity and making the urban environment more adaptable to future change.

The governance of surface water requires coordination between authorities to achieve these multiple benefits. In addition to flood risk management planning, this should include the interaction of:

- development planning and development management (local authority);

- sewer network management (Scottish Water);
- road management (roads authorities including local authorities);
- enforcement of Building Regulations (local authority);
- river basin management plans (SEPA);
- Local Biodiversity Actions Plans (local authority).

Sustainable surface water management will involve increased use of SUDS and creation of surface water flow routes that divert 'safe' floods to areas where impacts will be minimised. The best solutions will be achieved when the full drainage system, from source to receiving water, is designed from the outset. This allows the optimum balance between source, site and regional controls to be achieved.

To deliver these changes sustainable surface water management must be considered in existing urban areas and in new developments. In new developments consideration in the land use planning system is essential so that sustainable surface water management is embedded into the fabric of our urban and rural landscapes.

The principles set out in BOX 2 should be adopted by SEPA and the responsible authorities to support the delivery of sustainable surface water management.

### **Local flood risk management plans and surface water**

Local authorities will be expected to lead on the preparation of surface water management plans that will



identify and implement the most sustainable actions to reduce the risk of surface water flooding. These actions should be co-ordinated in the local flood risk management plans and flood risk management strategies. Separate guidance for delivering surface water management plans is available<sup>7</sup>. This work should be taken forward within the context of wider flood risk management strategies prepared by SEPA in order to ensure that surface water management decisions are undertaken in consideration of other flood management actions and interactions with the wider catchment.

In taking this work forward, careful consideration will need to be given to responsibilities for delivering and maintaining all parts of the drainage system, with particular attention given to responsibilities where the system, or parts of the system, performs more than one function. The aim should be to find a fair and practical way to share costs and responsibilities for the whole drainage system.

SEPA and Scottish Water will need to engage proactively in this work, offering support, expertise, data and models to responsible authorities. This should include drainage studies and, wherever possible, contributions to overland flow modelling and mapping.

SEPA's modelling guidance<sup>8</sup> should be considered when developing models.

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<http://www.gov.scot/Topics/Environment/Water/Flooding/FRMAct/guidance>

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[https://www.sepa.org.uk/environment/water/flooding/developing-our-knowledge/#Flood\\_maps](https://www.sepa.org.uk/environment/water/flooding/developing-our-knowledge/#Flood_maps)

## Prioritising effort

The level of effort invested in understanding and tackling surface water and drainage flooding problems must be proportionate to the risks they present. In complex urban settings where the risk of surface water flooding is significant, detailed urban studies and planning is likely to be required. In determining the level on the effort needed to investigate and manage surface water flooding, consideration should be given to:

- future urbanisation/redevelopment –urban expansion or regeneration presents a challenge to existing drainage systems but can also become an opportunity to address long-standing problems;
- opportunities to retrofit sustainable drainage and surface water management systems;
- evidence of surface water and sewer flooding– past flooding is a reliable indicator of future flooding;
- asset knowledge- where there are complex drainage systems, solutions are more likely to require detailed studies and a partnership approach.

SEPA and the responsible authorities will identify areas where surface water management plans will be necessary to tackle surface water flooding. These areas should be reviewed for each flood risk management cycle to take account of new information. The national flood risk assessment prepared by SEPA should provide information to help target effort. Longer term needs should be coordinated through the flood risk management strategies and local plans, for instance by identifying where detailed drainage studies are required.



## Principles of sustainable surface water management

Manage rain and surface water in a way that mimics natural systems and protects and enhances both the built and natural environment.

Manage rainfall and surface water safely above ground, avoiding harm to people, homes, businesses and other adverse impacts of flooding. Maximise the use of permeable surfaces and planted landscapes and convey water to watercourses using the natural topography. Avoid increasing surface water in the sewers as this can lead to flooding elsewhere. Reduce surface water in the sewers where possible.

Manage all rainfall events:


- Everyday rain – manage rain locally at source, maximise infiltration and evapotranspiration by maximising use of permeable surfaces and plants. Water can be collected for use. There should be little or no surface water run-off in these frequent events.
- More rain – collect, delay and convey safely above ground to watercourses following the natural topography. Do not increase surface water in the combined sewers as this can cause flooding elsewhere. Water can be collected for use.
- Extreme rain – delay, store and convey safely above ground to watercourses following the natural topography.

Multifunctional – maximise all benefits:

- People – integrate with, protect and enhance the urban landscape, provide attractive places for people to live, work and visit.
- Drainage and flood management – manage all rainfall events, avoid flooding to people and buildings, avoid increasing flows to receiving watercourses and combined sewers.
- Water quality – protect and enhance the quality and physical habitat of receiving watercourses. Collecting water for use can reduce the need to abstract water elsewhere.
- Biodiversity – protect and enhance biodiversity, maximising permeable surfaces and plants to attract wildlife.
- Adaptability to future change – help the urban environment adapt to future challenges of climate change (increasing rainfall, rising temperatures) and mitigate the loss of green space.

Co-ordinate with other authorities and projects to help to maximise benefits (e.g. using foot paths and cycle paths as routes for infiltration and conveying water, contributing to 'green and blue networks').

Think of different spatial scales required to manage surface water (e.g. what can be done locally at the building and street level; what regional and more strategic management is required; and what connections between these different scales are required?).



## 5. Selecting and implementing sustainable actions

### Introduction

**The main output of the flood risk management planning process should be a set of sustainable actions being taken to reduce overall flood risk across Scotland.**

Flood risk management strategies and local flood risk management plans will incorporate a wide spectrum of actions, ranging from national policies to flood protection schemes to awareness raising activities. All options must be identified and considered within a structured appraisal process. This will ensure that options are considered in a consistent way, that alternative options are properly considered and that investment decisions are justified. Sustainable solutions are likely to be a combination of actions.

Where significant investment of public funds is being proposed, actions should be appraised in a manner that is consistent with the guidelines in HM Treasury's Green Book.

This section provides guidance on:

- principles to support the selection of sustainable actions;
- the hierarchy and interaction of different forms of appraisal;
- the key steps that should be followed in performing an appraisal.

Detailed guidance on the appraisal process is set out separately<sup>9</sup>. The Scottish Government will update existing or issue further guidance on the appraisal process as necessary.

### A sustainable approach

In appraising actions for inclusion in flood risk management strategies and local plans, the Act requires that SEPA:

*identify actions to achieve objectives in a way which it considers is most sustainable.*

Flood management actions that don't respect the pillars of sustainability—social, economic and environmental, and the need to protect our natural resources for future generations, will not accord with the principles of sustainable development. Guidance on selecting sustainable actions is set out below.

#### *Risk-based decisions*

The Act places a duty on SEPA and the responsible authorities to: *act with a view to reducing overall flood risk*

An understanding of current risk and how that risk might change in space and in time is critical if the most sustainable solution is to be identified. Actions should target those areas where flood risk can be reduced now, while also taking steps to minimise any increase in the existing level of risk in the future. The long-term aim must be to reduce the risk of flooding across Scotland as far as is reasonable, taking full account of environmental,

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<http://www.gov.scot/Topics/Environment/Water/Flooding/FRMAct/guidance>





economic and social priorities and needs.

