Flood Risk Management Strategy

Forth

SEPA

Scottish Environment Protection Agency

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Foreword

Flooding can affect us all. The risk of flooding and its impacts can't be removed entirely from our lives but it can be managed. This strategy takes our knowledge and understanding of flooding and turns it into a set of actions that are planned, prioritised and co-ordinated to tackle flooding in the areas where it affects us the most.

Approximately 3,100 residential and 660 non-residential properties are at risk of flooding in the Forth Local Plan District. Stirling, Tillicoultry and Bridge of Allan are just some of the areas where the greatest impacts of flooding can be found. The annual damages across the region are estimated to be £8 million, largely from river flooding. Across Scotland we now estimate 108,000 properties to be at risk, with the expected annual flood damage being in the region of £252 million.

We can expect these numbers to increase. Changes to the climate, how we live and how we use the land bring more and more people and property into flood risk.

Although the risk of flooding will never be removed entirely, this strategy describes the ambition for managing flooding and the priorities for action. A Local Flood Risk Management Plan co-ordinated by Stirling Council provides additional detail on the responsibility for delivery, funding and coordination of actions across the Local Plan District. Taken together, these documents describe the commitment of public bodies to address flooding.

This Flood Risk Management Strategy is published by SEPA and has been approved by Scottish Ministers. It has been produced with the support and collaboration of Stirling Council, Clackmannanshire Council, Falkirk Council, Fife Council, Perth and Kinross Council, Scottish Water, Loch Lomond and Trossachs National Park and others with an interest in flood management. SEPA took account of the views received through two public consultations carried out during the development of the strategy and its supporting information.

How we plan for and manage our flood risk has far reaching consequences for Scotland's communities. As well as targeting action and resources in the areas where they can achieve most, the strategies also help to increase awareness of flood risk and improve understanding of how it can affect us.

Terry A'Hearn

Chief Executive Officer
SEPA

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Section 1: Flood Risk Management in Scotland

Forth Local Plan District

1 Flood risk management in Scotland

1.1 What is a Flood Risk Management Strategy?

Flood Risk Management Strategies have been developed to reduce the devastating and costly impact of flooding in Scotland. They coordinate the efforts of all organisations that tackle flooding, be it in our cities or rural areas and be it from rivers, the sea or from surface water. The strategies concentrate the work of these organisations to where the risk of flooding and benefits of investment are greatest.

By publishing these strategies, we are giving individuals, communities and businesses the information to better manage their own responsibilities. Everyone can take action with the confidence of knowing what others are doing and when they are doing it.

Flood Risk Management Strategies set out the short to long term ambition for flood risk management in Scotland. The strategies state the objectives, as agreed by responsible authorities, for tackling floods in high risk areas. Actions that will then deliver these objectives are described and prioritised in six-year planning cycles. The decisions are based on the best evidence available on the causes and consequences of flooding. Through this risk-based and plan-led approach, flood management will improve for individuals, communities and businesses at risk in Scotland.

Each strategy should be read alongside its Local Flood Risk Management Plan. The Local Flood Risk Management Plans have been developed by local authorities and provide additional local detail on the funding and delivery timetable for actions between 2016 and 2021. The publication date of the Local Flood Risk Management Plans is June 2016. Both the Flood Risk Management Strategy and Local Flood Risk Management Plan will be updated every six years.

These Flood Risk Management Strategies are approved by Scottish Ministers and published by SEPA, Scotland's strategic flood risk management authority. They have been prepared in collaboration with all 32 local authorities, Scottish Water and other organisations with a responsibility or interest in managing flooding. They are required under the Flood Risk Management (Scotland) Act 2009 and the European Commission's Floods Directive. The actions proposed to manage flood risk in high risk areas have been developed using the best available information at the time. The number of actions that are actually delivered over the six years set out in the strategy will depend on a number of factors including funding availability, and community engagement issues such as potential objections to a particular flood protection scheme.

1.2 How to read this Strategy

Each Flood Risk Management Strategy has three sections:

Section 1 contains background information on the approach taken in Scotland to manage flooding. It explains the duties and aims of organisations involved in tackling flooding, including how they work together and how flood risk management planning is linked to other government policies and initiatives.

Section 2 is the most important section for those individuals and communities seeking to understand their flood risk and its management. For priority areas (called Potentially Vulnerable Areas) there is a short description of the causes and consequences of flooding. The agreed objectives are clearly set out. And, most importantly, the actions that will deliver these objectives are prioritised and described.

Section 3 includes supporting information on the sources of flooding in wider river catchments and coastal areas. A glossary is also provided.

1.3 Managing flooding in Scotland

Flood risk management in Scotland aims to manage flooding in a sustainable way. Sustainable flood risk management considers where floods are likely to occur in the future and takes action to reduce their impact without moving the problem elsewhere. It considers all sources of flooding, whether from rivers, the sea or from surface water. It delivers actions that will meet the needs of present and future generations whilst also protecting and enhancing the environment.

The sustainable approach to managing flood risk works on a six year planning cycle, progressing through the key stages outlined below.

Identifying priority areas at significant flood risk

The first step to delivering a risk-based, sustainable and plan-led approach to flood risk management was SEPA's **National Flood Risk Assessment**, which was published in 2011. The assessment considered the likelihood of flooding from rivers, groundwater and the sea, as well as flooding caused when heavy rainfall is unable to enter drainage systems or the river network. The likelihood of flooding was examined alongside the estimated impact on people, the economy, cultural heritage and the environment. It significantly improved our understanding of the causes and consequences of flooding, and identified areas most vulnerable to floods.

Based on the National Flood Risk Assessment, SEPA identified areas where flooding was considered to be nationally significant. These areas are based on catchment units as it is within the context of the wider catchment that flooding can be best understood and managed. These nationally significant catchments are referred to as **Potentially Vulnerable Areas**. In Scotland, 243 Potentially Vulnerable Areas were identified. They are estimated to contain 92% of the total number of properties at risk.

A small number of Candidate Potentially Vulnerable Areas were identified after the National Flood Risk Assessment in light of new information that warranted further assessment and appraisal. They are included in the flood risk management planning process. The National Flood Risk Assessment will be updated to inform each subsequent planning cycle.

Improving the understanding of flooding

SEPA developed **flood hazard and flood risk maps** between 2012 and 2014. These maps improved our understanding of flooding and helped inform the subsequent selection of actions to manage flood risk in Potentially Vulnerable Areas. The flood hazard maps show information such as the extent of flooding, water level, as well as depth and velocity where appropriate. The flood risk maps provide detail on the impacts on people, the economy, cultural heritage and the environment.

In 2012 SEPA also developed an **assessment of the potential for natural flood management**. The assessment produced the first national source of information on where natural flood management actions would be most effective within Scotland.

Flood hazard and flood risk maps and the assessment of the potential for natural flood management can be viewed on the SEPA website www.sepa.org.uk.

Identifying objectives and selecting actions

The objectives and actions to manage flooding will provide the long-term vision and practical steps for delivering flood risk management in Scotland.

Working collaboratively with local partnerships, SEPA has agreed the objectives for addressing the main flooding impacts. Actions that could deliver these agreed objectives have been appraised for their costs and benefits to ensure the right combinations are identified and prioritised. The actions considered in the development of this strategy include structural actions (such as building floodwalls, restoring flood plains, or clearance and repair works to rivers) and non-structural actions (such as flood warning, land use planning or improving our emergency response). Structural and non-structural actions should be used together to manage flood risk effectively.

An assessment of the potential for natural flood management was used to help identify opportunities for using the land and coast to slow down and store water. Natural flood management actions were recommended in areas where they could contribute to the management of flood risk. In such instances these actions were put forward as part of flood protection or natural flood management studies.

Climate change and future flood risk

The UK Climate Projections (UKCP09) report predicts that climate change may lead to warmer and drier summers, warmer and wetter winters with less snow, and more extreme temperature and rainfall events. The predicted increase in rainfall is expected to variably increase the potential for river and surface water flooding, and similarly, there is expected to be a rise in sea levels that will vary around the coastline.

The predicted increases in flood risk described in Section 3 are solely based on the impact of a changing climate on the magnitude of flooding; they do not take into account any potential increase due to population change, development pressures or urban creep, nor do they take into account any mitigation as a result of actions contained in this or future Flood Risk Management Strategies.

Flood Risk Management Strategies and Local Flood Risk Management Plans

For flood risk management purposes, Scotland has been divided into 14 **Local Plan Districts**. Each Local Plan District will have a set of complementary plans: Flood Risk Management Strategies produced by SEPA, and Local Flood Risk Management Plans produced by a lead local authority. Flood Risk Management Strategies and Local Flood Risk Management Plans aim to make a strong and lasting contribution to sustainable flood risk management, and will be at the heart of efforts to tackle flooding in Scotland. They will help to target and maximise the benefit of public investment.

1.4 How the Flood Risk Management Strategy was developed

Partnership working

Many organisations and individuals are involved in helping to improve flood management in Scotland. A piecemeal approach to tackle flooding does not work.

Flooding is too complex, and the causes and impacts too complicated for any single organisation to address alone. Flooding disregards local authority boundaries and cuts across the responsibilities of organisations such as SEPA, Scottish Water and emergency responders. To be successful, flood management requires coordination among organisations as set out in this strategy. A willingness to collaborate by those responsible for flood management is essential.

This strategy has been developed in partnership by:

- Stirling Council (lead local authority), Clackmannanshire Council, Falkirk Council, Fife Council and Perth and Kinross Council;
- Loch Lomond and Trossachs National Park Authority;
- Scottish Water; and,
- SEPA.

These organisations are working more closely together than ever before. In local partnerships, here and throughout Scotland, SEPA has provided the technical analysis and ensured a consistent national approach is taken. It has provided the evidence upon which to make sensible, informed decisions. Local authorities, Loch Lomond and Trossachs National Park Authority and Scottish Water have made sure that local knowledge and expertise has informed the decision-making.

Consultation, engagement and advice

SEPA has been keen to hear from the people and communities that live under the threat of flooding to ensure that our technical analysis of the risks is accurate and that efforts to manage flooding are targeted to where most can be achieved. SEPA held two public consultations during the development of the Flood Risk Management Strategies. The first was on the general approach to flood risk management planning and the identification of priority areas (2011); the second, held jointly with local authorities, was on the understanding of flooding in these priority areas and on the objectives and actions to manage flooding (2015).

Further advice has been sought from relevant organisations at key stages. The strategies have benefited from Local Advisory Groups, providing important community and area-based knowledge on both the causes and consequences of flooding and on the appropriate actions for future management. Local Advisory Groups have been especially helpful in considering flood risk management planning in the context of wider plans and initiatives. The Forth Local Advisory Group includes representatives from a range of sectors, including government agencies, National Park Authorities, local authorities, non-government organisations, utility companies and land and asset managers.

In producing the Flood Risk Management Strategy, SEPA has also taken advice from a National Flood Management Advisory Group. Over 50 member organisations, reflecting the national importance and impact of flooding on our communities, economy, environment and cultural heritage, have been invited at key stages to provide comment and input.

Some of the work carried out by SEPA has been complex and technical in nature for which we have sought professional advice. Through membership of the Scottish Advisory and Implementation Forum for Flooding (SAIFF), we have received assistance from local authorities, Scottish Water, Forestry Commission Scotland, the National Park Authorities and other key interested organisations. We have also developed some of our methods by working with other organisations with similar responsibilities within the UK and Europe. We have specifically worked with the Environment Agency and English local authorities in the cross border areas.

SEPA's chief statutory function in flood risk management planning is to prioritise future actions across Scotland. To do this, SEPA made a technical, risk-based assessment of the costs and impacts of actions. This independent assessment was used alongside information from partner organisations to jointly agree priorities and identify indicative delivery dates for actions. A National Prioritisation Advisory Group, with representatives from the Scottish Government, COSLA, Scottish Water and local authorities, was established to provide guidance to SEPA on the priority of flood risk management actions, having considered both the technical ranking prepared by SEPA and issues of local priority.

Strategic Environmental Assessment and Habitats Regulation Appraisal

SEPA undertook a strategic environmental assessment to assess the significant environmental effects of the Flood Risk Management Strategies. Our assessment was published in an environmental report, and we consulted the public on our findings. We have published a post-adoption statement, which describes how we have taken account of the environmental assessment and the consultation responses, and how we will monitor any significant environmental effects of the Flood Risk Management Strategies.

We also undertook a Habitats Regulations Appraisal to ensure that the Flood Risk Management Strategies will not adversely affect the integrity of Special Areas of Conservation and Special Protection Areas. We consulted Scottish Natural Heritage and Natural England on our appraisal method and took their views into account. We have applied mitigation measures where required.

1.5 Roles and responsibilities for flood risk management planning

Individuals have a personal responsibility to protect themselves and their property from flooding. However, public bodies have responsibilities too and are working together to reduce the impacts of flooding in Scotland. Responsibility for flood risk management planning falls primarily to SEPA, local authorities and Scottish Water. Some of the key roles are outlined below and more information is available from the SEPA website.

Your responsibilities

Organisations and individuals have responsibilities to protect themselves from flooding. Being prepared by knowing what to do and who to contact if flooding happens can help you reduce the damage and disruption flooding can have on your life.

The first step to being prepared is signing up to Floodline so you can receive messages to let you know where and when flooding is likely to happen. Other useful tools and advice on how to be prepared are available on the Floodline website, including a quick guide to who to contact in the event of a flood. For more information visit: www.floodlinescotland.org.uk. You can also check how your area could be affected by flooding by looking at SEPA's flood maps.

SEPA

SEPA is Scotland's national flood forecasting, flood warning and strategic flood risk management authority. We have a statutory duty to produce Scotland's Flood Risk Management Strategies. As described above, we work closely with other organisations responsible for managing flood risk through a network of partnerships

and stakeholder groups to ensure that a nationally consistent approach to flood risk management is adopted.

SEPA also has a responsibility to identify where in Scotland there is the potential for natural flood management techniques to be introduced. Natural flood management uses the natural features of the land to store and slow down the flow of water.

In running Floodline, we provide direct warnings, live flooding information and advice on how to prepare for or cope with the impacts of flooding 24 hours a day, seven days a week. To help us forecast for flooding we work in partnership with the Met Office through the Scottish Flood Forecasting Service. SEPA has piloted surface water flood forecasting to help urban areas improve their resilience to and preparedness for flooding. The development and wider roll-out of this service is being considered alongside the technical, resource and communication challenges associated with providing surface water flooding guidance.

To raise awareness of flooding at a national level SEPA runs education initiatives, community engagement programmes and an annual campaign to promote the useful advice and information available through Floodline. We work in partnership with local authorities, Neighbourhood Watch Scotland, Ready Scotland and others to share our resources and help to promote preparedness and understanding of how flood risk is managed.

Local authorities and lead local authorities

Local authorities work together for flood risk management planning purposes through a lead local authority. The lead local authority must perform several important functions over and above the general flood-related duties and powers given to local authorities. Most significantly, the lead local authority, having contributed with other local authorities to the production of the Flood Risk Management Strategy, must prepare a Local Flood Risk Management Plan. Although the lead local authority is responsible for the production of the plan, its content will be drawn from and agreed by all relevant local authorities, other responsible authorities and SEPA. Local authorities have been working collaboratively in the manner described above to develop these Local Flood Risk Management Plans.

It is the responsibility of your local authority to implement its flood protection actions agreed within the Flood Risk Management Strategy, including new schemes or engineering works and their statutory requirements to monitor, clear and maintain watercourses. You can help your local authority to manage flooding by letting them know if debris is blocking watercourses or if flood defences have been tampered with.

During severe flooding, local authorities will work with the emergency services and coordinate shelter for people evacuated from their homes.

Scottish Water

Scottish Water is a responsible authority for flood risk management and is working closely with SEPA, local authorities and others to coordinate plans to manage flood risk.

Scottish Water has the public drainage duty and is responsible for foul drainage and the drainage of rainwater run-off from roofs and any paved ground surface from the boundary of properties. Additionally, Scottish Water helps to protect homes from flooding caused by sewers either overflowing or becoming blocked. Scottish Water is not responsible for private pipework or guttering within the property boundary.

National parks

The two National Park Authorities, Loch Lomond and Trossachs National Park and Cairngorms National Park, were designated as responsible authorities for flood risk management purposes in 2012. Both have worked with SEPA, local authorities and Scottish Water to help develop Flood Risk Management Strategies and Local Flood Risk Management Plans. They also fulfil an important role in land use planning, carrying out or granting permission for activities that can play a key role in managing and reducing flood risk.

Other organisations

- The **Scottish Government** oversees the implementation of the Flood Risk Management (Scotland) Act 2009, which requires the production of Flood Risk Management Strategies and Local Flood Risk Management Plans. Scottish Ministers are responsible for setting the policy framework for how organisations collectively manage flooding in Scotland. Scottish Ministers have also approved this Flood Risk Management Strategy.

- **Scottish Natural Heritage** has provided general and local advice in the development of this Flood Risk Management Strategy. Flooding is seen as natural process that can maintain the features of interest at many designated environmental sites, so Scottish Natural Heritage helps to ensure that any changes to patterns of flooding do not adversely affect the natural environment. Scottish Natural Heritage also provides advice on the impacts of Flood Protection Schemes and other land use development on designated sites and species.

- **Forestry Commission Scotland** was designated in 2012 as a responsible authority for flood risk management planning purposes and has engaged in the development of the Flood Risk Management Strategies through national and Local Advisory Groups. This reflects the widely held view that forestry can play a significant role in managing flooding.

- During the preparation of the flood risk management plans **Network Rail** and **Transport Scotland** have undertaken works to address flooding at a number of frequently flooded sites. Further engagement is planned with SEPA and local authorities to identify areas of future work. There is the opportunity for further works to be undertaken during the first flood risk management planning cycle although locations for these works are yet to be confirmed.

- **Utility companies** have undertaken site specific flood risk studies for their primary assets and have management plans in place to mitigate the effects of flooding to their assets and also minimise the impacts on customers.

- The **Met Office** provides a wide range of scientific support, forecasts and weather warnings. SEPA and the Met Office work together through our partnership the Scottish Flood Forecasting Service.

- The **emergency services** provide emergency support when flooding occurs and can coordinate evacuations. You should call the emergency services on 999 if you are concerned about your safety or the safety of others and act immediately on any advice provided.

- **Historic Environment Scotland** considers flooding as part of its regular assessments of historic sites. As such, flooding is considered as one of the many

factors which inform the development and delivery of its management and maintenance programmes.

1.6 Links with other plans and policies

River basin management planning

River basin management aims to protect and improve the condition of our rivers, lochs, estuaries and coastal waters. Taking action to reduce flood risk in Scotland provides an opportunity to connect with plans to improve the quality of Scotland's water environment at the same time. For example, coordination between river basin management and flood risk management can reduce flood risk, whilst improving water quality and biodiversity.

SEPA is leading the delivery of River Basin Management Plans and Flood Risk Management Strategies and has worked to ensure that there is integration and coordination between them. This coordination, particularly in regard to consultation and engagement, will be important for stakeholders many of whom have an interest in the objectives of both plans.

Land use and spatial planning

Land use planning decisions are one of the most powerful tools available to manage flood risk. The alignment of flood risk management and land use planning policy is pivotal to achieving sustainable flood risk management. Decisions relating to flood risk management can have significant implications for the location of development and, likewise, decisions relating to the location of development can impact on flood risk. Land use planning has the potential to contribute to sustainable flood risk management through the location, use and design of new development and the redevelopment of existing areas. Actions that deliver national level land use planning policies are summarised in Annex 2.

SEPA is a statutory consultee providing advice on planning applications with regards to flood risk. Guidance aims to minimise flood risk to development and ensure no adverse effects occur elsewhere.

Land use planning objectives and actions have been agreed with responsible authorities, which will ensure that flood risk is adequately taken into account throughout the planning process.

Emergency planning and response

Emergency plans are prepared under the Civil Contingencies Act 2004. They are in place across Scotland and are prepared by Category 1 and 2 Responders, such as Police Scotland and the Scottish Ambulance Service. Emergency plans ensure the effective management of response to emergencies. Emergency plans can either be generic and deal with all emergencies or specific to deal with, for example, flooding. The information contained in the Flood Risk Management Strategies can be used to inform wider emergency response plans for flooding.

Many organisations have specific roles and responsibilities during an emergency response to a flood for example, local authorities, the Scottish Fire and Rescue Services, Police Scotland and SEPA. In many cases, this response is augmented by the work of voluntary organisations, communities and individuals. During an emergency, the response by these agencies will be co-ordinated through regional and local resilience partnerships.

Scottish Water investment plans

There is a close relationship between Flood Risk Management Strategies and Scottish Water's investment plans. Sewer flooding is not considered in detail in this strategy although it remains a high priority for Scottish Water and its customers. Scottish Water's close involvement in flood risk management planning aims to ensure that there is strong coordination between the management of sewer and surface water flooding and the actions to be taken forward by local authorities.

1.7 Supporting information

Sources of flooding described in this strategy

The Flood Risk Management Strategy addresses the risk of flooding from rivers, the coast and surface water. The risk of flooding from rivers is usually due to rainfall causing a river to rise above bank level spreading out and inundating adjacent areas. Coastal flooding is where the risk is from the sea. Sea levels can change in response to tidal cycles or atmospheric conditions. Over the longer term sea levels and coastal flood risk may change due to climate change. Surface water flooding happens when rainwater does not drain away through the normal drainage systems or soak into the ground, but lies on or flows over the ground instead. There can be interactions between these sources of flooding, but for the purposes of this strategy they are dealt with independently.

The following aspects of flooding have not been incorporated into this strategy:

- **Groundwater** is generally a contributing factor to flooding rather than the primary source. It is caused by water rising up from underlying rocks or flowing from springs.

- **Reservoir breaches** have been assessed under separate legislation (Reservoirs (Scotland) Act 2011). Further information and maps can be found on SEPA's website.

- The Flood Risk Management (Scotland) Act 2009 does not require SEPA or responsible authorities to assess or manage **coastal erosion**. However, SEPA has included consideration of erosion in the Flood Risk Management Strategies by identifying areas that are likely to be susceptible to erosion and where erosion can exacerbate flood risk. As part of considering where actions might deliver multiple benefits, we have looked to see where the focus of coastal flood risk management studies coincides with areas of high susceptibility to coastal erosion. Subsequent detailed studies and scheme design will need to consider coastal erosion in these areas.

- **Coastal flood modelling.** The information on coastal flooding used to set objectives and identify actions is based on SEPA modelling using simplified coastal processes and flooding mechanisms at work during a storm. Wave overtopping cannot be accurately modelled at a national scale due to the importance of local factors such as prevailing wind conditions, the depth and profile of the near-shore sea bed or the influence of any existing defences or management structures. As a result, coastal flood risk may be underestimated in some areas. Conversely, in locations with wide and flat floodplains, the modelling may overestimate flood risk. To address this, in a number of locations where more detailed local models were available they have been incorporated into the development of the Flood Risk Management Strategies. Where wave overtopping has been specifically identified as a concern – but where no further detailed

modelling is available – particular compensation has been made in the selecting actions to address coastal flood risk.

Commonly used terms

Below are explanatory notes for commonly used terms in this strategy. A glossary of terms is also available.

- **Reference to flood risk.** During the development of this strategy flood risk has been assessed over a range of likelihoods. For consistency in reporting information within the strategies, unless otherwise stated, all references to properties or other receptors being 'at risk of flooding' refer to a medium likelihood flood (up to a 1 in 200 chance of flooding in any given year). By exception, references will be made to high or low risk flooding, which should be taken to mean a 1 in 10 chance/likelihood or 1 in 1000 chance/likelihood of flooding in any given year respectively.

Chance / likelihood of flooding	
High	1 in 10 year
Medium	1 in 200 year
Low	1 in 1000 year

- **Annual Average Damages** have been used to assess the potential economic impact of flooding within an area. Depending on its size or severity each flood will cause a different amount of damage to a given area. Annual Average Damages are the theoretical average economic damages caused by flooding when considered over a very long period of time. It does not mean that damage will occur every year: in many years there will be no damages, in some years minor damages and in a few years major damages may occur.
  High likelihood events, which occur more regularly, contribute proportionally more to Annual Average Damages than rarer events. Within the Flood Risk Management Strategies Annual Average Damages incorporate economic damages to the following receptors: residential properties, non-residential properties, vehicles, emergency services, agriculture and roads. They have been calculated based on the principles set out in the Flood Hazard Research Centre Multi-Coloured Handbook (2010).

- **History of flooding.** The history of flooding sections of this document report floods that have occurred up to July 2015.

1.8 Next steps and monitoring progress

Flood risk management planning has progressed significantly in recent years. Scotland now has the most advanced nationally consistent and locally informed understanding of the causes and consequences of flooding that it has ever had. SEPA is committed to improving this knowledge and understanding during subsequent planning cycles, accepting that these first Flood Risk Management Strategies are based on the best available current knowledge and data.

SEPA has prioritised actions based on funding assumptions provided by Scottish Government and the capacity of local authorities to deliver within the next six years. Lead local authorities will provide an interim report on the progress of delivering all actions in the Local Flood Risk Management Plan not earlier than two years and not later than three years from its publication. A final report will also be prepared at the end of the first planning cycle.

A second set of Flood Risk Management Strategies and Local Flood Risk Management Plans will be published in December 2021 and June 2022 respectively.

Licensing acknowledgements

Full data licensing acknowledgements can be found in Annex 3 of this strategy.

Flood Risk Management Strategy

Forth Local Plan District

This section is the most relevant for individuals, communities and businesses seeking to understand their local flood risk and its management. There is an overview of the Local Plan District, as well as further detail for every Potentially Vulnerable Area. For each Potentially Vulnerable Area, there is a short description of the causes and consequences of flooding. The agreed objectives are clearly set out and, most importantly, the actions that will deliver these objectives are prioritised and described.

Section 2: Understanding and managing flooding

2.1 Summary of flooding in the Forth Local Plan District

The Forth Local Plan District covers an area of 1,609km^2 with a population of approximately 130,000. It contains five local authorities, 11 Potentially Vulnerable Areas and 1 candidate Potentially Vulnerable Area.

Flood risk in the Forth

There are approximately 3,100 residential and 660 non-residential properties at risk of flooding within the Local Plan District. This equates to approximately 4% of all properties at risk of flooding nationally. Within the Local Plan District, approximately 5% of all residential and 8% of all non-residential properties are at risk and it is estimated that 94% of these properties are located within Potentially Vulnerable Areas. The Annual Average Damages from flooding (see glossary) are approximately £8.0 million.

River flooding is the main source of flood risk. The Annual Average Damages caused by river flooding are £5.5 million, those caused by surface water flooding are £2.3 million and those caused by coastal flooding are £240,000 (Figure 1).

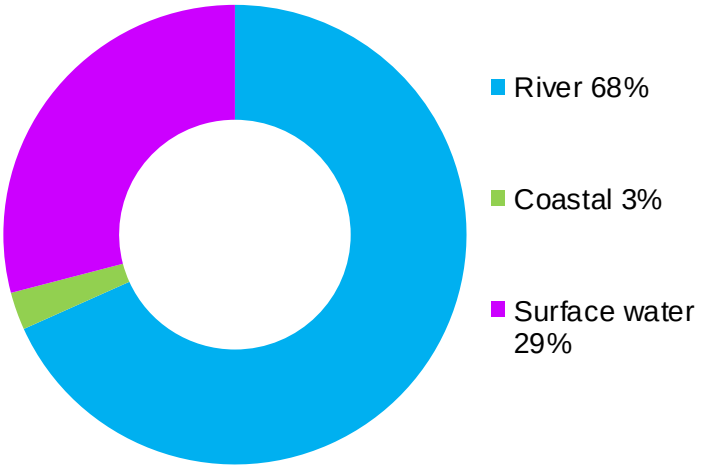


Figure 1: Annual Average Damages by flood source

Table 1 and Figure 3 show the number of properties at risk and the Annual Average Damages caused by flooding in the main towns and cities within the Local Plan District. This includes damages to residential and non-residential properties, transport and agriculture. Please note that economic damages to airports and rail infrastructure were not assessed, as information on damages at this scale is not available.

	Residential and non-residential properties at risk of flooding	Annual Average Damages
Stirling	1,300	£1.5 million
Tillicoultry	450	£740,000
Alloa	380	£1.4 million
Bridge of Allan	320	£360,000
Alva	220	£340,000
Menstrie	170	£290,000
Aberfoyle	100	£320,000
Dunblane	90	£130,000
Blackford	70	£270,000
Callander	70	£88,000

Table 1: Main areas with a risk of flooding

Background information on the Forth Local Plan District

The extent of the Forth Local Plan District and the location of the Potentially Vulnerable Areas are shown in Figure 2. It includes the urban areas of Stirling, Alloa, Bridge of Allan, Dunblane, Alva, Menstrie and Tillicoultry.

The largest river catchment is the River Forth along with its tributary the River Teith. Other watercourses include the River Devon, Black Devon and Allan Water. The largest lochs include Loch Katrine, Loch Lubnaig and Loch Venachar, all located in the catchment of the River Teith.

The main urban areas are centred around the inner Firth of Forth in the east of the Local Plan District. Further inland the catchment is more rural in nature. Across the area, the main types of land cover include heather and grassland (57%), coniferous and broadleaved woodland (21%), and arable and horticultural land (8%). The total urban area of the catchment is fairly small representing around 2% of total land cover.

The Forth Local Plan District includes a 74km stretch of coastline in the inner Firth of Forth where the River Forth, River Devon and Allan Water meet the Firth of Forth.

Further details of flood risk from distinct sources can be found in the river, coastal and surface water sections of this report.

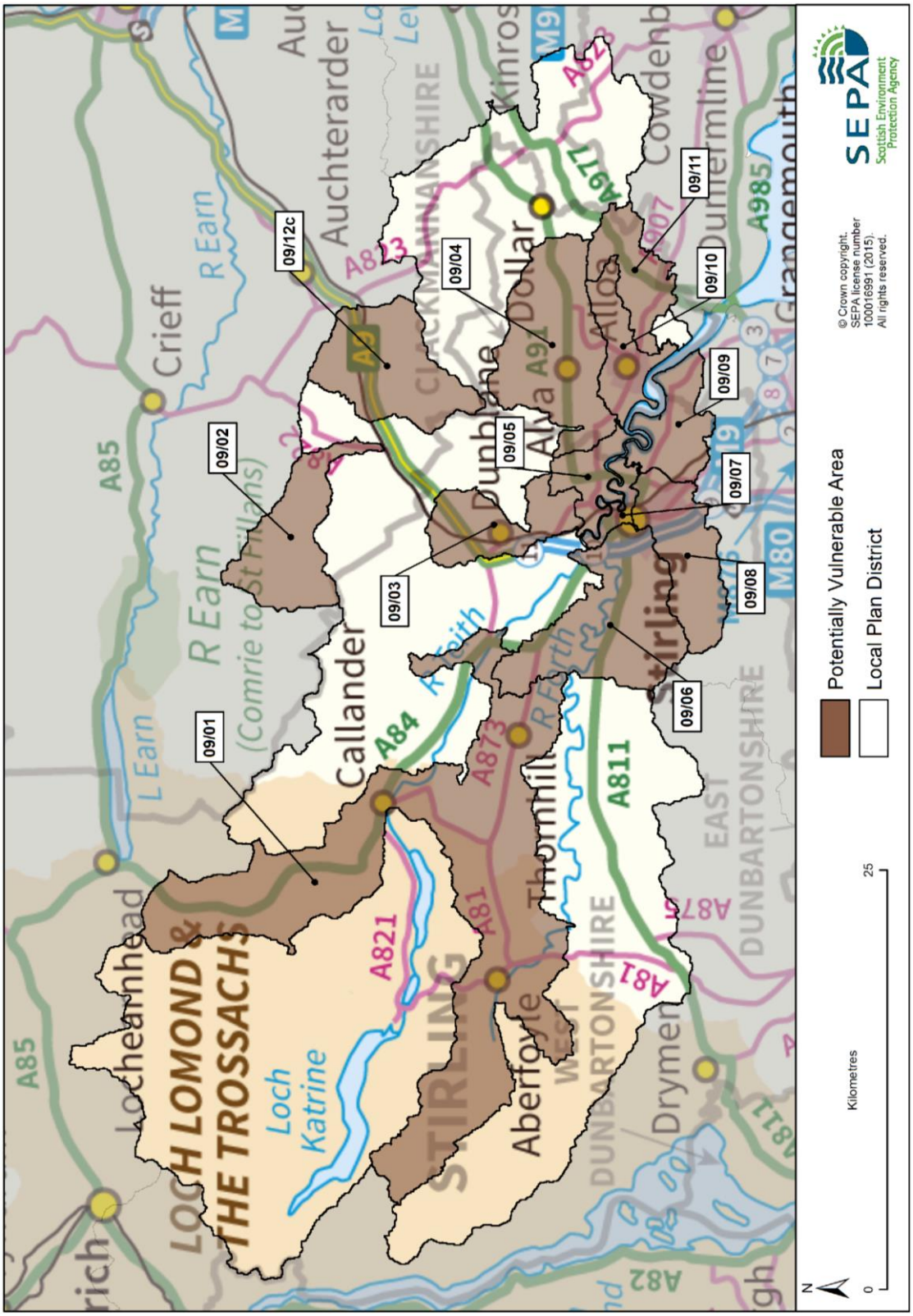


Figure 2: Forth Local Plan District with Potentially Vulnerable Areas identified

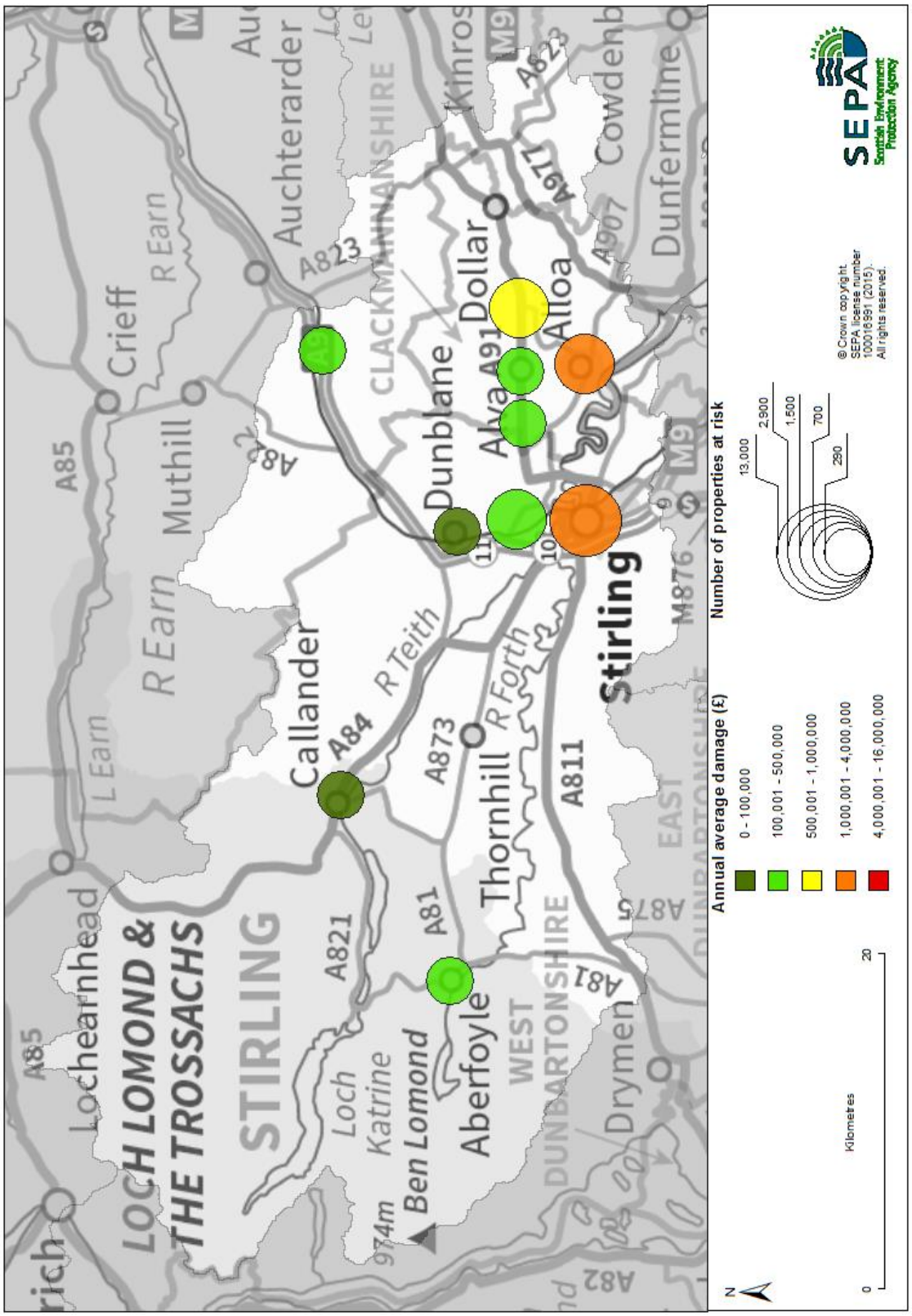


Figure 3: Forth Local Plan District showing areas with most properties at risk of flooding and associated damages

Objectives and actions in the Forth Local Plan District

The objectives are the shared aims for managing flooding. Actions describe where and how flood risk will be managed. Objectives and actions have been set by SEPA and agreed by flood risk management responsible authorities following consultation.