These options should cover the three main ways in which risk can be reduced (Figure 6): avoiding risk, reducing the likelihood of flooding, reducing the impacts of flooding.



**Figure 6** Approaches to reducing flood risk

Decisions on tackling risk should focus on addressing national priorities. However, flexibility must be maintained to allow local priorities to be addressed, particularly where a relatively small amount of investment can address important local priorities and encourage communities to help protect themselves, for example by subsidising flood protection products.

Flooding is a natural process and it is not realistic to expect all flood risk to be eliminated. Areas where it is not feasible to reduce risk or where current risks are believed to be acceptable should be clearly identified. In all cases, risk management actions should include arrangements to deal with residual risks (for example, if design limits are exceeded by floods). This could include promoting actions by individuals, local communities or business to improve property flood resilience and raising awareness of flooding issues and the availability of insurance for any residual risk.

*Adopt a long term planning approach*

Actions to tackle flood risk should be planned to ensure that any short term actions are part of a coherent longer term plan (50- 100 years) with a view to retaining sufficient flexibility to manage changing risks and societal changes over that period.

Testing flood risk management actions against long term trends will be essential to selecting sustainable actions that will stand the test of time. SEPA and the responsible authorities should work to establish approaches to examining future scenarios that can be applied consistently across flood risk assessments and management decisions. Wherever possible, a range of future scenarios should be examined, including a ‘worst case’ scenario.

The impacts of the changing climate should be consistently taken into account in flood risk management including in appraisals using up to date robust evidence and in accordance with the Scottish Government’s guidance.

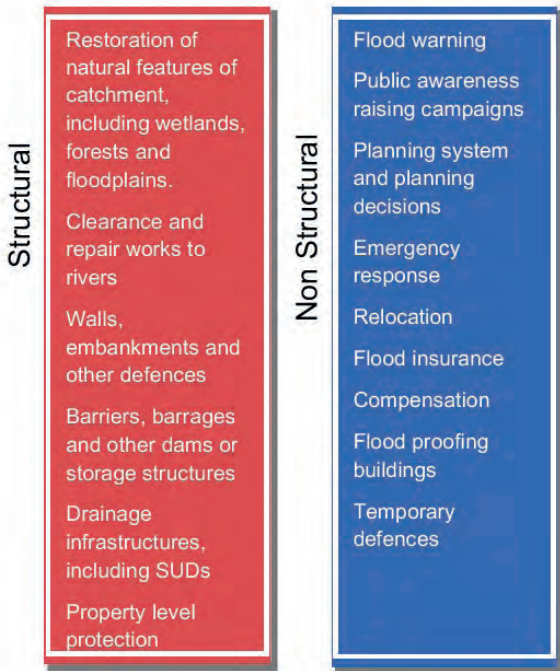
*Consider a broad and adaptable range of actions*

Consideration must be given to a broad range of structural and non-structural options (Figure 7), both individually and in combination across a catchment. In identifying options, careful consideration should be given to:

- options that prevent sudden catastrophes and enhance recovery;
- actions that can cope with natural variability and unexpected events;



- temporary as well as permanent options should be considered, for instance demountable defences;
- whether abandonment or relocation of property is a better alternative;



**Figure 7** Examples of structural and non-structural actions to manage flood risk

SEPA and the responsible authorities should avoid making decisions that will make it more difficult to manage the effects of climate change. This will involve not locking in options that limit further adaptation in the future.

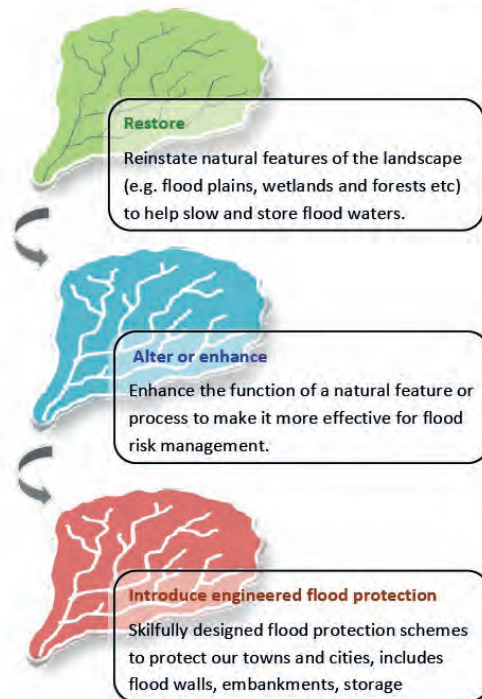
Being flexible may mean that actions are not implemented at a single time. Instead, implementation could be phased and accompanied by monitoring to provide evidence on when or whether further action is needed.

*Working with and restoring catchments*

As described in Section 2 and 3, all options should be developed in consideration of catchment and coastal processes and characteristics,

including consideration of how different interventions interact across a catchment or coastline.

In recognition of the range of potential benefits that can be obtained from working with our natural landscape, all reasonable and practical efforts should be made to enhance the (urban and rural) landscapes natural ability to slow and store flood waters. (Figure 8).



**Figure 8** Managing the catchment

There is unlikely to be a simple line between natural flood management actions and more traditional engineering, and in many cases options will need to be considered in combination. However, the overriding principle should be to ensure the most sustainable approach is adopted and that all available actions are considered.

As the evidence base for some of these actions is still evolving, wherever possible, monitoring should be undertaken to promote growth of the



evidence base. Monitoring will also allow actions to be adapted or refined as evidence on their effectiveness is obtained. Actions which benefit flood risk management to some degree and deliver other benefits, for instance environmental benefits or contributions to climate change adaptation, should be promoted wherever possible.

#### *Moving beyond design standards*

Simple consideration of design standards can limit consideration of how factors other than geometry affect the effectiveness of the defence—such as manually operated flood gates, which depend on accurate, timely flood warnings and operational response. More broadly, the design standard, for instance to contain a flood with a 100 year return period (an event that has a 1% probability of occurring in any given year) and which had become a default flood management objective in the past, if adhered to in the future, could limit decisions on how to optimise investment and protect those at greatest risk.

Although there are some benefits to be gained from adopting a common standard of protection for all flood protection work, not least of which is simplicity of communication and simplification of investment planning; this approach would mean that all works would be constructed without due regard to the value or importance of the assets being protected, whether they be people, critical infrastructure, property or the environment.

This guidance does not specify certain design standards. Instead, the approach adopted should be entirely risk based; linking benefits to costs, with the aim of maximising the reduction in overall risk. This approach requires management options to be

compared on the basis of the effect that they are expected to have on the frequency and impact of flooding in a specified area. This requires information to predict where flooding will occur (now and in the future) for a range of event probabilities. Estimates of the impacts of this flooding and any mitigation options can then be tested to identify the most cost beneficial option(s).