Some flood risk management objectives and actions apply to all areas, whether designated as a Potentially Vulnerable Area or not. For example, flood risk can be managed through national planning policy or as part of ongoing statutory duties for local authorities. The focus of this Flood Risk Management Strategy is to manage flood risk in Potentially Vulnerable Areas where specific actions apply in addition to the generic actions listed below. Further detail on specific actions can be found in the relevant Potentially Vulnerable Area chapter. Local authorities may have further information on how they manage flooding across their area.

Target area	Objective(s)	ID	Indicators
Applies across Forth Local Plan District	Avoid an overall increase in flood risk	9001	• 3,100 residential properties • 660 non-residential properties • 6,800 people
Applies across Forth Local Plan District	Reduce overall flood risk	9032	• 3,100 residential properties • 660 non-residential properties • 6,800 people

Action (ID):	**FLOOD FORECASTING** (90320009)		
Objective (ID):	**Reduce overall flood risk** (9032)		
Delivery lead:	SEPA		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	The Scottish Flood Forecasting Service is a joint initiative between SEPA and the Met Office that produces daily, national flood guidance statements which are issued to Category 1 and 2 responders. The service also provides information which allows SEPA to issue flood warnings, giving people a better chance of reducing the impact of flooding on their home or business. For more information please visit SEPA's website.		

Action (ID):	**SELF HELP** (90320011)		
Objective (ID):	**Reduce overall flood risk** (9032)		
Delivery lead:	–		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Everyone is responsible for protecting themselves and their property from flooding. Property and business owners can take simple steps to reduce damage and disruption to their homes and businesses should flooding happen. This includes preparing a flood plan and flood kit, installing property level protection, signing up to Floodline and the Resilient Communities Initiative, and ensuring that properties and businesses are insured against flood damage.		

Action (ID):	**AWARENESS RAISING** (90320013)		
Objective (ID):	**Reduce overall flood risk** (9032)		
Delivery lead:	Responsible authorities		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	SEPA and the responsible authorities have a duty to raise public awareness of flood risk. Improved awareness of flood risk and actions that prepare individuals, homes and businesses for flooding can reduce the overall impact. Local authorities will be undertaking additional awareness raising activities, further details will be set out in the Local FRM Plans.		

Action (ID):	**MAINTENANCE** (90320007)		
Objective (ID):	**Reduce overall flood risk** (9032)		
Delivery lead:	Local authority, asset / land managers		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Local authorities have a duty to assess watercourses and carry out clearance and repair works where such works would substantially reduce flood risk. The local authorities produce schedules of clearance and repair works and make these available for public inspection. Scottish Water undertake inspection and repair on the public sewer network. Asset owners and riparian landowners are responsible for the maintenance and management of their own assets including those which help to reduce flood risk.		

Action (ID):	**EMERGENCY PLANS / RESPONSE** (90320014)		
Objective (ID):	**Reduce overall flood risk** (9032)		
Delivery lead:	Category 1 and 2 Responders		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Providing an emergency response to flooding is the responsibility of many organisations, including local authorities, the emergency services and SEPA. Effective management of an emergency response relies on emergency plans that are prepared under the Civil Contingencies Act 2004 by Category 1 and 2 Responders. The emergency response by these organisations is co-ordinated through regional and local resilience partnerships. This response may be supported by the work of voluntary organisations.		

Action (ID):	**PLANNING POLICIES** (90010001)		
Objective (ID):	**Avoid an overall increase in flood risk** (9001) **Reduce overall flood risk** (9032)		
Delivery lead:	Planning authority		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Scottish Planning Policy and accompanying Planning Advice Notes set out Scottish Ministers' priorities for the operation of the planning system and for the development and use of land. In terms of flood risk management, the policy supports a catchment-scale approach to sustainable flood risk management and aims to build the resilience of our cities and towns, encourage sustainable land management in our rural areas, and to address the long-term vulnerability of parts of our coasts and islands. Under this approach, new development in areas with medium to high likelihood of flooding should be avoided. For further information on the application of national planning policies see Annex 2.		

2.2 Potentially Vulnerable Areas

The table below summarises the actions to manage flood risk in the Potentially Vulnerable Areas of this Local Plan District. Further detail is provided in each Potentially Vulnerable Area.

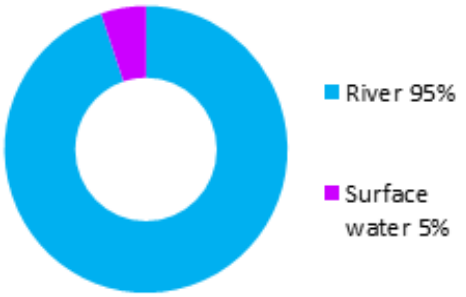
PVA	Flood protection scheme/ works	Natural flood management works	New flood warning	Flood protection study	Natural flood management study	Surface water plan/study	Strategic mapping and modelling	Maintain flood protection scheme*	Maintain flood warning*	Flood forecasting	Property level protection scheme	Community flood action groups	Self help	Awareness raising	Maintenance	Site protection plans	Emergency plans/ response	Planning policies
09/01	✓		✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓		✓	✓
09/02								N/A	N/A	✓			✓	✓	✓		✓	✓
09/03	✓					✓	✓	✓	✓	✓			✓	✓	✓		✓	✓
09/04				✓		✓	✓	✓	✓	✓		✓	✓	✓	✓		✓	✓
09/05	✓						✓	N/A	✓	✓			✓	✓	✓		✓	✓
09/06				✓		✓	✓	N/A	✓	✓			✓	✓	✓		✓	✓
09/07	✓					✓	✓	N/A	✓	✓			✓	✓	✓		✓	✓
09/08						✓	✓	N/A	N/A	✓			✓	✓	✓		✓	✓
09/09							✓	N/A	N/A	✓			✓	✓	✓		✓	✓
09/10			✓			✓	✓	N/A	N/A	✓			✓	✓	✓		✓	✓
09/11							✓	N/A	N/A	✓			✓	✓	✓		✓	✓
09/12c				✓				N/A	N/A	✓			✓	✓	✓		✓	✓

*Note: N/A is used where there is no formal Flood Protection Scheme or flood warning scheme present.

Trossachs (Potentially Vulnerable Area 09/01)

Local Plan District	Local authority	Main catchment
Forth	Stirling Council	River Forth

Summary of flooding impacts



At risk of flooding

- 200 residential properties
- 90 non-residential properties
- £770,000 Annual Average Damages

(damages by flood source shown left)

Summary of objectives to manage flooding

Objectives have been set by SEPA and agreed with flood risk management authorities. These are the aims for managing local flood risk. The objectives have been grouped in three main ways: by reducing risk, avoiding increasing risk or accepting risk by maintaining current levels of management.

Many organisations, such as Scottish Water and energy companies, actively maintain and manage their own assets including their risk from flooding. Where known, these actions are described here. Scottish Natural Heritage and Historic Environment Scotland work with site owners to manage flooding where appropriate at designated environmental and/or cultural heritage sites. These actions are not detailed further in the Flood Risk Management Strategies.

Summary of actions to manage flooding

The actions below have been selected to manage flood risk.

Flood protection scheme/works	*Natural flood management works*	New flood warning	Community flood action groups	*Property level protection scheme*	*Site protection plans*
Flood protection study	Natural flood management study	Maintain flood warning	Awareness raising	Surface water plan/study	Emergency plans/response
Maintain flood protection scheme	Strategic mapping and modelling	Flood forecasting	Self help	Maintenance	Planning policies

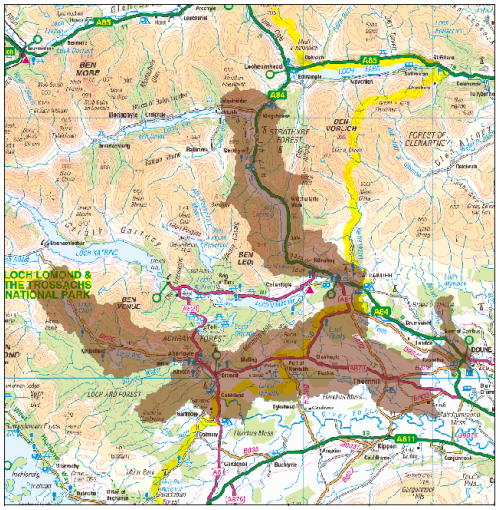
Trossachs (Potentially Vulnerable Area 09/01)

Local Plan District	Local authority	Main catchment
Forth	Stirling Council	River Forth

Background

This Potentially Vulnerable Area covers an area of 238km^2 and is part of the River Forth catchment (shown below). This is a steep, rural area which contains part of the Loch Lomond and Trossachs National Park and the urban areas of Aberfoyle and Callander. The main watercourses are the River Forth and the River Teith.

The River Forth originates north of Loch Ard forest in the west and flows through Aberfoyle down towards Stirling.



The River Teith runs from its source in the north west, through Callander and Doune down towards Stirling.

The area has a risk of river and surface water flooding. The majority of damages in this Potentially Vulnerable Area are caused by river flooding.

There are approximately 200 residential properties and 90 non-residential properties at risk of flooding. The Annual Average Damages are approximately £770,000.

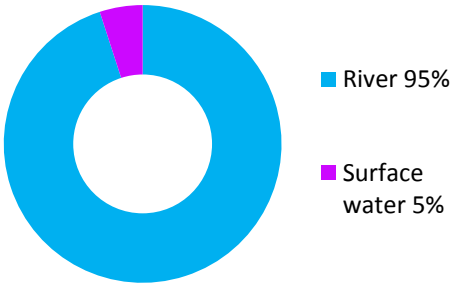


Figure 1: Annual Average Damages by flood source

Summary of flooding impacts

The highest risk of river flooding is from the River Forth to Aberfoyle.

The risk of flooding to people, property, as well as to community facilities, utilities, the transport network, designated sites and agricultural land is summarised in Table 1.

The damages associated with floods of different likelihood are shown in Figure 2. For this Potentially Vulnerable Area the highest damages are to residential properties followed by damages to non-residential properties. The location of the impacts of flooding is shown in Figure 3.

The figures presented for Annual Average Damages include damages to residential properties, non-residential properties, transport and agriculture.

	1 in 10 High likelihood	1 in 200 Medium likelihood	1 in 1000 Low likelihood
Residential properties (total 3,400)	60	200	220
Non-residential properties (total 640)	30	90	110
People	140	430	480
Community facilities	<10 Educational buildings	<10 Includes: educational buildings and emergency services	<10 Includes: educational buildings and emergency services
Utilities	<10	<10	<10
Transport links (excluding minor roads)	4 A roads, 6 B roads at 125 locations	4 A roads, 6 B roads at 138 locations	4 A roads, 6 B roads at 222 locations
Environmental designated areas (km^2)	6.8	7.1	7.2
Designated cultural heritage sites	16	18	19
Agricultural land (km^2)	6.8	9.4	10.9

Table 1: Summary of flooding impacts

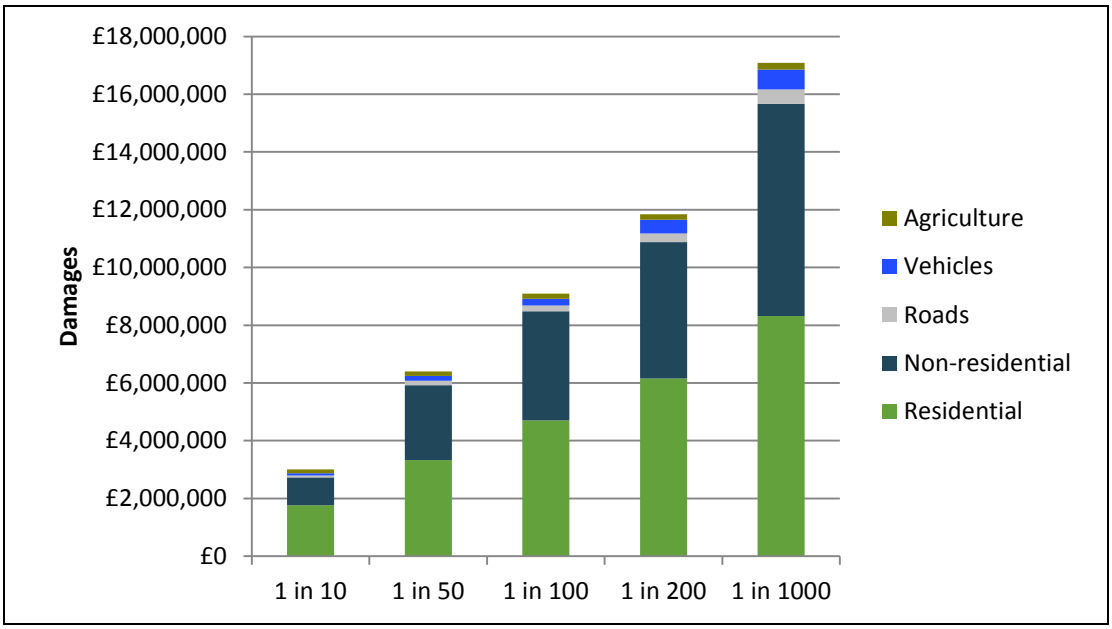


Figure 2: Damages by flood likelihood

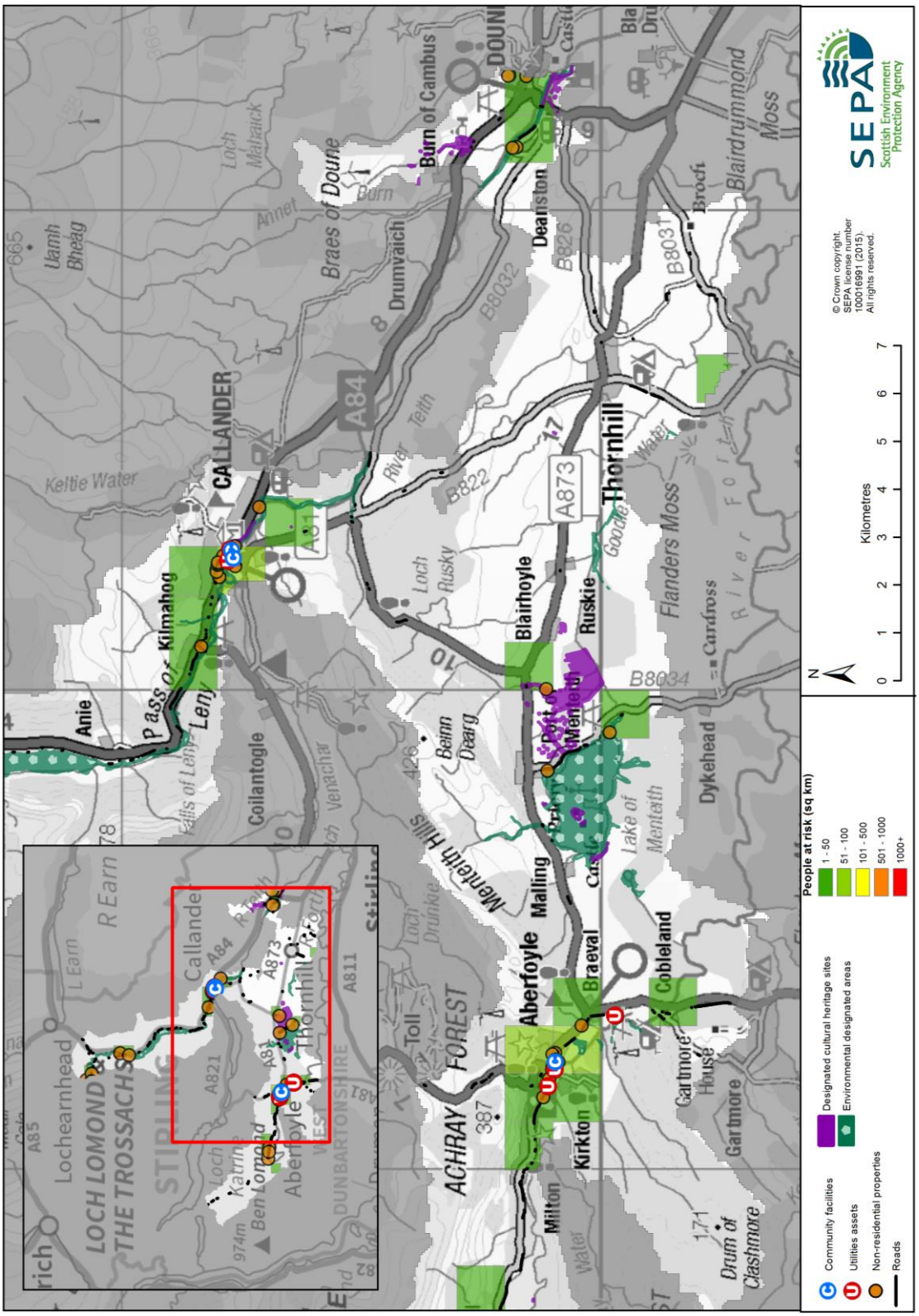


Figure 3: Impacts of flooding

History of flooding

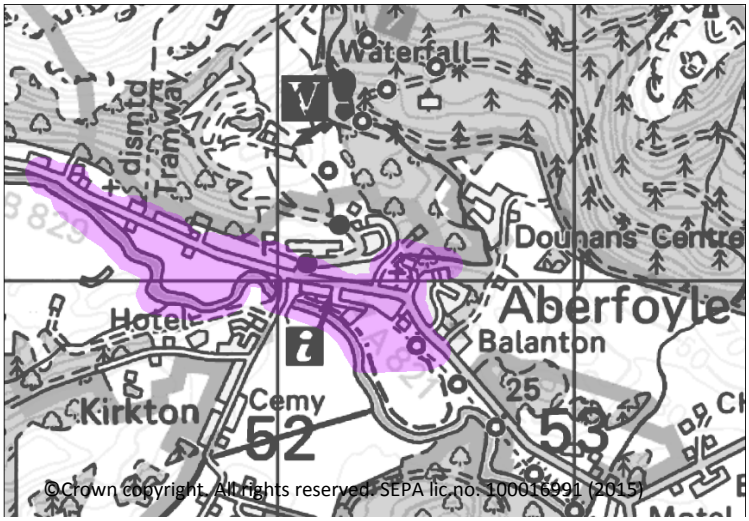
This area has a long history of flooding. The following significant floods have been recorded:

- 8 September 2009: River Forth caused property flooding on Main Street, Aberfoyle.
- 15 January 2007: River Forth caused property flooding on Main Street, Aberfoyle.
- 14 December 2006: River Forth caused property flooding on Main Street in Aberfoyle and Main Street in Callander, the campsite at Strathyre was flooded and the A84 was closed between Strathyre and Callander.
- 1 December 2006: River Teith caused property flooding adjacent to Meadows car park in Callander. On the same date, River Forth flooded 10 commercial properties at Aberfoyle, one pumping station and two sections of the B829.
- 1 January 2005: River Teith caused property flooding in Callander adjacent to Meadows car park. The Main Street was flooded to Dreadnought Hotel.
- 1 August 2004: Extreme rainfall caused widespread surface water flooding across Callander. Primary source of water was Callander Crags with direct runoff into properties via golf course and overtopping of small watercourses. Areas affected included Ancaster Road, Bridge Street, Gullipen View, Leny Feus, Main Street, Marshall Crescent and Tulipan Crescent.
- 18 August 2004: High levels on the River Keltie caused structural damage to Old Keltie Bridge; 15-20 properties were flooded on Ancaster Road, and further properties were flooded on Tulipan Crescent in Callander. There was a landslip at Glenample requiring bridge and road reconstruction at Edinample Bridge and South Lochearn Road.
- 1 September 1998: Extreme rainfall caused widespread surface water flooding across Callander. Primary source of water was Callander Crags with direct runoff into properties, overwhelming of sewer network and overtopping of small watercourses. Areas affected included Ancaster Road, Bridge Street, Bridgend, Cross Street, Livingston Avenue, Main Street, South Church Street, Stirling Road, Tulipan Crescent and Willoughby Place.
- 3 January 1993: River Teith caused flooding to more than 15 properties in the vicinity of the Meadows car park in Callander.
- 1990: Flooding from the River Teith reached the Dreadnought Hotel on Main Street, Callander. The Caledonian Hotel flooded to a depth of 0.6m.
- 1913: Flooding from the River Teith reached the Dreadnought Hotel on Main Street.
- 12-14 June 1905: Several properties on Main Street and Leny Road, Callander flooded from the River Teith.

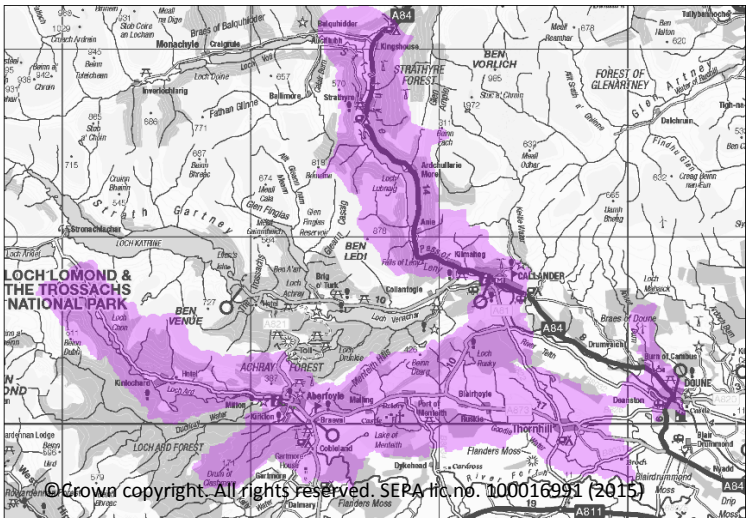
Objectives to manage flooding in Potentially Vulnerable Area 09/01

Objectives provide a common goal and shared ambition for managing floods. These objectives have been set by SEPA and agreed with flood risk management authorities following consultation. They were identified through an assessment of the underlying evidence of the causes and impacts of flooding. Target areas have been set to focus actions; they do not necessarily correspond to areas at risk in SEPA's flood map. The objectives below have been set for the Trossachs Potentially Vulnerable Area.

Reduce economic damages to residential and non-residential properties in Aberfoyle caused by flooding from the River Forth

Indicators:	Target area:
• £100,000 Annual Average Damages from residential properties • £120,000 Annual Average Damages from non-residential properties	
Objective ID: 9002	

Reduce economic damages to residential and non-residential properties in the Trossachs Potentially Vulnerable Area caused by river flooding

Indicators:	Target area:
• £170,000 Annual Average Damages from residential properties • £67,000 Annual Average Damages from non-residential properties	
Objective ID: 9003	

Target area	Objective	ID	Indicators within PVA
Callander	Reduce economic damages and number of residential properties at risk of surface water flooding in Callander where practical	9033	* See note below
Applies across Forth Local Plan District	Avoid an overall increase in flood risk	9001	• 200 residential properties • £770,000 Annual Average Damages
Applies across Forth Local Plan District	Reduce overall flood risk	9032	• 200 residential properties • £770,000 Annual Average Damages
Applies across Forth Local Plan District	Organisations such as Scottish Water, energy companies and Historic Environment Scotland actively maintain and manage their own assets, including the risk of flooding. These actions are not detailed further in the Flood Risk Management Strategies.		

* This objective will be monitored using surface water flood risk across the Potentially Vulnerable Area. For 09/01 there are 20 residential properties at risk and Annual Average Damages of £29,000.

Actions to manage flooding in Potentially Vulnerable Area 09/01

Actions describe where and how flood risk will be managed. These actions have been set by SEPA and agreed with flood risk management authorities following consultation. Selection of actions to deliver the agreed objectives was based on a detailed assessment and comparison of economic, social and environmental criteria. The actions shaded and then described below have been selected as the most appropriate for the Trossachs Potentially Vulnerable Area.

Selected actions					
Flood protection scheme/works	*Natural flood management works*	New flood warning	Community flood action groups	*Property level protection scheme*	*Site protection plans*
Flood protection study	Natural flood management study	Maintain flood warning	Awareness raising	Surface water plan/study	Emergency plans/response
Maintain flood protection scheme	Strategic mapping and modelling	Flood forecasting	Self help	Maintenance	Planning policies

Action (ID):	**FLOOD PROTECTION SCHEME/WORKS** (90030006)		
Objective (ID):	Reduce economic damages to residential and non-residential properties in the Trossachs Potentially Vulnerable Area caused by river flooding (9003)		
Delivery lead:	Stirling Council		
Priority:	National:	Within local authority:	
	42 of 42	**3 of 3**	
Status:	**Under development**	Indicative delivery:	**2016-2021**
Description:	A flood protection scheme has been proposed for Callander. The scheme would consist of flood embankments and protect the Meadows car park and residential properties from the 1 in 50 year event.		
Potential impacts			
Economic:	The proposed scheme may benefit 15 residential properties and 15 non-residential properties at risk of flooding in this location, with estimated damages avoided of £210,000.		
Social:	A reduction in flood risk would have a positive benefit to the health and wellbeing of the community. In addition there is one road which has been identified as potentially benefitting from this action. There may be negative impacts through disturbance to the local community during the construction phase.		
Environmental:	Flood protection schemes can have both positive and negative impacts on the ecological quality of the environment depending on how they are designed. To be in accord with the FRM Strategy, the responsible authority (and where applicable, the licensing authority) should seek to ensure that the works will not have an adverse effect on the integrity of the River Teith Special Area of Conservation. In		

Environmental:	addition, a number of nationally and locally designated sites are present in the study area and could be positively or negatively impacted. These include conservation areas, listed buildings and national parks.

Action (ID):	**FLOOD PROTECTION SCHEME/WORKS** (90020006)		
Objective (ID):	Reduce economic damages to residential and non-residential properties in Aberfoyle caused by flooding from the River Forth (9002)		
Delivery lead:	Stirling Council		
Status:	**Under development**	Indicative delivery:	**2016-2021**
Description:	Flood protection works have been proposed for Aberfoyle to protect residential properties and local businesses from high likelihood flooding (1 in 5 year standard of protection). The works would consist of flood embankments and would also help maintain access to the school and emergency service access beyond Aberfoyle. The works depend on the provision of flood warning by SEPA and would be carried out simultaneously with flood warning provisions.		
Potential impacts			
Economic:	The proposed scheme may benefit seven residential properties and 13 non-residential properties at risk of flooding in this location.		
Social:	A reduction in flood risk would have a positive benefit to the health and wellbeing of the community. In addition there are three utilities and one road (key road providing single access point to school and villages for 14 miles) which have been identified as potentially benefitting from this action. There may be negative impacts through disturbance to the local community during the construction phase.		
Environmental:	Flood protection schemes can have both positive and negative impacts on the ecological quality of the environment depending on how they are designed. To be in accord with the FRM Strategy, the responsible authority (and where applicable, the licensing authority) should seek to ensure that the works will not have an adverse effect on the integrity of the Trossachs Woods Special Area of Conservation.		

Action (ID):	**NEW FLOOD WARNING** (90320010)		
Objective (ID):	Reduce overall flood risk (9032)		
Delivery lead:	SEPA		
Status:	**Not started**	Indicative delivery:	**2016-2021**
Description:	Flood warning is required for properties at risk of flooding from the River Forth in Aberfoyle and flooding of the B829 single access road from Aberfoyle to Milton, Kinlochard, Stronachlacher and Inversnaid. Further feasibility assessment will be required to assess the delivery potential of a new flood warning scheme in this area.		

Action (ID):	**FLOOD PROTECTION STUDY** (90020005)		
Objective (ID):	Reduce economic damages to residential and non-residential properties in Aberfoyle caused by flooding from the River Forth (9002)		
Delivery lead:	Stirling Council		
Priority:	National:	Within local authority:	
	39 of 168	**1 of 2**	
Status:	**Under development**	Indicative delivery:	**2016-2021**
Description:	A flood protection study has been carried out by Stirling Council for Aberfoyle assessing flood storage and sediment management. No economically viable option has been identified (benefit cost ratio of 0.37) but Stirling Council will self-fund a 1 in 5 year flood protection scheme. The study can be revisited in future to further examine options to reduce flood risk in conjunction with investigations of flood warning by SEPA.		
Potential impacts			
Economic:	The study could benefit 62 residential properties and 46 non-residential properties at risk of flooding in this location, with potential damages avoided of up to £9.3 million.		
Social:	Social impacts will depend on the outcome of the study and recommended actions. A reduction in flood risk would have a positive benefit to the health and wellbeing of the community. In addition the study could benefit one community facility, one emergency service, two utilities and two roads located within the study area.		
Environmental:	Flood protection studies should consider the positive and negative impacts of proposed actions on the ecological quality of the environment and designated sites. Where possible opportunities to enhance and restore the environment should be sought, for example through natural flood management. To be in accord with the FRM Strategy, the responsible authority should seek to ensure as part of the study that the action will not have an adverse effect on the integrity of the Trossachs Woods Special Area of Conservation. Listed buildings, national parks, Sites of Special Scientific Interest and ancient woodlands are also present in the study area and could be positively or negatively impacted.		

Action (ID):	**NATURAL FLOOD MANAGEMENT STUDY** (90020003)		
Objective (ID):	Reduce economic damages to residential and non-residential properties in Aberfoyle caused by flooding from the River Forth (9002)		
Delivery lead:	SEPA in partnership with other organisations		
Status:	**Ongoing**	Indicative delivery:	**2016-2021**
Description:	The ongoing Duchray catchment pilot study is looking at a range of natural flood management options including runoff control and sediment management to help reduce flood risk in Aberfoyle. The study has been undertaken in partnership with Loch Lomond and the		

	Trossachs National Park and the Forestry Commission and is due to be completed in 2016. The study should inform any future flood protection studies.
Potential impacts	
Economic:	The economic impact of natural flood management actions is difficult to define. However, these actions can reduce flood risk for high likelihood events. Forty residential and non-residential properties could potentially benefit from natural flood management actions in this location.
Social:	Social impacts will depend on the outcome of the study and recommended actions. A reduction in flood risk would have a positive benefit to the health and wellbeing of the community. Natural flood management actions can restore and enhance natural environments and create opportunities for recreation and tourism.
Environmental:	Natural flood management actions can have a positive impact on the ecological quality of the environment by restoring and enhancing natural habitats. Listed buildings, national parks, Sites of Special Scientific Interest and ancient woodlands are also present in the study area and could be positively or negatively impacted.

Action (ID):	**SURFACE WATER PLAN/STUDY** (90330018)		
Objective (ID):	Reduce economic damages and number of residential properties at risk of surface water flooding in Callander where practical (9033)		
Delivery lead:	Stirling Council		
Status:	**Ongoing**	Indicative delivery:	**2016-2021**
Description:	The area must be covered by a surface water management plan or plans that set objectives for the management of surface water flood risk and identify the most sustainable actions to achieve the objectives.		

Action (ID):	**STRATEGIC MAPPING AND MODELLING** (90320016)		
Objective (ID):	Reduce overall flood risk (9032)		
Delivery lead:	SEPA		
Status:	**Not started**	Indicative delivery:	**2016-2021**
Description:	SEPA will seek to incorporate additional surface water data into the flood maps to improve understanding of flood risk. Approximately 800km² of improved surface water data is currently available within this Local Plan District. The inclusion of additional surface water hazard data resulting from the completion of local authority surface water management plans and Scottish Water integrated catchment studies will be considered as these projects are completed.		

Action (ID):	**STRATEGIC MAPPING AND MODELLING** (90320019)		
Objective (ID):	Reduce overall flood risk (9032)		
Delivery lead:	Scottish Water		
Status:	**Not started**	Indicative delivery:	**2016-2021**
Description:	Scottish Water will carry out an assessment of flood risk within the highest risk sewer catchments to improve knowledge and understanding of surface water flood risk.		

Action (ID):	**MAINTAIN FLOOD PROTECTION SCHEME** (90020017)		
Objective (ID):	Reduce economic damages to residential and non-residential properties in Aberfoyle caused by flooding from the River Forth (9002)		
Delivery lead:	Stirling Council		
Status:	**Not started**	Indicative delivery:	**Ongoing**
Description:	Maintain the flood embankment in Aberfoyle once completed in 2016. The embankment will have a design standard of protection of 1 in 5 years.		

Action (ID):	**MAINTAIN FLOOD WARNING** (90320030)		
Objective (ID):	Reduce overall flood risk (9032)		
Delivery lead:	SEPA		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Continue to maintain the Callander flood warning area which covers the River Teith and the Callander to Stirling flood warning area which covers the River Teith to the confluence with the River Forth, both of which form part of the Stirling river flood warning scheme.		

Action (ID):	**FLOOD FORECASTING** (90320009)		
Objective (ID):	Reduce overall flood risk (9032)		
Delivery lead:	SEPA		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	The Scottish Flood Forecasting Service is a joint initiative between SEPA and the Met Office that produces daily, national flood guidance statements which are issued to Category 1 and 2 Responders. The service also provides information which allows SEPA to issue flood warnings, giving people a better chance of reducing the impact of flooding on their home or business. For more information please visit SEPA's website.		

Action (ID):	**COMMUNITY FLOOD ACTION GROUPS** (90020012)		
Objective (ID):	Reduce economic damages to residential and non-residential properties in Aberfoyle caused by flooding from the River Forth (9002)		
Delivery lead:	Community		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Aberfoyle Flood Forum operates in this area. The membership includes representation of residents and the business community. The group acts as a pressure group to promote flooding concerns in Aberfoyle and wider area.		

Action (ID):	**COMMUNITY FLOOD ACTION GROUPS** (90030012)		
Objective (ID):	Reduce economic damages to residential and non-residential properties in the Trossachs Potentially Vulnerable Area caused by river flooding (9003)		
Delivery lead:	Community		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Callander Flood Action Group operates in this area. The forum takes on flood warden duties, raises public awareness, liaises with relevant authorities, provides assistance to residents on property protection and is helping to develop a community resilience plan.		

Action (ID):	**SELF HELP** (90320011)		
Objective (ID):	Reduce overall flood risk (9032)		
Delivery lead:	—		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Everyone is responsible for protecting themselves and their property from flooding. Property and business owners can take simple steps to reduce damage and disruption to their homes and businesses should flooding happen. This includes preparing a flood plan and flood kit, installing property level protection, signing up to Floodline and Resilient Communities initiatives, and ensuring that properties and businesses are insured against flood damage.		