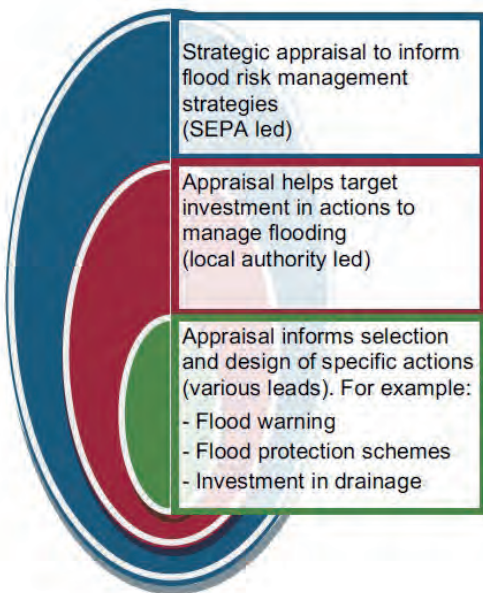
In practice, it is recognised that design standards are benchmarks. We expect a variety of protection levels to be considered during the design process including 0.5%, 1% and if appropriate a lesser level. As an option we expect actions that protect to a 1% exceedance probability plus allowances for climate change to be included in all appraisals. It is not expected that sewer pipes which are currently built for a 1 in 30 year flood event (3.33%) should be designed to this level. However we would expect SEPA and the responsible authorities to consider the feasibility of designing for protecting to a 1% exceedance through the use of a number of actions including above surface storage etc. Where other design standards are considered, a clear justification must be provided, for instance, where a scheme to protect to a lesser standard is the only technically viable option.

In many cases, particularly when tackling surface water flooding, a combination of actions will need to be brought together (above and below ground) to reduce flood risk. In these cases, the emphasis should be on examining the benefits and costs of combinations of actions against a range of flooding scenarios. For instance, the costs and benefits of upsizing sewers alone compared to the costs of actions to create above

ground storage and a small increase in sewer capacity.

## An integrated approach to appraisal

Appraisal has an important role to play at all levels of flood risk management, from the preparation of flood risk management strategies and local plans that set out the strategic direction of flood risk management, through to specific projects or schemes (Figure 9).



**Figure 9** Roles of appraisal in flood risk management

It is important that appraisal is viewed as part of the process of developing and implementing flood risk management strategies and local plans and the actions set out therein: it should not be viewed or undertaken as a separate process or exercise.


The Act requires close interaction between the preparation of flood risk management strategies and local plans and the implementation of actions. For instance, the power conferred on local authorities to undertake flood protection work, including schemes, can only be

exercised where it will contribute to delivering the actions in a flood management plan or not impair delivery of actions set out in plans. Similarly, investment by SEPA in flood warning schemes is expected to be based upon needs identified in flood risk management strategies.

It is therefore important that strategic appraisals underpinning flood risk management strategies and local plans form the outline for appraisals made for the individual projects within the plans. This does not mean that the details of individual schemes will be set out in flood management strategies. Instead, the appraisals will set out catchment focused flood risk management strategies, which should identify the need for particular types of local actions or management response. Where these actions, for instance flood protection schemes or long term land management agreements, require significant public expenditure, more detailed feasibility and appraisal work will be required to ensure that the options and designs reflect local needs.

As discussed in Section 3, the process of preparing flood risk management strategies and local plans should facilitate the process of taking forward and implementing a flood protection scheme. For example, the information generated by SEPA should fulfil, at least in part, early optioneering stages of scheme development, while also supporting subsequent, more detailed assessments and appraisals.

Local scale assessments will need to be consistent with those at a higher level, taking forward the assumptions and principles already agreed on. For example, ensuring that appraisal of shorter-term activity, such as the maintenance of defences, is



undertaken in the context of wider strategic objectives as set out in flood risk management strategies.

Throughout the appraisal process:

- the degree of detail considered should be proportionate to the complexity of the problem and the information required to reach and demonstrate a robust decision;
- the cost of the appraisal stage should be proportionate to the overall costs and factors associated with delivering the plan, policy or project;
- the sensitivity of options to changes in cost and benefit assumptions should be tested at different stages of appraisal, to fully understand the uncertainties that exist in the analysis of options.

### The appraisal process

All appraisals should go through the following three stages. Additional stages may be added as necessary depending on the purpose of the appraisal and information available.

1. **Define** the purpose of the appraisal, the issue and the case for intervention and set clear objectives for the appraisal.
2. **Describe** the impacts (positive and negative) associated with a wide range of possible options. As necessary and appropriate, evaluate impacts in qualitative and quantitative terms and assigning monetary values to them where possible.
3. **Compare** different options and combinations of options and selecting those that are most appropriate, deliverable and prioritise between actions as necessary.

Guidance on the appraisal process is published separately<sup>9</sup>.

### Quantifying impacts

To support selection of sustainable actions, SEPA and the responsible authorities will need to ensure that the full ranges of positive and negative impacts of actions are considered in an equitable manner.

Wherever possible, impacts (positive and negative) should be valued in monetary terms. Values should be based on market prices and derived estimates for non-market values where feasible. This is to provide a consistent basis for comparing impacts of different options both at a plan and project level.

Impacts that cannot be valued in monetary terms should always be described, quantified and brought into the appraisal through appraisal summary tables. Understanding these impacts is critical to selecting sustainable actions, and they should not be ignored simply because they are difficult to quantify or value in monetary terms.

The effort invested in valuing impacts should be proportionate to the complexity of the problem and the information required to reach a robust decision. Wherever possible, standard approaches should be used for assessing impacts to ensure consistency within and across different appraisals.

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<sup>9</sup> Options appraisal for flood risk management guidance available at: <http://www.gov.scot/Topics/Environment/Water/Flooding/FRMAct/guidance>



## Scrutiny

SEPA and the responsible authorities should undertake in-house quality assurance checks of all proposals and post project evaluation, to create a cycle of continuous learning and to understand where policy and delivery can improve. It may also be beneficial for peer reviews to be undertaken to promote best practice and consistency across responsible authorities.

The Scottish Government may review a sample of appraisals after they have been approved. This will help determine how the principles in this guidance are being applied and whether further guidance is necessary.

## Implementing actions

Consideration of sustainability does not end when the best actions have been selected. It is also important that actions are implemented in a sustainable manner. It is not the purpose of this guidance to set out how this can best be achieved, but the following principles should be applied.

- aim to minimise construction waste;
- maximise the reuse of materials;
- adopt low carbon construction strategies;
- ensure designs support the principle of adaptive management wherever possible.

## 6. Working with Stakeholders

### Introduction

**Public awareness, participation and community engagement are essential components of sustainable flood risk management. Public participation can not only raise awareness of flood risk, it can also inform decisions and contribute to the successful implementation of actions and ensure that the public know what actions they can take themselves.**

Land and property owners are primarily responsible for protecting their properties from flooding. Individuals, businesses and communities can play an important local role in flood management by acting as their own first line of defence against flooding. These actions can play an important role in complementing and supporting the work undertaken by SEPA and the responsible authorities.



When the residents of Waulkmill near Langholm wanted advance warning of flooding and river heights, they built their own early warning system

SEPA, through the CivTech programme, is working with RiverTrack to bring localised and timely flood alerts to smaller at-risk communities.



This section provides guidance on:

- communicating flood risk;
- improving access to information on flood risk, including flood warning, flood maps and other resources;
- improving access to information on the steps that individuals can take to protect their families, homes and businesses from flooding, before and after a flood;
- improving awareness of actions that can increase flood risk and alternative options, for instance using permeable paving;
- raising awareness among stakeholders about the contribution they can make to flood risk management.

### Communicating flood risk

It is important that the public understand the flood risk that they face. These can be complex concepts to explain. This means that special attention must be given to how information on flooding is conveyed to the public. Experience suggests that simply stating 'return periods' or probabilities for particular floods can be very confusing, particularly to communities who have recently experienced flooding.

SEPA and the responsible authorities must investigate a range of options for expressing flood probabilities and risk to the public. Visual tools in particular can help with understanding such as figures, maps and diagrams to communicate the messages.

Options may include providing information on the chance that an individual or community could be affected by a flood, rather than information on the likelihood of particular flood occurring.

# FLOOD AREA

Comparisons to other risks people face in daily life could also be used to help explain flooding issues. As no comparison is perfect, this approach should not be relied upon in isolation.

Where risk thresholds have been used, for instance when identifying areas potentially vulnerable to flooding, they must be accompanied by clear explanations of the criteria used, how risks were calculated or estimated, and how thresholds have been set.

## Maximising access to information

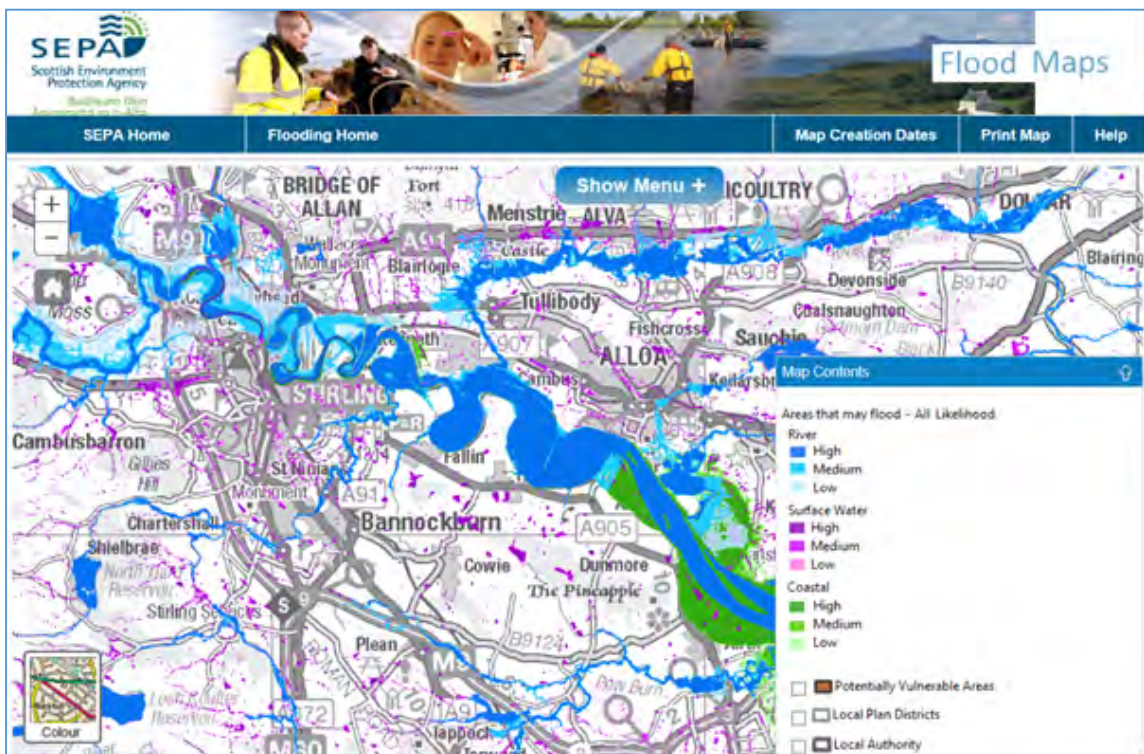
Public engagement and participation needs to be on-going and regularly refreshed, seeking to attract attention and changes in behaviour without causing undue alarm. At all times, it must be based on clear, accurate information, presented in the most accessible manner, using non-technical language.

This includes using channels and partnering organisations already popular with those we seek to engage.

Working in collaboration with community resilience organisations and other advocates (like the Scottish Flood Forum), SEPA, and the responsible authorities should help individuals, business owners and local community groups take some responsibility for their own flood awareness and preparation. This will include documents and communication material to promote the use of flood resilient repairs and property level protection.

### Using flood maps

Flood maps are a powerful tool for communicating complex flooding information. For instance flood outlines can show predictions of where flood waters would go under different flooding conditions.



©Crown Copyright. SEPA (2018). All Rights Reserved. The Flood Map data was developed using data from various sources. Full acknowledgement of data providers and participating parties is available at <https://www.sepa.org.uk/flood-map-help-pages/acknowledgements/>



The flood risk management planning process will generate an extensive resource of information on flooding and its impacts including new maps<sup>10</sup>. It is important that the public are given appropriate access to relevant information. Care must be taken to ensure that the information available to the public is of value and suited to their needs.

Flood maps and other similar resources will become more sophisticated, and in some cases may consider multiple sources of flooding and their impacts. SEPA and the responsible authorities will need to ensure that information is presented in a way which is clear and understandable for a non-technical user.

#### *Flood warning*

SEPA is Scotland's flood warning authority with responsibility for warning and informing the public and strategic partners on the threat of flooding through the Floodline service.



In 2017 SEPA published its Flood Warning Development Framework outlining how it intends to maintain, improve and broaden its service up until 2021. There should be continued emphasis on improving this flood warning service, and this should include maintaining and improving

links to other awareness raising initiatives.

#### *Perceptions and attitudes to flood risk*

To help target awareness raising work, SEPA and the responsible authorities should continue work to develop a more comprehensive understanding of public perceptions and attitudes to flood risk. In undertaking this work, particular attention should be given to understanding how past experiences or the lack of them colour perceptions of flood risk.

Information on perceptions and attitudes to flood risk should be reviewed periodically to test the performance and success of awareness raising and other campaigns.

### **An active and planned approach to public participation**

Public engagement and participation in flood risk management decisions will help reassure the public that sustainable actions are being selected. In taking forward public engagement and participation, SEPA and the responsible authorities should focus on:

- building understanding and trust locally, particularly through inclusive decision making;
- involving local residents, land managers and key community representatives in the planning process;
- clarifying the responsibilities of public bodies, home occupiers and business owners and the important supportive role of voluntary organisations;
- agreeing priorities and setting realistic expectations; and

<sup>10</sup> <http://map.sepa.org.uk/floodmap/map.htm>

- raising long term awareness of flood risk and its sustainable management through schools and colleges including those that serve the land management sectors.