Action (ID):	**AWARENESS RAISING** (90320013)		
Objective (ID):	Reduce overall flood risk (9032)		
Delivery lead:	Responsible authorities		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	SEPA and the responsible authorities have a duty to raise public awareness of flood risk. Improved awareness of flood risk and actions that prepare individuals, homes and businesses for flooding can reduce the overall impact. SEPA will engage with the community and promote Floodline. This will be achieved through property level protection events delivered by the Scottish Flood Forum and SEPA led education events. Local authorities will be undertaking additional awareness raising activities. Further details will be set out in the Local FRM Plan.		

Action (ID):	**MAINTENANCE** (90320007)		
Objective (ID):	Reduce overall flood risk (9032)		
Delivery lead:	Stirling Council, asset / land managers		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Local authorities have a duty to assess watercourses and carry out clearance and repair works where such works would substantially reduce flood risk. They produce schedules of clearance and repair works and make these available for public inspection. Scottish Water undertake inspection and repair on the public sewer network. Asset owners and riparian landowners are responsible for the maintenance and management of their own assets including those which help to reduce flood risk.		

Action (ID):	**EMERGENCY PLANS/RESPONSE** (90320014)		
Objective (ID):	Reduce overall flood risk (9032)		
Delivery lead:	Category 1 and 2 Responders		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Providing an emergency response to flooding is the responsibility of many organisations, including local authorities, the emergency services and SEPA. Effective management of an emergency response relies on emergency plans that are prepared under the Civil Contingencies Act 2004 by Category 1 and 2 Responders. The emergency response by these organisations is co-ordinated through regional and local resilience partnerships. This response may be supported by the work of voluntary organisations.		

Action (ID):	**PLANNING POLICIES** (90010001)		
Objective (ID):	Avoid an overall increase in flood risk (9001) Reduce overall flood risk (9032)		
Delivery lead:	Planning authority		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Scottish Planning Policy and accompanying Planning Advice Notes set out Scottish Ministers' priorities for the operation of the planning system and for the development and use of land. In terms of flood risk management, the policy supports a catchment-scale approach to sustainable flood risk management and aims to build the resilience of our cities and towns, encourage sustainable land management in our rural areas, and to address the long-term vulnerability of parts of our coasts and islands. Under this approach, new development in areas with medium to high likelihood of flooding should be avoided. For further information on the application of national planning policies see Annex 2.		

Braco (Potentially Vulnerable Area 09/02)

Local Plan District	Local authority	Main catchment
Forth	Perth and Kinross Council	Allan Water

Summary of flooding impacts

At risk of flooding

- 20 residential properties
- <10 non-residential properties
- £29,000 Annual Average Damages

(damages by flood source shown left)

Summary of objectives to manage flooding

Objectives have been set by SEPA and agreed with flood risk management authorities. These are the aims for managing local flood risk. The objectives have been grouped in three main ways: by reducing risk, avoiding increasing risk or accepting risk by maintaining current levels of management.

Many organisations, such as Scottish Water and energy companies, actively maintain and manage their own assets including their risk from flooding. Where known, these actions are described here. Scottish Natural Heritage and Historic Environment Scotland work with site owners to manage flooding where appropriate at designated environmental and/or cultural heritage sites. These actions are not detailed further in the Flood Risk Management Strategies.

Summary of actions to manage flooding

The actions below have been selected to manage flood risk.

Flood protection scheme/works	*Natural flood management works*	*New flood warning*	*Community flood action groups*	*Property level protection scheme*	*Site protection plans*
Flood protection study	*Natural flood management study*	*Maintain flood warning*	Awareness raising	*Surface water plan/study*	Emergency plans/response
Maintain flood protection scheme	*Strategic mapping and modelling*	Flood forecasting	Self help	Maintenance	Planning policies

Braco (Potentially Vulnerable Area 09/02)

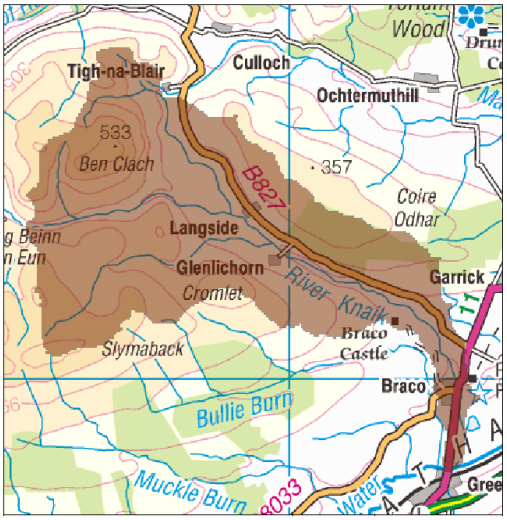
Local Plan District	Local authority	Main catchment
Forth	Perth and Kinross Council	Allan Water

Background

This Potentially Vulnerable Area is 39km^2 and is part of the Stirling catchment (shown right). This is a steep, rural area covering the catchment of the River Knaik which flows into the small urban area of Braco.

All damages in this Potentially Vulnerable Area are caused by river flooding.

There are approximately 20 residential properties at risk of flooding. The Annual Average Damages are approximately £29,000.



Summary of flooding impacts

Work carried out since the National Flood Risk Assessment in 2011 has concluded that the risk of flooding in this Potentially Vulnerable Area is relatively low. The designation of this Potentially Vulnerable Area will be reviewed in the next flood risk management planning cycle.

The greatest risk of flooding is to Braco from the River Knaik. The risk of flooding to people and property, as well as to community facilities, utilities, the transport network, designated sites and agricultural land is summarised in Table 1.

The damages associated with floods of different likelihood are shown in Figure 1. For this Potentially Vulnerable Area the highest damages are to residential properties.

The location of the impacts of flooding is shown in Figure 2. The figures presented for Annual Average Damages include damages to residential properties, non-residential properties, transport and agriculture.

	1 in 10 High likelihood	1 in 200 Medium likelihood	1 in 1000 Low likelihood
Residential properties (total 260)	<10	20	50
Non-residential properties (total 40)	<10	<10	<10
People	<10	50	110
Community facilities	0	0	0
Utilities	0	0	0
Transport links (excluding minor roads)	1 A road at 2 locations	1 A road at 2 locations	1 A road at 4 locations
Environmental designated areas (km^2)	0	0	0
Designated cultural heritage sites	1	1	1
Agricultural land (km^2)	1.0	1.2	1.3

Table 1: Summary of flooding impacts

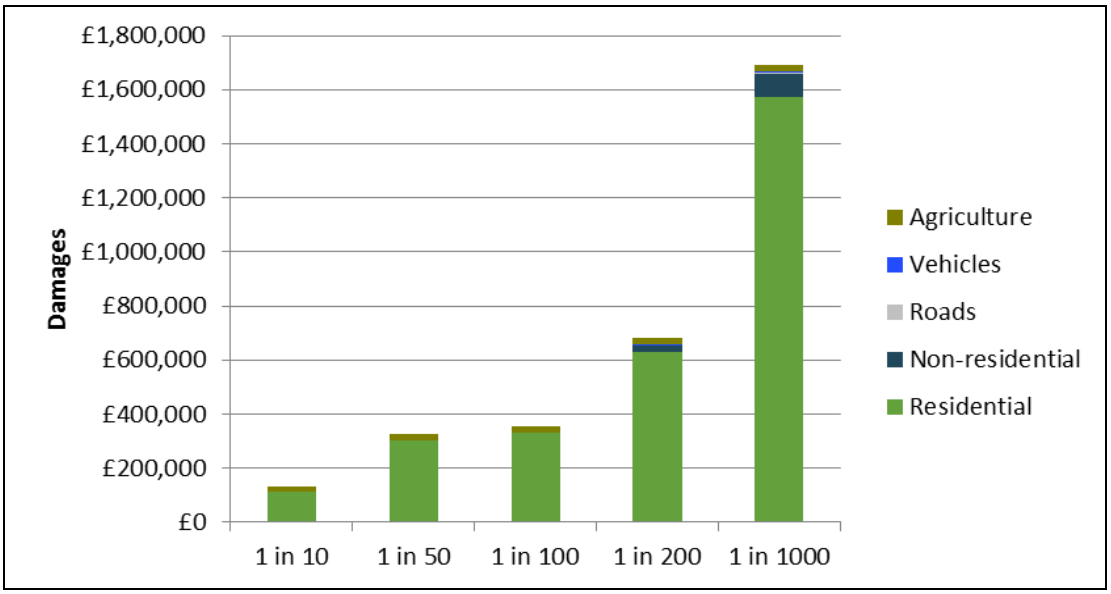


Figure 1: Damages by flood likelihood

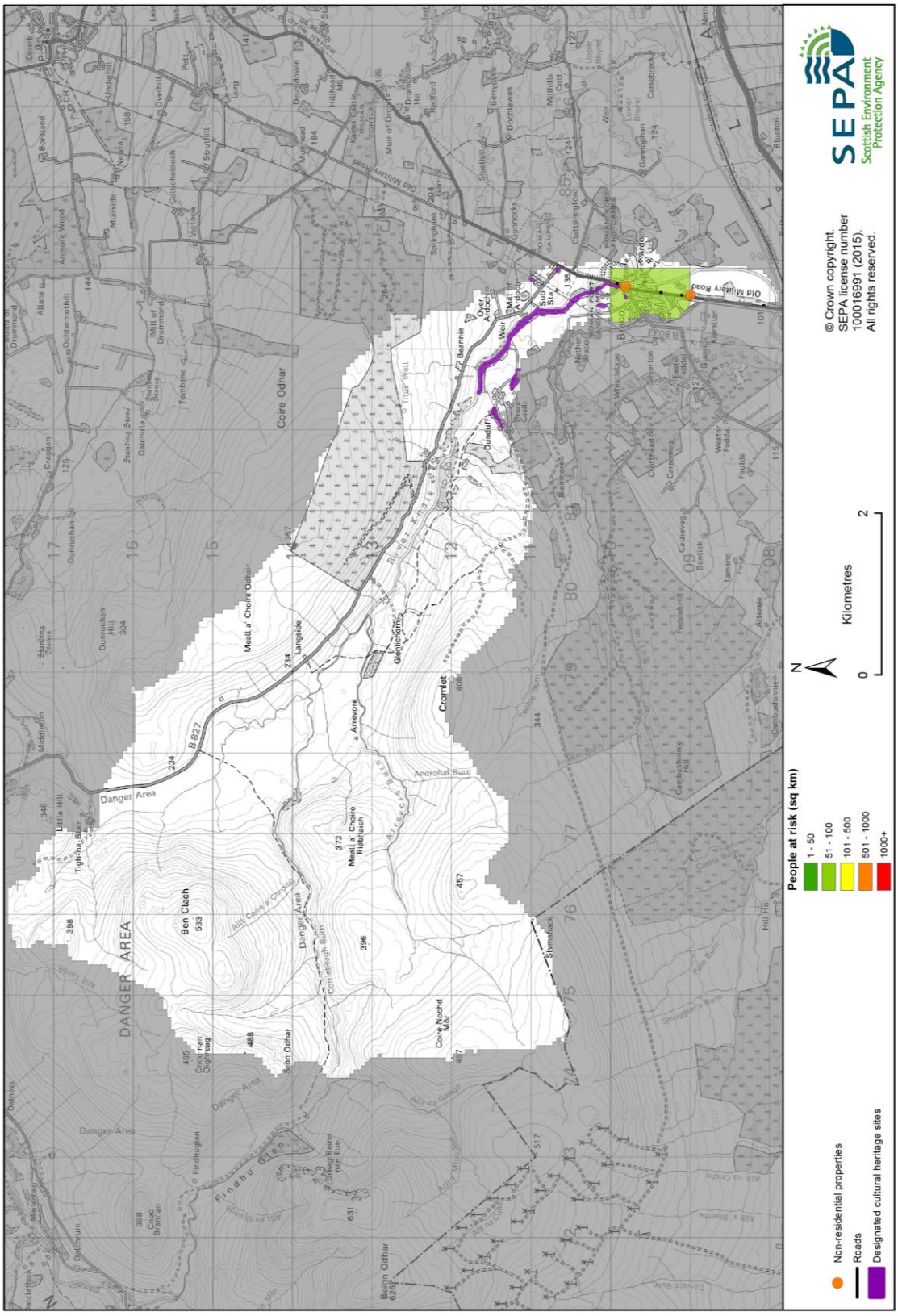


Figure 2: Impacts of flooding

History of flooding

No significant floods have been recorded in this area.

Objectives to manage flooding in Potentially Vulnerable Area 09/02

Objectives provide a common goal and shared ambition for managing floods. These objectives have been set by SEPA and agreed with flood risk management authorities following consultation. They were identified through an assessment of the underlying evidence of the causes and impacts of flooding. Target areas have been set to focus actions; they do not necessarily correspond to areas at risk in SEPA's flood map. The objectives below have been set for Braco Potentially Vulnerable Area.

Target area	Objective	ID	Indicators within PVA
Applies across Forth Local Plan District	Avoid an overall increase in flood risk	9001	• 20 residential properties • £29,000 Annual Average Damages
Applies across Forth Local Plan District	Reduce overall flood risk	9032	• 20 residential properties • £29,000 Annual Average Damages
Applies across Forth Local Plan District	Organisations such as Scottish Water, energy companies and Historic Environment Scotland actively maintain and manage their own assets, including the risk of flooding. These actions are not detailed further in the Flood Risk Management Strategies.		

Actions to manage flooding in Potentially Vulnerable Area 09/02

Actions describe where and how flood risk will be managed. These actions have been set by SEPA and agreed with flood risk management authorities following consultation. Selection of actions to deliver the agreed objectives was based on a detailed assessment and comparison of economic, social and environmental criteria. The actions shaded and then described below have been selected as the most appropriate for Braco Potentially Vulnerable Area.

Selected actions					
Flood protection scheme/works	*Natural flood management works*	*New flood warning*	*Community flood action groups*	*Property level protection scheme*	*Site protection plans*
Flood protection study	*Natural flood management study*	*Maintain flood warning*	Awareness raising	*Surface water plan/study*	Emergency plans/response
Maintain flood protection scheme	*Strategic mapping and modelling*	Flood forecasting	Self help	Maintenance	Planning policies

Action (ID):	**FLOOD FORECASTING** (90320009)		
Objective (ID):	Reduce overall flood risk (9032)		
Delivery lead:	SEPA		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	The Scottish Flood Forecasting Service is a joint initiative between SEPA and the Met Office that produces daily, national flood guidance statements which are issued to Category 1 and 2 Responders. The service also provides information which allows SEPA to issue flood warnings, giving people a better chance of reducing the impact of flooding on their home or business. For more information please visit SEPA's website.		

Action (ID):	**SELF HELP** (90320011)		
Objective (ID):	Reduce overall flood risk (9032)		
Delivery lead:	—		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Everyone is responsible for protecting themselves and their property from flooding. Property and business owners can take simple steps to reduce damage and disruption to their homes and businesses should flooding happen. This includes preparing a flood plan and flood kit, installing property level protection, signing up to Floodline and Resilient Communities initiatives, and ensuring that properties and businesses are insured against flood damage.		

Action (ID):	**AWARENESS RAISING** (90320013)		
Objective (ID):	Reduce overall flood risk (9032)		
Delivery lead:	Responsible authorities		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	SEPA and the responsible authorities have a duty to raise public awareness of flood risk. Improved awareness of flood risk and actions that prepare individuals, homes and businesses for flooding can reduce the overall impact. From 2016 SEPA will engage with the community through local participation in national initiatives, including partnership working with Neighbourhood Watch Scotland. In addition, SEPA will engage with local authorities and community resilience groups where possible. Local authorities will be undertaking additional awareness raising activities. Further details will be set out in the Local FRM Plan.		

Action (ID):	**MAINTENANCE** (90320007)		
Objective (ID):	Reduce overall flood risk (9032)		
Delivery lead:	Perth & Kinross Council, asset / land managers		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Local authorities have a duty to assess watercourses and carry out clearance and repair works where such works would substantially reduce flood risk. They produce schedules of clearance and repair works and make these available for public inspection. Scottish Water undertake inspection and repair on the public sewer network. Asset owners and riparian landowners are responsible for the maintenance and management of their own assets including those which help to reduce flood risk.		

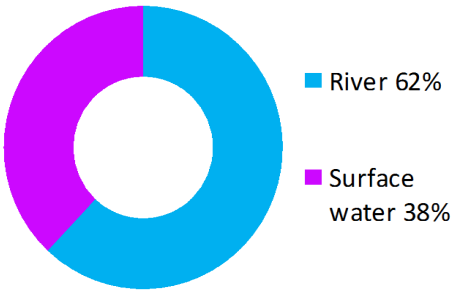
Action (ID):	**EMERGENCY PLANS/RESPONSE** (90320014)		
Objective (ID):	Reduce overall flood risk (9032)		
Delivery lead:	Category 1 and 2 Responders		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Providing an emergency response to flooding is the responsibility of many organisations, including local authorities, the emergency services and SEPA. Effective management of an emergency response relies on emergency plans that are prepared under the Civil Contingencies Act 2004 by Category 1 and 2 Responders. The emergency response by these organisations is co-ordinated through regional and local resilience partnerships. This response may be supported by the work of voluntary organisations.		

Action (ID):	**PLANNING POLICIES** (90010001)		
Objective (ID):	Avoid an overall increase in flood risk (9001) Reduce overall flood risk (9032)		
Delivery lead:	Planning authority		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Scottish Planning Policy and accompanying Planning Advice Notes set out Scottish Ministers' priorities for the operation of the planning system and for the development and use of land. In terms of flood risk management, the policy supports a catchment-scale approach to sustainable flood risk management and aims to build the resilience of our cities and towns, encourage sustainable land management in our rural areas, and to address the long-term vulnerability of parts of our coasts and islands. Under this approach, new development in areas with medium to high likelihood of flooding should be avoided. For further information on the application of national planning policies see Annex 2.		

Dunblane and Bridge of Allan (Potentially Vulnerable Area 09/03)

Local Plan District	Local authority	Main catchment
Forth	Stirling Council	Allan Water

Summary of flooding impacts



At risk of flooding

- 370 residential properties
- 50 non-residential properties
- £550,000 Annual Average Damages

(damages by flood source shown left)

Summary of objectives to manage flooding

Objectives have been set by SEPA and agreed with flood risk management authorities. These are the aims for managing local flood risk. The objectives have been grouped in three main ways: by reducing risk, avoiding increasing risk or accepting risk by maintaining current levels of management.

Many organisations, such as Scottish Water and energy companies, actively maintain and manage their own assets including their risk from flooding. Where known, these actions are described here. Scottish Natural Heritage and Historic Environment Scotland work with site owners to manage flooding where appropriate at designated environmental and/or cultural heritage sites. These actions are not detailed further in the Flood Risk Management Strategies.

Summary of actions to manage flooding

The actions below have been selected to manage flood risk.

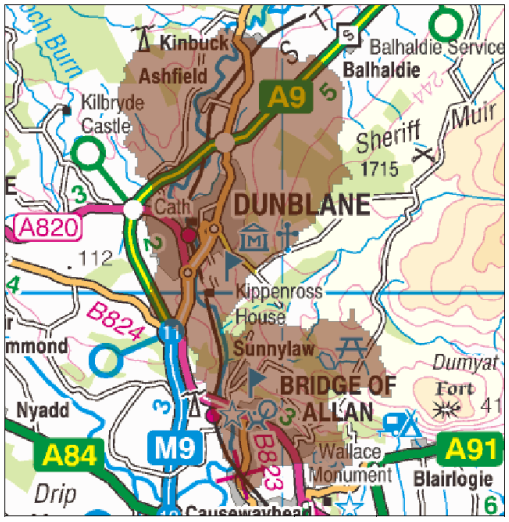
Flood protection scheme/works	*Natural flood management works*	*New flood warning*	*Community flood action groups*	*Property level protection scheme*	*Site protection plans*
Flood protection study	*Natural flood management study*	Maintain flood warning	Awareness raising	Surface water plan/study	Emergency plans/response
Maintain flood protection scheme	Strategic mapping and modelling	Flood forecasting	Self help	Maintenance	Planning policies

Dunblane and Bridge of Allan (Potentially Vulnerable Area 09/03)

Local Plan District	Local authority	Main catchment
Forth	Stirling Council	Allan Water

Background

This Potentially Vulnerable Area is 29km^2 and is part of the Stirling catchment (shown below). It contains a mixture of urban and rural areas and includes the towns of Dunblane and Bridge of Allan. The main river is the Allan Water, which flows from the north of the area through its entire length, before converging with the River Forth.



The area has a risk of river and surface water flooding. The majority of damages in this Potentially Vulnerable Area are caused by river flooding.

There are approximately 370 residential properties and 50 non-residential properties at risk of flooding. The Annual Average Damages are approximately £550,000.

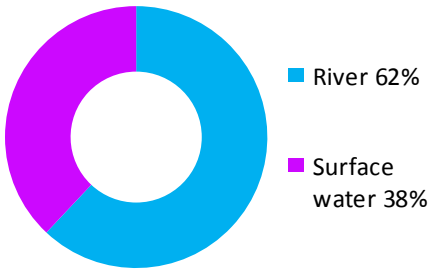


Figure 1: Annual Average Damages by flood source

Summary of flooding impacts

The highest risk of river flooding is from the Allan Water and River Forth to Bridge of Allan. The highest risk of surface water flooding is in Dunblane and Bridge of Allan.

The risk of flooding to people, property, as well as to community facilities, utilities, the transport network, designated sites and agricultural land is summarised in Table 1.

The damages associated with floods of different likelihood are shown in Figure 2. For this Potentially Vulnerable Area the highest damages are to residential properties followed by damages to roads, notably the A9. The location of the impacts of flooding is shown in Figure 3.

The figures presented for Annual Average Damages include damages to residential properties, non-residential properties, transport and agriculture.

	1 in 10 High likelihood	1 in 200 Medium likelihood	1 in 1000 Low likelihood
Residential properties (total 5,800)	10	370	490
Non-residential properties (total 600)	<10	50	60
People	30	810	1,100
Community facilities	<10 Emergency services	<10 Emergency services	<10 Emergency services
Utilities	<10	10	20
Transport links (excluding minor roads)	2 A roads, 3 B roads at 60 locations 2 Railway routes at 28 locations: Dunblane to Stirling Perth to Dunblane	2 A roads, 3 B roads at 109 locations 2 Railway routes at 48 locations: Dunblane to Stirling Perth to Dunblane	2 A roads, 3 B roads at 122 locations 2 Railway routes at 49 locations: Dunblane to Stirling Perth to Dunblane
Environmental designated areas (km^2)	0.2	0.2	0.2
Designated cultural heritage sites	4	5	5
Agricultural land (km^2)	0.9	1.2	1.5

Table 1: Summary of flooding impacts

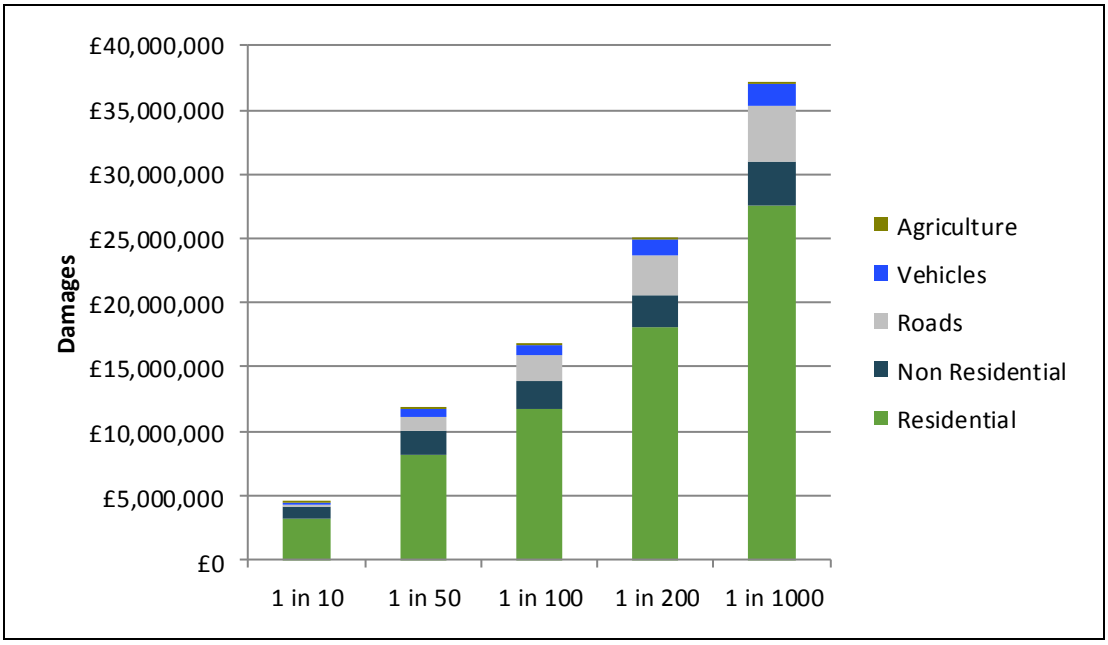


Figure 2: Damages by flood likelihood

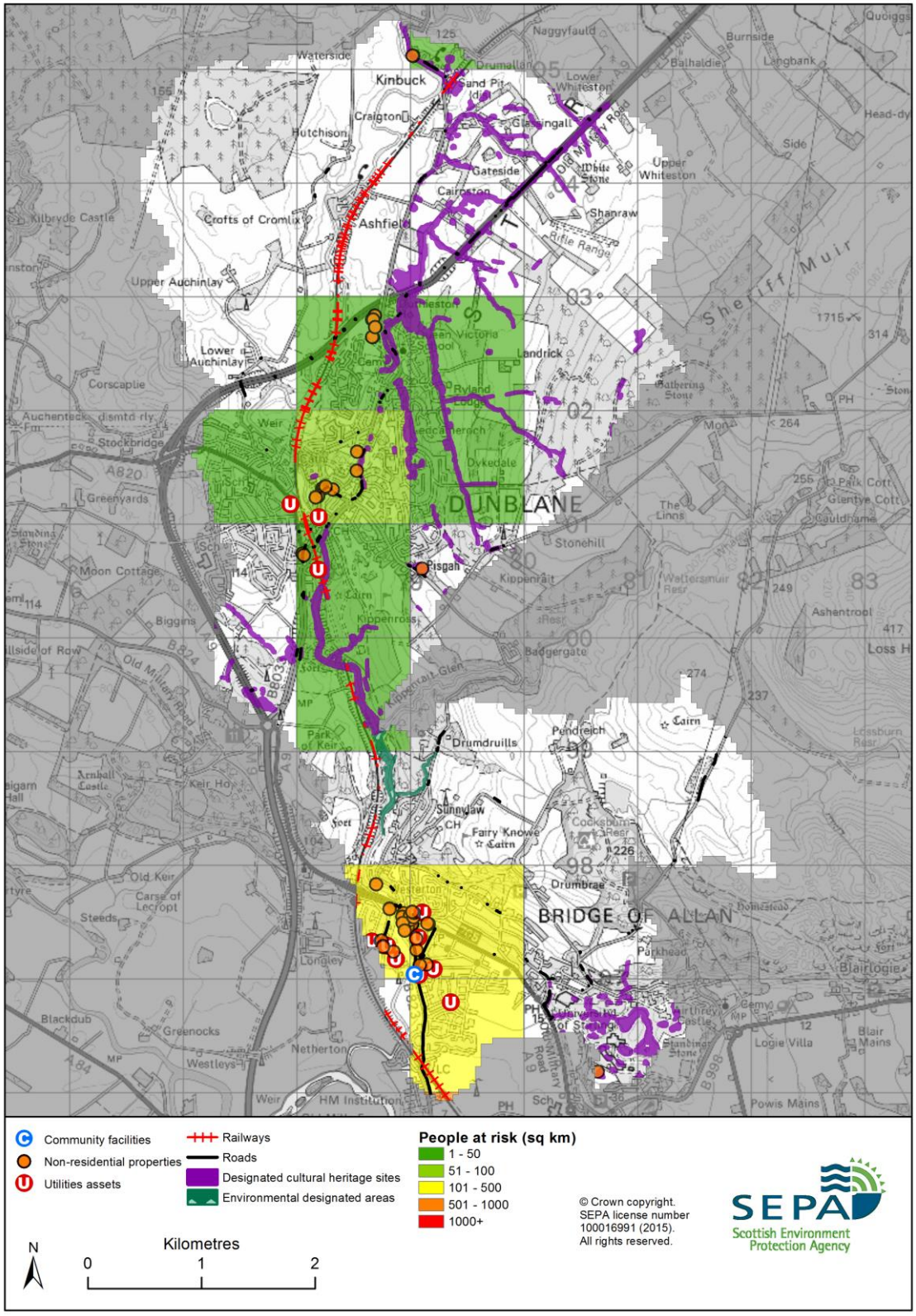


Figure 3: Impacts of flooding

History of flooding

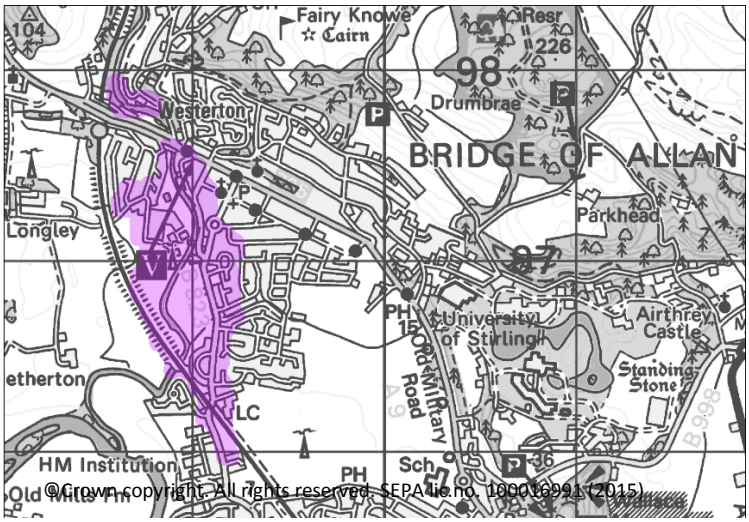
This area has a long history of flooding. The following significant floods have been recorded:

- 29 August 2012: Approximately 64mm of rain fell within two hours causing localised surface water flooding to 25 properties in Bridge of Allan (Abercrombie Drive, John Murray Drive, Anne Drive, Fountain Road and Upper Glen Road) and 10 properties in Dunblane (Newton Crescent, High Street and Glen Road). The railway was closed in Dunblane and part of Upper Glen Road was washed out in Bridge of Allan.
- 14 December 2006: Flooding of Allan Water and River Forth affected a number of properties at Millrow in Dunblane, Cornton Road in Bridge of Allan and Bridgehaugh. The highest river level recorded at the SEPA gauging station on the River Forth at Craigforth was 3.97m above normal levels.
- January 1993: Estimated 1 in 100 year flood in Bridge of Allan caused property flooding.
- 1 October 1985: Allan Water burst its banks in the Bridge of Allan affecting properties on Allanvale Road and Cornton Road.
- 1 January 1984: Estimated 1 in 34 year event caused flooding to properties in Bridge of Allan. As a result, the current flood defence on Allanvale Road was constructed.

Objectives to manage flooding in Potentially Vulnerable Area 09/03

Objectives provide a common goal and shared ambition for managing floods. These objectives have been set by SEPA and agreed with flood risk management authorities following consultation. They were identified through an assessment of the underlying evidence of the causes and impacts of flooding. Target areas have been set to focus actions; they do not necessarily correspond to areas at risk in SEPA's flood map. The objectives below have been set for Dunblane and Bridge of Allan Potentially Vulnerable Area.

Reduce economic damages to residential and non-residential properties in Bridge of Allan caused by flooding from the Allan Water

Indicators:	Target area:
• £240,000 Annual Average Damages from residential properties • £44,000 Annual Average Damages from non-residential properties	
Objective ID: 9007	

Target area	Objective	ID	Indicators within PVA
Dunblane	Reduce economic damages and number of residential properties at risk of surface water flooding in Dunblane where practical	9005	* See note below
Stirling and Bridge of Allan	Reduce economic damages and number of residential properties at risk of surface water flooding in Stirling and Bridge of Allan where practical	9016	* See note below
Applies across Forth Local Plan District	Avoid an overall increase in flood risk	9001	• 370 residential properties • £550,000 Annual Average Damages
Applies across Forth Local Plan District	Reduce overall flood risk	9032	• 370 residential properties • £550,000 Annual Average Damages
Applies across Forth Local Plan District	Organisations such as Scottish Water, energy companies and Historic Environment Scotland actively maintain and manage their own assets, including the risk of flooding. These actions are not detailed further in the Flood Risk Management Strategies.		

* This objective will be monitored using surface water flood risk across the Potentially Vulnerable Area. For 09/03 there are 70 residential properties at risk and Annual Average Damages of £210,000.

Actions to manage flooding in Potentially Vulnerable Area 09/03

Actions describe where and how flood risk will be managed. These actions have been set by SEPA and agreed with flood risk management authorities following consultation. Selection of actions to deliver the agreed objectives was based on a detailed assessment and comparison of economic, social and environmental criteria. The actions shaded and then described below have been selected as the most appropriate for Dunblane and Bridge of Allan Potentially Vulnerable Area.

Selected actions					
Flood protection scheme/works	*Natural flood management works*	*New flood warning*	*Community flood action groups*	*Property level protection scheme*	*Site protection plans*
Flood protection study	*Natural flood management study*	Maintain flood warning	Awareness raising	Surface water plan/study	Emergency plans/response
Maintain flood protection scheme	Strategic mapping and modelling	Flood forecasting	Self help	Maintenance	Planning policies

Action (ID):	**FLOOD PROTECTION SCHEME/WORKS** (90070006)		
Objective (ID):	Reduce economic damages to residential and non-residential properties in Bridge of Allan caused by flooding from the Allan Water (9007)		
Delivery lead:	Stirling Council		
Priority:	National:	Within local authority:	
	35 of 42	**1 of 3**	
Status:	**Under development**	Indicative delivery:	**2016-2027**
Description:	A flood protection scheme has been proposed for Bridge of Allan. The scheme would consist of flood embankments and sheet piling to protect properties from the 1 in 50 year event.		
Potential impacts			
Economic:	The proposed flood protection scheme has estimated damages avoided of £3.2 million and an estimated benefit cost ratio for temporary defences of 1.22; for permanent defences of 0.72 (based on 50 year flood).		
Social:	A reduction in flood risk would have a positive benefit to the health and wellbeing of the community. In addition there are one community facility, one emergency service and two utilities which have been identified as potentially benefitting from this action. There may be negative impacts through disturbance to the local community during the construction phase.		
Environmental:	Flood protection schemes can have both positive and negative impacts on the ecological quality of the environment depending on how they are designed. The proposed flood protection works are partially located on the Allan Water (water body ID 6832). The		

Environmental:	physical condition of this river is identified by SEPA to be at less than good status. Opportunities to improve the condition of the river should be considered by coordinating with river basin management planning. To be in accord with the FRM Strategy, the responsible authority (and where applicable, the licensing authority) should seek to ensure that the works will not have an adverse effect on the integrity of the Kipeenrait Glen Special Area of Conservation and River Teith Special Area of Conservation. Furthermore, a number of nationally and locally designated sites are present in the study area and could be positively or negatively impacted. These include conservation areas and listed buildings.

Action (ID):	**SURFACE WATER PLAN/STUDY** (90050018)		
Objective (ID):	Reduce economic damages and number of residential properties at risk of surface water flooding in Dunblane where practical (9005)		
Delivery lead:	Stirling Council		
Status:	**Ongoing**	Indicative delivery:	**2016-2021**
Description:	The area must be covered by a surface water management plan or plans that set objectives for the management of surface water flood risk and identify the most sustainable actions to achieve the objectives.		