To support this work, SEPA and the responsible authorities, in liaison with the Scottish Government, the Scottish Flood Forum and other relevant organisations, should develop and begin application of a national engagement and communication strategy. This work will include an active role developing the Flood Resilient Properties Action Plan and disseminating its outputs to communities at flood risk.



A meeting in Moffat gives local residents an opportunity to discuss flood management actions.

The strategy should support the adoption of clear and consistent messages and materials at a national and local level, and actively encourage greater public involvement. The strategy should not be viewed as a one off exercise; instead it is about creating an on-going process of engagement that can be applied in all areas of flood risk management.

The strategy should help ensure that the public:

- are provided with accessible and comprehensible information on flood risk and flood risk management and actions they can take;
- are involved in the co-production of information resources;

- are aware of actions being taken by SEPA and the responsible authorities to manage flood risk;
- have appropriate expectations for the level of flood protection that can be provided;
- have access to information on the consequences of key flood risk management decisions;
- have clear opportunities to communicate their views and priorities for flood risk management;
- have confidence that their views and priorities are fully considered in decision-making processes;
- understand the basis on which decisions have been made.

## Promoting and supporting actions by individuals and communities

Investing in flood protection schemes and other actions to reduce flood risk is an important part of protecting Scotland's communities and businesses from the impacts of flooding. However, it will never be possible to eliminate flood risk. Actions by individuals, business and communities will play an important role in complementing and supporting the work undertaken by SEPA and the responsible authorities.

Individuals already take responsibility for managing many risks they face in their day to day lives, for example, to protect themselves from fire by using smoke detectors, fire blankets and fire extinguishers. A similar approach should be encouraged for flood risk, with individuals acting as their own first line of defence against flooding.

Simple steps include keeping abreast of flood warning information, checking flood maps to see whether homes are



in flood risk areas, making a plan of actions that should be taken in the event of a flood. Steps can also be taken to reduce the damage caused by flood waters and the repair time, for instance by making flood resilient property repairs after a flood and installing flood resilient products, such as property level protection, to homes and businesses.

SEPA and the responsible authorities need to support actions by individuals by improving access to information on the steps that individuals can take to protect their family's homes and businesses from flooding. This could include showcasing best practise and promoting self-help guides, particularly amongst those who have not experienced a significant flood.

SEPA and responsible authorities should encourage land managers to contribute to flood risk management through altering land management practices in areas identified as important for this purpose. This can be done in a number of ways, for instance through demonstration sites, representative bodies, advisory organisations and trusted intermediaries such as the Tweed Forum. Appropriate incentives could also be made available to encourage voluntary agreement.

In promoting these messages and actions, the aim should be to minimise the damage caused by flooding and improve the ability of individuals, businesses and communities to recover quickly, fully and more resilient from a flood.

## **Improving awareness of actions that can increase flood risk**


Small changes to how land within and around properties, and businesses is managed could, over time, make a substantial contribution to increase flood risk. In urban areas, simple actions like paving over gardens can have a major cumulative impact on flooding. Similarly, land management activities in rural areas can adversely impact upon the landscapes ability to store and slow the flow of water, that can cause problems elsewhere.

SEPA and the responsible authorities should promote awareness of the cumulative impact that individuals and business can have on flooding and the positive actions that can be taken to prevent and reduce these effects.

## **Involving stakeholders in the decision making process**

To support the preparation of flood risk management plans, the Act provides for the creation of advisory groups. The groups, which must include representation from a wide range of interests, will provide an important forum for discussing flood management and engaging with the stakeholder community. SEPA and the responsible authorities will need to consider how best to engage with existing stakeholder forums and whether further fora will need to be established.

SEPA has established a National Flood Management Advisory Group (NFMAG) to advise on the key deliverables outlined in the FRM Act and ensure all deadlines are met. A Cross Border Advisory Group (CBAG) is also in place to ensure that the



relevant authorities on each side of the border coordinate their work to ensure that they understand how the impact of flood risk on one side of the border is affected by actions and inactions on the other side of the border.

SEPA and the lead local authorities have also established local advisory groups. These include representation from a wide range of interests (including local planning authorities, Scottish Natural Heritage, Royal Society for the Protection of Birds, harbour authorities, Historic Environment Scotland and others) and provide an important forum for discussing flood management and its links to river basin management and other local projects.

Opportunities for stakeholder participation should be incorporated at all stages of flood risk management, from the preparation of flood risk management strategies and plans through to schemes and projects. Engagement with interested parties should aim to gain a sound understanding of local issues and an appreciation of the concerns of individuals, communities and businesses potentially affected, as well as more strategic and national perspectives. Professional advice is provided through the Scottish Advisory and Implementation Forum for Flooding (SAIFF). There are a number of working groups that include members from SEPA, Scottish Water, local authorities and other groups to support a variety of aspects of flood risk management, including natural flood management and surface water management.

## Consultation

SEPA and the responsible authorities need to consider and utilise a range of different mechanisms for engagement including physical and online forums, mobile texts as well as formal written consultation routes.

Stakeholder participation should be used to help identify and develop management options and to gain an understanding of local people's views and needs, in particular those affected by flooding and those that can assist in protecting against it. Involvement of individuals, businesses and communities in taking forward actions should be promoted wherever possible.

Information should be conveyed to stakeholders in a transparent way, using plain language to enable stakeholders to gain a better understanding of the decisions that affect them and what they can do to influence or get involved in the decision making process.

Formal and informal consultation should be undertaken in the development of strategies, plans and projects. This should enable stakeholders affected, including the community and statutory consultees to make a meaningful contribution to the appraisal processes. Consultation should be coordinated and structured to enable interested parties to understand the decision making process. Statutory consultation requirements, to do with environmental impact assessment, strategic environment assessment and in the Act, should be used to inform policy and projects appraisal.

From the outset, it should be explained to communities and other beneficiaries



that the availability of public funds for delivering flood risk management may be dependent on national priorities for investment and how the project compares with the benefits achievable by investment in other parts of the country. However, it is equally important that people understand that constraints on public funds shouldn't prevent beneficial local projects being developed, partly or wholly funded or delivered by local beneficiaries. This is subject to the impacts being acceptable to the whole community and such projects complying with any relevant legislation.

As part of the consultation process, the potential benefits and the beneficiaries should be clearly identified. This should enable stakeholders to understand the relevance of costs and benefits. It may also encourage contributions towards projects which could enable actions to be promoted that otherwise might not be afforded or allowed to proceed sooner. Such contributions should allow public funding to go further and deliver improved flood risk management in areas that otherwise would not benefit.

## 7. Delivering responsibilities collectively

### Introduction

**Responsibilities for flood risk management are divided between different organisations. Strong partnerships, founded on common aspirations, are needed to deliver coordinated or joint actions, aligned investment planning and efficient use of resources. Finding new ways to share skills, expertise and services is important to delivering partnership working.**

This section provides guidance on:

- the statutory framework for partnership working;
- what it means to adopt a partnership approach to flood risk management;
- building the right kind of partnerships;
- governance and resourcing arrangements.