Action (ID):	**SURFACE WATER PLAN/STUDY** (90160018)		
Objective (ID):	Reduce economic damages and number of residential properties at risk of surface water flooding in Stirling and Bridge of Allan where practical (9016)		
Delivery lead:	Stirling Council		
Status:	**Ongoing**	Indicative delivery:	**2016-2027**
Description:	The area must be covered by a surface water management plan or plans that set objectives for the management of surface water flood risk and identify the most sustainable actions to achieve the objectives.		

Action (ID):	**SURFACE WATER PLAN/STUDY** (90160019)		
Objective (ID):	Reduce economic damages and number of residential properties at risk of surface water flooding in Stirling and Bridge of Allan where practical (9016)		
Delivery lead:	Scottish Water in partnership with local authorities		
Status:	**Ongoing**	Indicative delivery:	**2016-2021**
Description:	An integrated catchment study will be carried out to support the surface water management plan process and improve knowledge and understanding of surface water flood risk and interactions with other sources of flooding e.g. with the sewer network, watercourses and the sea.		

Action (ID):	**STRATEGIC MAPPING AND MODELLING** (90320019)		
Objective (ID):	Reduce overall flood risk (9032)		
Delivery lead:	Scottish Water		
Status:	**Not started**	Indicative delivery:	**2016-2021**
Description:	Scottish Water will review the assessment of flood risk within the highest risk sewer catchments to improve knowledge and understanding of surface water flood risk.		

Action (ID):	**MAINTAIN FLOOD PROTECTION SCHEME** (90070017)		
Objective (ID):	Reduce economic damages to residential and non-residential properties in Bridge of Allan caused by flooding from the Allan Water (9007)		
Delivery lead:	Stirling Council		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Continue to maintain the existing flood protection scheme that protects Bridge of Allan. The Bridge of Allan Flood Protection Scheme consists of earth embankments, flood walls and other works.		

Action (ID):	**MAINTAIN FLOOD WARNING** (90320030)		
Objective (ID):	Reduce overall flood risk (9032)		
Delivery lead:	SEPA		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Continue to maintain the Dunblane and Bridge of Allan flood warning areas which cover the Allan Water and are part of the Stirling river flood warning scheme.		

Action (ID):	**FLOOD FORECASTING** (90320009)		
Objective (ID):	Reduce overall flood risk (9032)		
Delivery lead:	SEPA		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	The Scottish Flood Forecasting Service is a joint initiative between SEPA and the Met Office that produces daily, national flood guidance statements which are issued to Category 1 and 2 Responders. The service also provides information which allows SEPA to issue flood warnings, giving people a better chance of reducing the impact of flooding on their home or business. For more information please visit SEPA's website.		

Action (ID):	**SELF HELP** (90320011)		
Objective (ID):	Reduce overall flood risk (9032)		
Delivery lead:	—		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Everyone is responsible for protecting themselves and their property from flooding. Property and business owners can take simple steps to reduce damage and disruption to their homes and businesses should flooding happen. This includes preparing a flood plan and flood kit, installing property level protection, signing up to Floodline and Resilient Communities initiatives, and ensuring that properties and businesses are insured against flood damage.		

Action (ID):	**AWARENESS RAISING** (90320013)		
Objective (ID):	Reduce overall flood risk (9032)		
Delivery lead:	Responsible authorities		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	SEPA and the responsible authorities have a duty to raise public awareness of flood risk. Improved awareness of flood risk and actions that prepare individuals, homes and businesses for flooding can reduce the overall impact. From 2016 SEPA will undertake flood risk education and awareness raising activities. In addition, SEPA will engage with community resilience groups and participate in property level protection events delivered by the Scottish Flood Forum where possible. Local authorities will be undertaking additional awareness raising activities. Further details will be set out in the Local FRM Plan.		

Action (ID):	**MAINTENANCE** (90320007)		
Objective (ID):	Reduce overall flood risk (9032)		
Delivery lead:	Stirling Council, asset / land managers		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Local authorities have a duty to assess watercourses and carry out clearance and repair works where such works would substantially reduce flood risk. They produce schedules of clearance and repair works and make these available for public inspection. Scottish Water undertake inspection and repair on the public sewer network. Asset owners and riparian landowners are responsible for the maintenance and management of their own assets including those which help to reduce flood risk.		

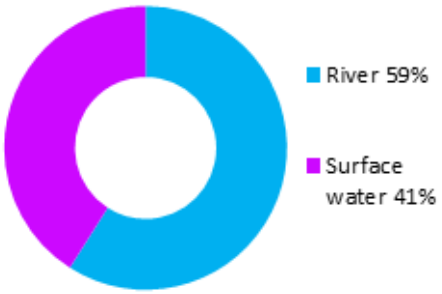
Action (ID):	**EMERGENCY PLANS/RESPONSE** (90320014)		
Objective (ID):	Reduce overall flood risk (9032)		
Delivery lead:	Category 1 and 2 Responders		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Providing an emergency response to flooding is the responsibility of many organisations, including local authorities, the emergency services and SEPA. Effective management of an emergency response relies on emergency plans that are prepared under the Civil Contingencies Act 2004 by Category 1 and 2 Responders. The emergency response by these organisations is co-ordinated through regional and local resilience partnerships. This response may be supported by the work of voluntary organisations.		

Action (ID):	**PLANNING POLICIES** (90010001)		
Objective (ID):	Avoid an overall increase in flood risk (9001) Reduce overall flood risk (9032)		
Delivery lead:	Planning authority		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Scottish Planning Policy and accompanying Planning Advice Notes set out Scottish Ministers' priorities for the operation of the planning system and for the development and use of land. In terms of flood risk management, the policy supports a catchment-scale approach to sustainable flood risk management and aims to build the resilience of our cities and towns, encourage sustainable land management in our rural areas, and to address the long-term vulnerability of parts of our coasts and islands. Under this approach, new development in areas with medium to high likelihood of flooding should be avoided. For further information on the application of national planning policies see Annex 2.		

Hillfoots Villages (Potentially Vulnerable Area 09/04)

Local Plan District	Local authority	Main catchment
Forth	Clackmannanshire Council, Stirling Council	River Devon

Summary of flooding impacts



At risk of flooding

- 720 residential properties
- 170 non-residential properties
- £1.6 million Annual Average Damages

(damages by flood source shown left)

Summary of objectives to manage flooding

Objectives have been set by SEPA and agreed with flood risk management authorities. These are the aims for managing local flood risk. The objectives have been grouped in three main ways: by reducing risk, avoiding increasing risk or accepting risk by maintaining current levels of management.

Many organisations, such as Scottish Water and energy companies, actively maintain and manage their own assets including their risk from flooding. Where known, these actions are described here. Scottish Natural Heritage and Historic Environment Scotland work with site owners to manage flooding where appropriate at designated environmental and/or cultural heritage sites. These actions are not detailed further in the Flood Risk Management Strategies.

Summary of actions to manage flooding

The actions below have been selected to manage flood risk.

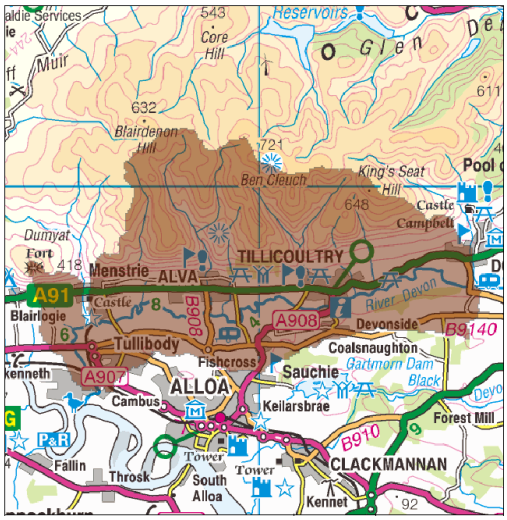
Flood protection scheme/works	*Natural flood management works*	*New flood warning*	Community flood action groups	*Property level protection scheme*	*Site protection plans*
Flood protection study	*Natural flood management study*	Maintain flood warning	Awareness raising	Surface water plan/study	Emergency plans/response
Maintain flood protection scheme	Strategic mapping and modelling	Flood forecasting	Self help	Maintenance	Planning policies

Hillfoots Villages (Potentially Vulnerable Area 09/04)

Local Plan District	Local authority	Main catchment
Forth	Clackmannanshire Council, Stirling Council	River Devon

Background

This Potentially Vulnerable Area is 61km^2 and is part of the Stirling catchment (shown below). This is a large, very steep catchment which covers the Hillfoots villages including Menstrie, Alva, Tullibody, Dollar and Tillicoultry. This catchment is considered particularly flashy and is at risk of flooding from many small burns, including the Menstrie Burn, Alva Burn and Tillicoultry Burn. There is also risk of flooding from the River Devon.



The area has a risk of river and surface water flooding. The majority of damages in this Potentially Vulnerable Area are caused by river flooding.

There are approximately 720 residential properties and 170 non-residential properties at risk of flooding. The Annual Average Damages are approximately £1.6 million.

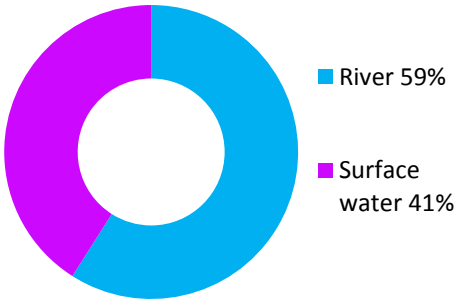


Figure 1: Annual Average Damages by flood source

Summary of flooding impacts

The risk of river flooding is greatest from the Tillicoultry Burn, the Menstrie Burn and the Alva Burn, as well as from the River Devon to Tillicoultry, Menstrie and Alva. The highest risk of surface water flooding is in Alva, Tillicoultry, Menstrie and Dollar.

The risk of flooding to people and property, as well as to community facilities, utilities, the transport network, designated sites and agricultural land is summarised in Table 1.

The damages associated with floods of different likelihood are shown in Figure 2. For this Potentially Vulnerable Area the highest damages are to residential properties followed by damages to non-residential properties. The transport network within this area is also known to be prone to flooding, notably the road links across the River

Devon to the Hillfoots Villages including the A91, which is a main route for Clackmannanshire. The location of the impacts of flooding is shown in Figure 3.

The figures presented for Annual Average Damages include damages to residential properties, non-residential properties, transport and agriculture.

	1 in 10 High likelihood	1 in 200 Medium likelihood	1 in 1000 Low likelihood
Residential properties (total 11,000)	140	720	860
Non-residential properties (total 790)	30	170	220
People	310	1,600	1,900
Community facilities	0	<10 Educational buildings	<10 Educational buildings
Utilities	<10	40	40
Transport links (excluding minor roads)	3 A roads, 3 B roads at 63 locations	3 A roads, 3 B roads at 100 locations	3 A roads, 3 B roads at 133 locations
Environmental designated areas (km^2)	0.1	0.1	0.1
Designated cultural heritage sites	6	6	6
Agricultural land (km^2)	3.4	4.8	5.5

Table 1: Summary of flooding impacts

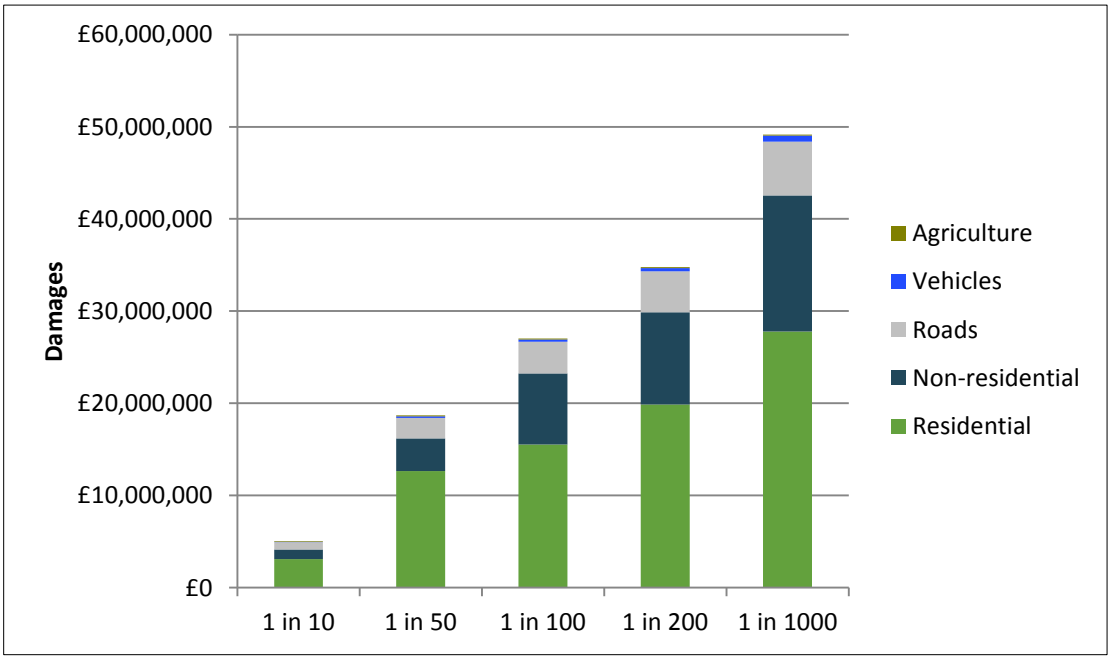


Figure 2: Damages by flood likelihood

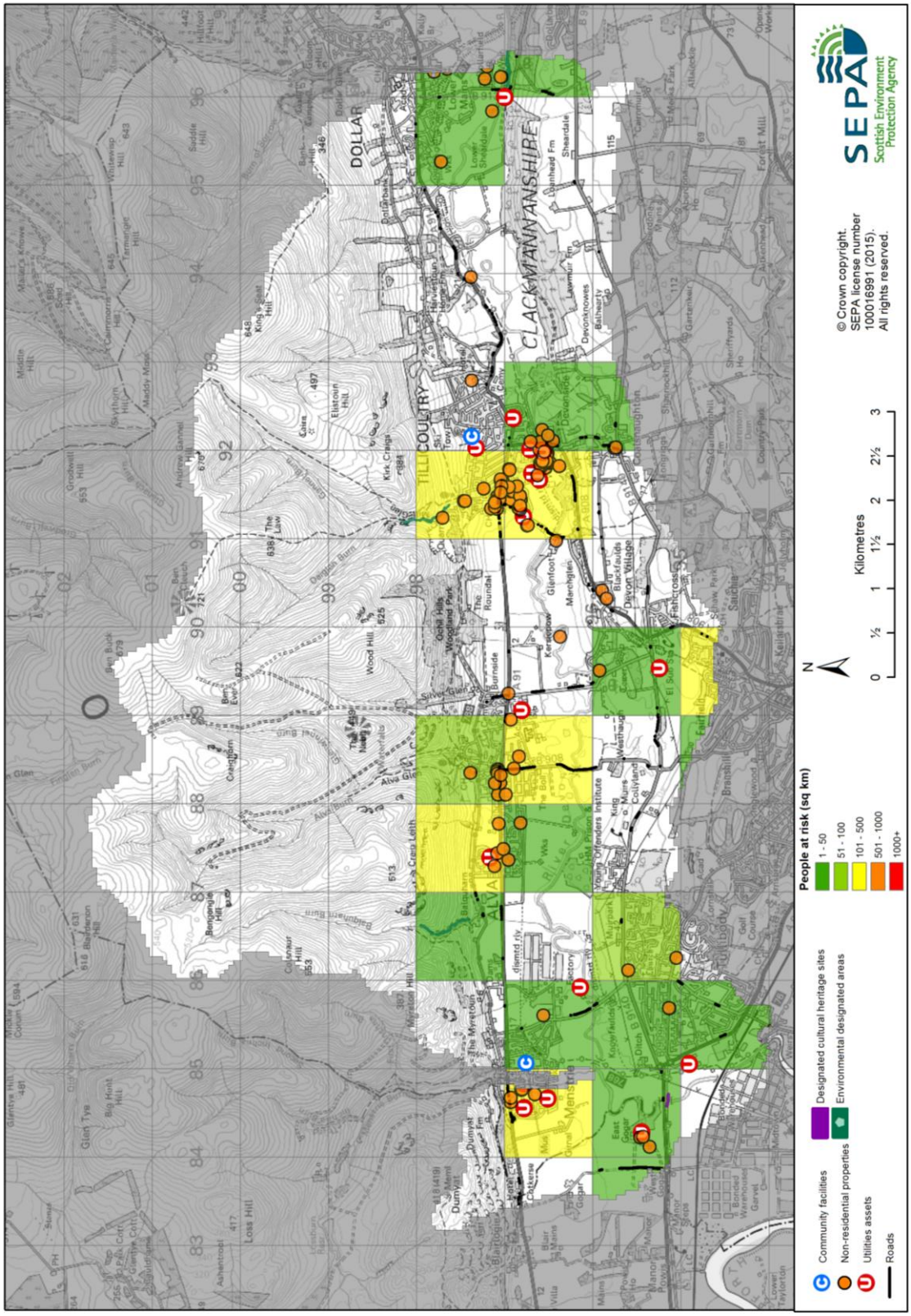


Figure 3: Impacts of flooding

History of flooding

There is a long history of flooding in this area. The following significant floods have been recorded in this area:

- 29 August 2012: Menstrie Burn flooding affected approximately 20 properties, and necessitated the evacuation of Menstrie House care home and the closing of the A91 road.
- 21 August 2012: Surface water flooding affected approximately 15 properties in Dollar on Princes Crescent, Tarmangie Drive, The Ness and White Wisp Gardens.
- 6 August 2012: Very heavy rainfall caused a large surface water flood in Dollar. Approximately 20 properties were directly affected on Princes Crescent, Tarmangie Drive, The Ness and White Wisp Gardens in Dollar.
- 20 January 2011: All of the main access roads to/from Tillicoultry were closed due to flooding from the River Devon.
- 28 September 2009: Menstrie Burn flooding caused seven homes to be evacuated in Ochil Road.
- 25 January 2008: River Devon burst its banks after 182mm of rain fell in just three days. Four commercial properties and 15 residential properties were flooded on Elistoun Drive and surrounding roads.
- 9 August 2004: 30-40 properties around Burnside Road, Menstrie were affected by flooding from the Menstrie Burn. This flooding was exacerbated by tree debris and the failure of a metal bridge in Menstrie.
- 28 August 1877: Heavy overnight rainfall resulted in the overtopping of both the Quarrel Burn and River Devon leading to the death of two people in Tillicoultry. Much of the town was inundated with flood waters and multiple bridges and homes were washed away. There was extensive damage to property in Dollar. Alloa railway station and Alloa Brewery were submerged.
- 10 October 1845: Flooding from the Black Devon resulted in the death of one person.
- 1785: Flooding of River Devon caused the bridge over the River Devon to collapse at Racks Mill, Dollar.