### General duties on the Scottish Ministers and public bodies

Section 1 of the Act places a set of general duties on the Scottish Ministers, SEPA, and the responsible authorities (Table 6). With the support of the Scottish Ministers, SEPA and the responsible authorities must embrace and build on these statutory responsibilities to create a framework for partnership working that is underpinned by a common set of goals and responsibilities.

This will, at times, mean rethinking traditional responsibilities built around individual organisations. This will involve promoting joint working

practices and initiatives; ultimately leading to greater coherence in the way flooding is managed.


**Table 6 General duties on SEPA and other responsible authorities (based on Section 1 of the Act)**

Exercise functions to reduce overall flood risk
Exercise functions to secure compliance with the Floods Directive
Act with a view to achieving objectives set out in flood risk management plans
Have regard to the social, environmental and economic impact of exercising functions
Act in the way best calculated to manage flood risk in a sustainable way
Promote sustainable flood management
Act with a view to raising public awareness of flood risk
Act in the way best calculated to contribute to sustainable development
So far as practicable, adopt an integrated approach by cooperating with each other

### A partnership approach to flood management

Many public bodies have already recognised the benefits of working in partnership, either on an informal or a more formal basis. If approached effectively and in a focussed way, joint working can yield a range of benefits:

- by identifying and removing duplication of effort and by sharing resources and information efficiencies can be found;
- sharing of expertise allowing each organisation to focus on its strengths and avoid the need to develop/maintain expertise where it exists elsewhere;
- building relationships to help deliver in one area of work can lead to benefits and improvements in other common areas;
- developing a better understanding of respective roles and processes



through joint working leads to improved coordination and delivery of actions.

SEPA and the responsible authorities must work across traditional institutional boundaries to deliver an integrated approach to flood risk management. This will require adoption of partnership working at all levels of flood management, from national strategic partnerships through to local/operational partnerships that deliver coordinated actions on the ground. This is not to say that everything must be delivered in partnership. SEPA and the other responsible authorities should deliver projects individually where it is more effective to do so whilst ensuring that partners are aware of what's being developed.

A wide range of powers exists in statute to support partnership work and joint delivery of projects and services. SEPA and the responsible authorities should draw on these powers and arrangements to support their work to manage flood risk.

### **Building partnerships**

When developing flood risk management plans, SEPA and the responsible authorities should work in partnerships founded on collaboration and co ownership of issues and actions (Table 6). To develop and deliver the first set of flood risk management plans fourteen local plan district partnerships have been set up to cover the whole of Scotland. These partnerships are led by a lead local authority. Membership includes SEPA, all local authorities in the district, Scottish Water, Forestry Commission Scotland and where relevant, Loch Lomond and the Trossachs National Park and Cairngorm National Park.

Each partnership has its own terms of reference developed to best support decision making and delivery taking account of local circumstances. Sub groups to deliver specific actions have been set up as and when required. Whilst the local plan district partnerships were set up to facilitate preparation and agreement to the flood risk management strategies and local flood risk management plans, they must evolve to support and coordinate delivery of actions.

SEPA and the responsible authorities should continue to work in these local plan district partnerships founded on collaboration and co ownership of issues and actions (Table 6).

A wide range of partnership models are available and the lead local authority and other partners should from time to time review their terms of reference to ensure that the most appropriate model for the local circumstances and aims is in place (Table 7).

The Integrated Catchment Studies provide a good example of collaborative partnerships. These were established to develop a better understanding of flood risk from combined sources (including above ground sources and below ground sewerage and drainage systems) where responsibilities are split across two or more authorities and where solutions will most likely require coordination of different funding streams.



Table 7 Common types of partnership arrangements

Degree of Partnership	Characterised by...
Co-existence	<p><i>"You stay on your turf and I'll stay on mine"</i></p> <p>(May be a rational solution - where clarity is brought to who does what and with whom)</p>
Co-operation	<p><i>"I'll lend you a hand when my work is done"</i></p> <p>(Often a pre-requisite of further degrees of partnership, where there is early recognition of mutual benefits and opportunities to work together)</p>
Co-ordination	<p><i>"We need to adjust what we do to avoid overlap and confusion"</i></p> <p>(Where the partners accept the need to make some changes to improve services/activities from a user/customer/community perspective and make better use of their own resources)</p>
Collaboration	<p><i>"Let's work on this together"</i></p> <p>(Where the partners agree to work together on strategies or projects, where each contributes to achieve a shared goal)</p>
Co-ownership	<p><i>"We feel totally responsible"</i></p> <p>(Where the parties commit themselves wholly to achieving a common vision, making significant changes in what they do and how they do it)</p>

Whatever partnership model is being adopted, or which evolves, careful consideration should be given to whether the partnership should be formed through informal working relationships or be bound by legal agreements. It is essential that any arrangements are reviewed periodically to ensure that they remain appropriate as the partnership develops.

Consideration will also need to be given to who should be represented. Partnerships typically encompass members with three distinct roles:

**Decision makers** – the organisations that need to be involved in decisions and investment;

**Consultees** – the organisations or individuals who should be consulted for their advice or views but do not necessarily need to be regularly involved in all decision-making;

**Informed parties** – the organisations or individuals which may be interested in the outcomes of the partnership and should be kept informed but who are unlikely to have strong views about the decisions being made.

### Governance arrangements

It is important that the local plan district partnerships are underpinned by a clear governance and decision making forum. These arrangements should promote accountability among the partners, and with those affected by decisions: shared responsibility should not mean diminished accountability.

Local flood risk management plans cannot be completed until agreements over funding and implementation timetables are reached. Delays in reaching agreements could affect delivery and approval of the plans and result in failure to meet statutory deadlines. It is important therefore that arrangements are in place within each organisation to secure agreements on flood management actions and their implementation.

To help ensure agreements can be reached, SEPA and the responsible authorities must establish the necessary forums, advisory groups and governance arrangements to support their flood management work. This could include, for more formal arrangements, the creation of boards to oversee the work of individual partnerships. To enable a partnership to work well there has to be:

- Clear objectives that are agreed by all partners;





- A plan that sets out each partner's responsibilities, actions and timescales;
- Commitment from partners that they can invest effort and resource (time or finances);
- A lead co-ordinator who will be responsible for reviewing whether work towards the objectives is progressing;
- Clear communication, between partners and externally;
- Engagement of wider stakeholders. Consultation and buy-in from the local community can be essential.

### Managing partnerships

Often, a successful partnership requires some form of dedicated administrative and programme/project support, or at least a firm commitment from members' organisations to the significance of the partnership and to the importance of time devoted to it by members.

SEPA and the responsible authorities should examine the need for dedicated staff to support the management of any partnerships formed to develop and implement flood risk management plans.

More generally, each organisation will need to ensure that:

- they have the time to contribute effectively at meetings, operate on behalf of the partnership between meetings and implement appropriate actions within or on behalf of their organisation;
- partnership skills and behaviours are embedded throughout the organisation so 'partnership

behaviour' is not limited to those who sit round partnership tables;

- key members of the partnership are given guidance on delegated authority and support to fast-track decisions that it is not possible to make round the partnership table;
- Mediation mechanisms are built in to help resolve any disputes quickly and effectively.

### Sharing services

Shared services is the convergence and streamlining of similar functions within an organisation, or across organisations, to ensure that they are delivered more efficiently than working alone, for instance, through economies of scale, access to specialised skill-sets and expertise.

SEPA and the responsible authorities should challenge themselves to collaborate, and engage in sharing services as an integral part of the partnerships formed to deliver flood risk management where appropriate. This should include considering joint initiatives and consolidation of services that can be shared with others where it adds value to the flood risk management process and reduces the resources required to deliver a reduction in flood risk.

Examples of areas where there may be benefits to be gained from a shared service approach include:

- establishment and procurement of 3rd party projects, for example a natural flood management initiative delivered by a River Trust or Fisheries Board;
- creation and sharing of flood risk management data, information and knowledge; for example information



from detailed flood protection studies that can be incorporated into national flood maps;

- awareness raising exercises, web tools to access flooding information and other communications work;
- training and building of skills and expertise;
- programme and project management.

Formal agreements such as service level agreements or memoranda of understanding should be established to manage the interdependencies and resource implications of sharing services. In all cases, these arrangements should be used to promote innovation and improvement.

### Resourcing

Delivering the actions set in flood risk management strategies and local flood risk management plans will require significant investment of public funds. In partnership with the Scottish Ministers, SEPA and the responsible authorities should investigate and apply different forms of joint resourcing (Table 8).

As a minimum, all resource commitments must be aligned. However, in many instances, joint funding commitments or pooling of resources may be necessary. For instance, between local authorities working to deliver coordinated actions across a catchment, or between local authorities and Scottish Water when coordinating their respective work to deliver sustainable urban drainage.

SEPA and all responsible authorities are funded separately for their duties under the Act. They will have to get together to identify how they can pull together those resources to deliver actions on the ground.

**Table 8** Examples of joint funding arrangements

Type	Examples
Aligning resources	<ul style="list-style-type: none"> <li>- Co-ordination of planning across partner organisations</li> <li>- Targeting funding from different agencies in the same areas</li> <li>- Lead or joint commissioning of related services</li> </ul>
Pooling non-financial resources	<ul style="list-style-type: none"> <li>- Time spent on partnership or inter-agency groups</li> <li>- Information generation and sharing</li> <li>- Different partners providing different elements in combination to provide a service (e.g. awareness raising campaigns)</li> <li>- Secondment of staff with specialist skills to projects or multi-disciplinary teams</li> <li>- Shared use of facilities or equipment</li> </ul>
Joint funding	<ul style="list-style-type: none"> <li>- Joint funded posts</li> <li>- Jointly funded data, tools or models</li> <li>- Contributions to specific activities – with funds managed by one agency</li> </ul>
Pooling budgets	<ul style="list-style-type: none"> <li>- To deliver coordinate drainage works or other projects</li> <li>- Creating centres of excellence or expertise in flood management</li> </ul>

## Annex 1

### Flood risk management milestones for the 2<sup>nd</sup> flood risk management planning cycle (2022 – 2028)

Deadline	Lead authority	FRM Act requirement
June 2017	Scottish Government	Publish reviewed guidance on sustainable flood management.
December 2018	SEPA	Publish the 2 <sup>nd</sup> National flood risk assessment leading to a review and identification of potentially vulnerable areas
	SEPA	Identify any changes to Local Plan Districts
No statutory deadline	Local authorities	Regularly review and update schedule of clearance and repair works.
Timescales to be set by Scottish Ministers	Local authorities	Prepare maps of water bodies and Sustainable Urban Drainage Systems (SUDS).
Timescales to be set by Scottish Ministers	SEPA	Prepare maps of artificial structures and natural features.
Timescales to be set by Scottish Ministers	Scottish Water	Publish an assessment of flood risk from sewerage systems.
December 2019	SEPA	Publish an assessment of opportunities for restoration of natural features and characteristics to reduce flood risk.
	SEPA	Publish reviewed flood hazard maps and flood risk maps.
	SEPA	Publish a statement of consultation actions.
December 2020	SEPA and lead local authorities	Publish draft 2 <sup>nd</sup> flood risk management strategies and local plans for consultation.
December 2021	SEPA and lead local authorities	Publish 2 <sup>nd</sup> flood risk management strategies.
June 2022	Lead local authorities	Publish local flood risk management plans.
2022 onwards	SEPA and responsible authorities	Implement the actions in local flood risk management plans
<b>Cycle repeated every 6 years thereafter</b>		



## Annex 2

### Glossary of terms

#### **Actions**

These are activities to be taken to reduce the risk of flooding. This may include woodland planting, flood walls, flood warning and others.

#### **Cost/Benefit Analysis**

Comparison of present value scheme benefits and costs as part of an economic appraisal. The benefit-cost ratio is the total present value benefits divided by the total present value costs.

#### **Catchment or Catchment Area**

The specific land area that drains into a watercourse.

#### **Civil Contingencies**

The Civil Contingencies Act 2004 establishes a framework for emergency planning and response at both a local and a national level.

#### **Climate Change**

Long-term changes in climate, either through natural variability or human intervention.

#### **Coastal Flooding**

Flooding that results from a combination of high tides and stormy conditions.

#### **Consequence**

An impact such as economic, social or environmental damage/improvement. May be expressed quantitatively (e.g. monetary value), by category (e.g. High, Medium, Low) or descriptively.

#### **Controlled Activities Regulations (CAR)**

A reference to The Water Environment (Controlled Activities) (Scotland)

Regulations 2005. All engineering works in or in the vicinity of rivers, lochs and wetlands now require authorisation under the CAR Regulations.

#### **Culvert**

A closed conduit used for the conveyance of surface drainage water under a roadway, railroad, canal, or other impediment.

#### **DEFRA**

DEFRA (Department for Environment, Food and Rural Affairs) is a UK Government Department.

#### **Diffuse Pollution**

Pollution which originates from various activities and which cannot be traced to a single source e.g. contaminated run off from built up areas.

#### **Do-Nothing Scenario**

An option used in benefit/cost analysis to act as a baseline against which all other options are tested. It assumes no active intervention.

#### **EC Floods Directive**


The EC Directive on the Assessment and Management of Flood Risks or *EC Floods Directive* builds on and is closely related to the Water Framework Directive.

#### **Embankment**

Artificial raising of the natural bank height of a waterway.

#### **Environment**

Where environmental issues are referred to in this document, this term is used to encompass landscape and visual, flora, fauna, geological or



geomorphological features and buildings, air, water, sites and objects of archaeological, architectural or historical interest. (It is recognised that in other contexts the environment has much wider implications).

### **Environmental Impact Assessment (EIA)**

Environmental Impact Assessment (EIA) is a process which identifies the potential environmental effects (both negative and positive) of a proposal.

### **Flood Risk Management Strategies (FRMS)**

**High-level plans prepared by SEPA** that set out the strategic direction of flood management, through to specific projects or schemes.

### **Floodplains**

Floodplains are land areas adjacent to rivers and streams that are subject to recurring inundation.

### **Fluvial flooding**

Also known as river flooding. Flooding that results from rivers and water courses exceeding their capacity.

### **Greenhouse Gases**

Naturally occurring gases, such as carbon dioxide, nitrous oxide, methane and ozone, and man-made gases like chlorofluorocarbons, which absorb some of the sun's radiation and convert it into heat.

### **Groundwater Flooding**

Flooding that occurs when water levels in the ground rise above surface levels. It is most likely to occur in areas underlain by permeable rocks, called aquifers.

### **Hazard**

A situation with the potential to result in harm. A hazard does not necessarily lead to harm.

### **Impermeable Surface**

A surface that does not permit the infiltration of water and, therefore, generates surface water runoff during periods of rainfall.

### **Lead local authority**

Each local plan district is governed by a partnership of all responsible authorities which cover that area. The lead local authority has overall responsibility for running the partnership, publishing the local flood risk management plans and reporting on the progress of actions.

### **Local Flood Risk Management Plans**

Plan prepared by lead local authorities that provide a local expression of the strategic plans prepared by SEPA. Include a summary of how actions will be implemented in each local plan area.

### **Pluvial flooding**

Flooding that results from overland flow which has been generated by rainfall before the runoff enters any watercourse or sewer. This is also referred to as surface water flooding.

### **Post project evaluation**

A procedure to review the performance of a project with respect to its original objectives and the manner in which the project was carried out.

### **Preparedness**

Informing the population about flood risks and what to do in the event of a flood.

**Probability**

The probability of an outcome is the relative proportion or frequency of events leading to that outcome, out of all possible events. It describes how likely an event is to happen.

**Qualitative Methods**

Approaches which use descriptive rather than numerical values for assessment and decision making.

**Residual risk**

The risk which remains after risk management and mitigation. May include, for example, risk due to very severe (above design standard) storms, or risks from unforeseen hazards.

**Resilience**

Resilience is a measure of the ability of something to recover from a flood.

**Responsible authorities**

Designated under the Flood Risk Management (Scotland) Act 2009 to have responsibility for reducing the risk of flooding in Scotland. In 2017 these include local authorities, Scottish Water, Forestry Commission Scotland, Cairngorms National Park, and Loch Lomond and the Trossachs National Park. The Scottish Government may designate further responsible authorities.

**Restoration of natural flooding processes**

This is the return of a landscape, ecosystem, or other ecological entity to a predefined historical state where the flooding processes are uninterrupted.

**Return Period**

The flood return period is a measure of the rarity of an event - the longer the return period, the rarer the event. It is

the average length of time (usually in years) separating floods of a similar magnitude.

**Risk**

A combination of the likelihood and consequences of an event.

**River Basin District**

Geographic areas over which River Basin Management plans are prepared. In Scotland there are 2 River Basin Districts identified under the 2003 Act - one for the Solway/Tweed area and one covering the rest of Scotland.

**River Basin Management Planning**

River basin planning is a strategic decision-making process introduced by the Water Framework Directive (WFD) which integrates the management of land and water within river basin districts (RBDs).

**SCOTS**

The Society of Chief Officers of Transportation in Scotland (SCOTS).

**Scottish Water**

Scottish Water is a publicly owned business, answerable to the Scottish Parliament and the people of Scotland. Its key duties are providing clean, safe drinking water and disposing of waste water from homes and businesses across Scotland.

**Sensitivity testing**

Method in which the impact on the output of an analysis is assessed by systematically changing the input values

**SEPA**

Scottish Environment Protection Agency. SEPA is the public body responsible for environmental protection in Scotland.



### **Sewer Flooding**

Flooding caused by a blockage or overflowing in a sewer or urban drainage system.

### **Sustainability**

Actions taken now to manage the risk of flooding that are robust enough to stand the test of time. There are three pillars of sustainability that must be considered - environmental, social and economic.

### **Sustainable Development**

Sustainable development is an approach to resource use that aims to meet human needs, while preserving the environment so that these needs can be met not only in the present, but also for future generations. The delivery of sustainable development is generally recognised to require reconciliation of three pillars of sustainability – environmental, social and economic.

### **Sustainable Urban Drainage Systems (SUDS)**

A set of techniques designed to slow the flow of water, can contribute to reducing flood risk by absorbing some of the initial rainfall, and then releasing it gradually, thereby reducing the flood peak and helping to mitigate downstream problems, and make a useful contribution to flood management.

### **Vulnerability**

Vulnerability is defined as a combination of susceptibility and resilience.

### **Water Framework Directive (WFD)**

The WFD establishes integrated river basin management for Europe. It requires all inland and coastal waters

to reach "good status" by 2015, or an alternative or delayed objective.

### **Whole Life Costs**

The total costs associated with a scheme for its full design and potential residual life span, taking proper account of all aspects of design, construction, maintenance and external impacts. A particularly useful approach in helping to determine economic sustainability when used to compare the relative costs of long-life schemes such as flood defences and where decisions between short-term capital costs and long-term maintenance costs need to be made.



## Annex 3

### Related Resources

The Scottish Government and SEPA have produced additional resources to support flood risk management planning.

Document title	Purpose	Link
<b>Options Appraisal guidance</b>	Scottish Government guidance on methods for identifying and assessing positive and negative impacts of FRM actions and combination of actions (options).	<a href="http://www.gov.scot/Topics/Environment/Water/Flooding/FRMAAct/guidance">http://www.gov.scot/Topics/Environment/Water/Flooding/FRMAAct/guidance</a>
<b>Flood modelling guidance for responsible authorities</b>	To support development and commissioning of flood studies with regards to modelling.	<a href="https://www.sepa.org.uk/environment/water/flooding/developing-our-knowledge/#Flood_maps">https://www.sepa.org.uk/environment/water/flooding/developing-our-knowledge/#Flood_maps</a>
<b>Technical Flood Risk Guidance for stakeholders</b>	Advice on modelling for flood risk assessments to support planning applications.	<a href="http://www.sepa.org.uk/media/162602/ss-nfr-p-002-technical-flood-risk-guidance-for-stakeholders.pdf">http://www.sepa.org.uk/media/162602/ss-nfr-p-002-technical-flood-risk-guidance-for-stakeholders.pdf</a>
<b>Flood study check-list</b>	To support development and commissioning of flood studies.	Request from <a href="mailto:frmplanning@sepa.org.uk">frmplanning@sepa.org.uk</a>
<b>Surface Water Management Planning guidance</b>	Support for developing and implementing surface water management plans. SWMP quick start guide supports this guidance.	<a href="http://www.gov.scot/Topics/Environment/Water/Flooding/FRMAAct/guidance">http://www.gov.scot/Topics/Environment/Water/Flooding/FRMAAct/guidance</a>
<b>Natural Flood Management Handbook</b>	Includes case studies, demonstration projects, NFM assessment tools and more.	<a href="https://www.sepa.org.uk/media/163560/sepa-natural-flood-management-handbook1.pdf">https://www.sepa.org.uk/media/163560/sepa-natural-flood-management-handbook1.pdf</a>

If you experience issues with any of the links provided, please email [FRMplanning@sepa.org.uk](mailto:FRMplanning@sepa.org.uk)





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