Objectives to manage flooding in Potentially Vulnerable Area 09/04

Objectives provide a common goal and shared ambition for managing floods. These objectives have been set by SEPA and agreed with flood risk management authorities following consultation. They were identified through an assessment of the underlying evidence of the causes and impacts of flooding. Target areas have been set to focus actions; they do not necessarily correspond to areas at risk in SEPA's flood map. The objectives below have been set for the Hillfoots Villages Potentially Vulnerable Area.

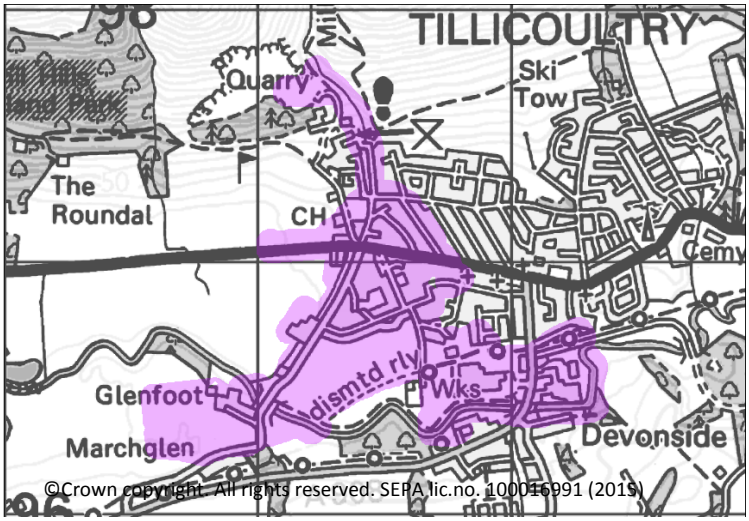
Reduce economic damages to residential and non-residential properties in Tillicoultry caused by flooding from the River Devon and Tillicoultry Burn

Indicators:

- £320,000 Annual Average Damages from residential properties
- £170,000 Annual Average Damages from non-residential properties

Objective ID: 9010

Target area:



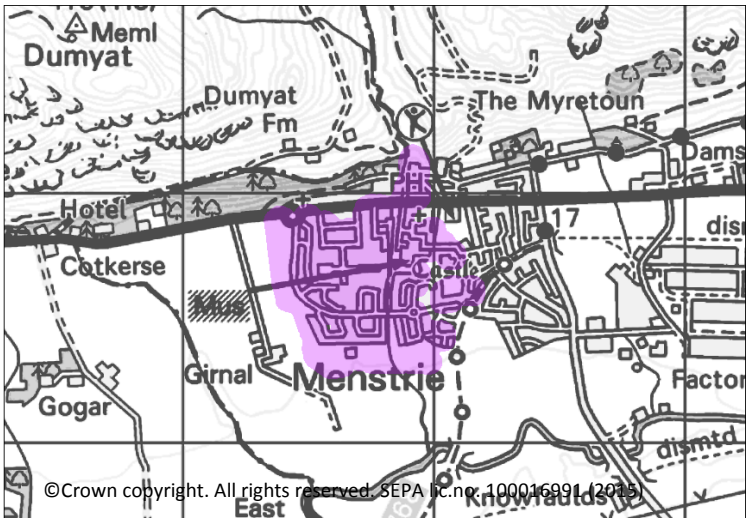
Reduce economic damages to residential and non-residential properties, flood risk to community facilities and risk to people in Menstrie caused by flooding from the Menstrie Burn

Indicators:

- 330 people
- £210,000 Annual Average Damages from residential properties
- £20,000 Annual Average Damages from non-residential properties
- One educational building

Objective ID: 9011, 9013

Target area:



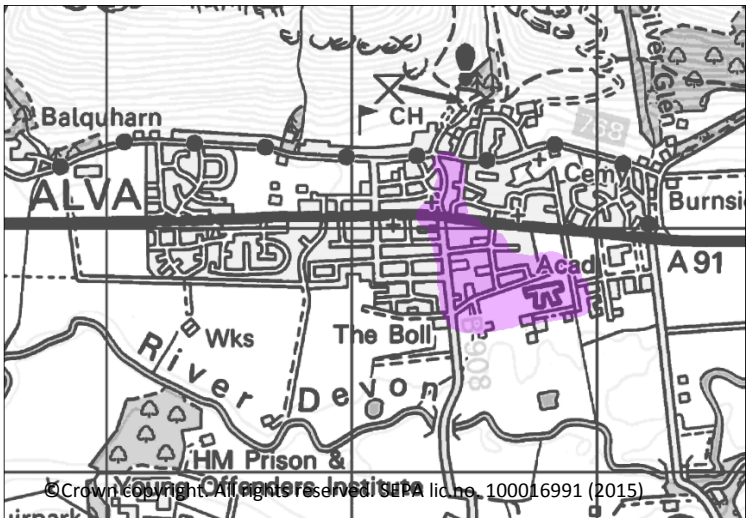
Reduce economic damages to residential and non-residential properties in Alva caused by flooding from the River Devon, Alva Burn and unnamed burns

Indicators:

- £31,000 Annual Average Damages from residential properties
- £4,900 Annual Average Damages from non-residential properties

Objective ID: 9012

Target area:



Target area	Objective	ID	Indicators within PVA
Dollar	Reduce economic damages and number of residential properties at risk of surface water flooding in Dollar where practical	9008	* See note below
Alloa, Alva, Menstrie, Tillicoultry, Coalsnaughton and Devonside	Reduce economic damages and number of residential properties at risk of surface water flooding in Alloa, Alva, Menstrie, Tillicoultry, Coalsnaughton and Devonside where practical	9026	* See note below
Applies across Forth Local Plan District	Avoid an overall increase in flood risk	9001	• 720 residential properties • £1.6 million Annual Average Damages
Applies across Forth Local Plan District	Reduce overall flood risk	9032	• 720 residential properties • £1.6 million Annual Average Damages
Applies across Forth Local Plan District	Organisations such as Scottish Water, energy companies and Historic Environment Scotland actively maintain and manage their own assets, including the risk of flooding. These actions are not detailed further in the Flood Risk Management Strategies.		

* This objective will be monitored using surface water flood risk across the Potentially Vulnerable Area. For 09/04 there are 270 residential properties at risk and Annual Average Damages of £640,000.

Actions to manage flooding in Potentially Vulnerable Area 09/04

Actions describe where and how flood risk will be managed. These actions have been set by SEPA and agreed with flood risk management authorities following consultation. Selection of actions to deliver the agreed objectives was based on a detailed assessment and comparison of economic, social and environmental criteria. The actions shaded and then described below have been selected as the most appropriate for the Hillfoots Villages Potentially Vulnerable Area.

Selected actions					
Flood protection scheme/works	*Natural flood management works*	*New flood warning*	Community flood action groups	*Property level protection scheme*	*Site protection plans*
Flood protection study	*Natural flood management study*	Maintain flood warning	Awareness raising	Surface water plan/study	Emergency plans/response
Maintain flood protection scheme	Strategic mapping and modelling	Flood forecasting	Self help	Maintenance	Planning policies

Action (ID):	**FLOOD PROTECTION STUDY** (90100005)		
Objective (ID):	Reduce economic damages to residential and non-residential properties in Tillicoultry caused by flooding from the River Devon and Tillicoultry Burn (9010)		
Delivery lead:	Clackmannanshire Council		
Priority:	National:	Within local authority:	
	21 of 168	**1 of 2**	
Status:	**Not started**	Indicative delivery:	**2016-2021**
Description:	A flood protection study has been recommended for Tillicoultry to assess whether flood storage, direct flood defences, and sediment management could reduce flood risk. The study should also investigate the viability of property level protection. The study should take a catchment approach and consider the potential benefits and disbenefits and interaction between actions upstream and downstream.		
Potential impacts			
Economic:	The study could benefit 319 residential properties and 95 non-residential properties at risk of flooding in this location, with potential damages avoided of up to £13 million.		
Social:	Social impacts will depend on the outcome of the study and recommended actions. A reduction in flood risk would have a positive benefit to the health and wellbeing of the community. In addition the study could benefit four utilities and two roads located within the study area.		
Environmental:	Flood protection studies should consider the positive and negative impacts of proposed actions on the ecological quality of the environment and designated sites. Where possible opportunities to		

Environmental:	enhance and restore the environment should be sought, for example through natural flood management. Conservation areas and listed buildings are also present in the study area and could be positively or negatively impacted.

Action (ID):	**FLOOD PROTECTION STUDY** (90110005)		
Objective (ID):	Reduce economic damages to residential and non-residential properties, flood risk to community facilities and risk to people in Menstrie caused by flooding from the Menstrie Burn (9011, 9013)		
Delivery lead:	Clackmannanshire Council		
Priority:	National:		Within local authority:
	61 of 168		**2 of 2**
Status:	**Ongoing**	Indicative delivery:	**2016-2021**
Description:	A flood protection / natural flood management study should be carried out for Menstrie. Initial study has been completed following a flood event on 29 August 2012. Most of the short-term and maintenance-related matters identified in the study have been addressed. Further information about rainfall and gauge data for the catchment is being gathered to inform further modelling and consequent economic appraisal of possible direct defences. The natural flood management component should build on existing natural flood management works, but look at the wider catchment area and should examine run off control and sediment management. Further assessment should also be undertaken to assess the potential benefits of a property level protection scheme in Menstrie. Due to very short flood warning times, automatic property level protection would be recommended. The study might lead to implementation of actions at later stages of the flood risk management cycle, subject to availability of funding.		
Potential impacts			
Economic:	The study could benefit 149 residential properties and 10 non-residential properties at risk of flooding in this location, with potential damages avoided of up to £5.8 million. Thirty-five of these residential and non-residential properties are at risk from high likelihood events and may benefit from natural flood management actions.		
Social:	Social impacts will depend on the outcome of the study and recommended actions. A reduction in flood risk would have a positive benefit to the health and wellbeing of the community and socially vulnerable people located within the flood protection study area. In addition one community facility is located within the study area and could benefit from potential actions. Natural flood management actions can restore and enhance natural environments and create opportunities for recreation and tourism.		
Environmental:	Flood protection studies should consider the positive and negative impacts of proposed actions on the ecological quality of the environment and designated sites. Where possible opportunities to enhance and restore the environment should be sought, for example through natural flood management. Listed buildings and ancient woodlands are also present in the study area and could be positively or negatively impacted.		

Action (ID):	**SURFACE WATER PLAN/STUDY** (90080018)		
Objective (ID):	Reduce economic damages and number of residential properties at risk of surface water flooding in Dollar where practical (9008)		
Delivery lead:	Clackmannanshire Council		
Status:	**Not started**	Indicative delivery:	**2016-2021**
Description:	The area must be covered by a surface water management plan or plans that set objectives for the management of surface water flood risk and identify the most sustainable actions to achieve the objectives.		

Action (ID):	**SURFACE WATER PLAN/STUDY** (90260018)		
Objective (ID):	Reduce economic damages and number of residential properties at risk of surface water flooding in Alloa, Alva, Menstrie, Tillicoultry, Coalsnaughton and Devonside where practical (9026)		
Delivery lead:	Clackmannanshire Council		
Status:	**Not started**	Indicative delivery:	**2016-2027**
Description:	The area must be covered by a surface water management plan or plans that set objectives for the management of surface water flood risk and identify the most sustainable actions to achieve the objectives.		

Action (ID):	**SURFACE WATER PLAN/STUDY** (90260019)		
Objective (ID):	Reduce economic damages and number of residential properties at risk of surface water flooding in Alloa, Alva, Menstrie, Tillicoultry, Coalsnaughton and Devonside where practical (9026)		
Delivery lead:	Scottish Water in partnership with local authorities		
Status:	**Ongoing**	Indicative delivery:	**2016-2021**
Description:	An integrated catchment study will be carried out to support the surface water management plan process and improve knowledge and understanding of surface water flood risk and interactions with other sources of flooding e.g. with the sewer network, watercourses and the sea.		

Action (ID):	**STRATEGIC MAPPING AND MODELLING** (90320019)		
Objective (ID):	Reduce overall flood risk (9032)		
Delivery lead:	Scottish Water		
Status:	**Not started**	Indicative delivery:	**2016-2021**
Description:	Scottish Water will review the assessment of flood risk within the highest risk sewer catchments to improve knowledge and understanding of surface water flood risk.		

Action (ID):	**MAINTAIN FLOOD PROTECTION SCHEME** (90100017)		
Objective (ID):	Reduce economic damages to residential and non-residential properties in Tillicoultry caused by flooding from the River Devon and Tillicoultry Burn (9010)		
Delivery lead:	Clackmannanshire Council		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Continue to maintain the existing formal flood defences along the River Devon.		

Action (ID):	**MAINTAIN FLOOD WARNING** (90320030)		
Objective (ID):	Reduce overall flood risk (9032)		
Delivery lead:	SEPA		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Continue to maintain the Rackmill Dollar, Sterling Mills Tillicoultry, Glenfoot Bridge at Marchglen, River Devon at Alva, River Devon at Cambus Weir and the Menstrie Industrial Site flood warning areas which are part of the Devon river flood warning scheme.		

Action (ID):	**FLOOD FORECASTING** (90320009)		
Objective (ID):	Reduce overall flood risk (9032)		
Delivery lead:	SEPA		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	The Scottish Flood Forecasting Service is a joint initiative between SEPA and the Met Office that produces daily, national flood guidance statements which are issued to Category 1 and 2 Responders. The service also provides information which allows SEPA to issue flood warnings, giving people a better chance of reducing the impact of flooding on their home or business. For more information please visit SEPA's website.		

Action (ID):	**COMMUNITY FLOOD ACTION GROUPS** (90100012)		
Objective (ID):	Reduce economic damages to residential and non-residential properties in Tillicoultry caused by flooding from the River Devon and Tillicoultry Burn (9010)		
Delivery lead:	Community		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Tillicoultry Flood Action Group operates in this area. The group aims to increase community resilience to flooding.		

Action (ID):	**COMMUNITY FLOOD ACTION GROUPS** (90110012)		
Objective (ID):	Reduce economic damages to residential and non-residential properties, flood risk to community facilities and risk to people in Menstrie caused by flooding from the Menstrie Burn (9011, 9013)		
Delivery lead:	Community		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Menstrie (The Charrier) Flood Action Group operates in this area. The groups aim to increase community resilience to flooding.		

Action (ID):	**COMMUNITY FLOOD ACTION GROUPS** (90120012)		
Objective (ID):	Reduce economic damages to residential and non-residential properties in Alva caused by flooding from the River Devon, Alva Burn and unnamed burns (9012)		
Delivery lead:	Community		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Alva (Cochrane Crescent/ Grodwell Drive) Community Flood Action Group operates in this area.		

Action (ID):	**SELF HELP** (90320011)		
Objective (ID):	Reduce overall flood risk (9032)		
Delivery lead:	—		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Everyone is responsible for protecting themselves and their property from flooding. Property and business owners can take simple steps to reduce damage and disruption to their homes and businesses should flooding happen. This includes preparing a flood plan and flood kit, installing property level protection, signing up to Floodline and Resilient Communities initiatives, and ensuring that properties and businesses are insured against flood damage.		

Action (ID):	**AWARENESS RAISING** (90320013)		
Objective (ID):	Reduce overall flood risk (9032)		
Delivery lead:	Responsible authorities		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	SEPA and the responsible authorities have a duty to raise public awareness of flood risk. Improved awareness of flood risk and actions that prepare individuals, homes and businesses for flooding can reduce the overall impact. From 2016 SEPA will engage with the community through local participation in national initiatives, including partnership working with Neighbourhood Watch Scotland. In addition, SEPA will engage with local authorities and community resilience groups where possible. Local authorities will be undertaking additional awareness raising activities. Further details will be set out in the Local FRM Plan.		

Action (ID):	**MAINTENANCE** (90320007)		
Objective (ID):	Reduce overall flood risk (9032)		
Delivery lead:	Local authorities, asset / land managers		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Local authorities have a duty to assess watercourses and carry out clearance and repair works where such works would substantially reduce flood risk. They produce schedules of clearance and repair works and make these available for public inspection. Scottish Water undertake inspection and repair on the public sewer network. Asset owners and riparian landowners are responsible for the maintenance and management of their own assets including those which help to reduce flood risk.		

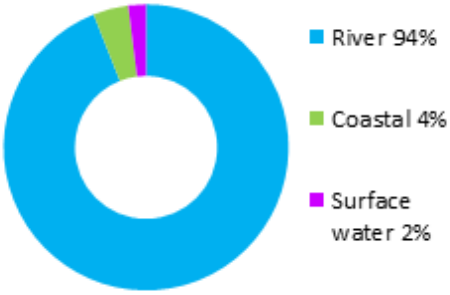
Action (ID):	**EMERGENCY PLANS/RESPONSE** (90320014)		
Objective (ID):	Reduce overall flood risk (9032)		
Delivery lead:	Category 1 and 2 Responders		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Providing an emergency response to flooding is the responsibility of many organisations, including local authorities, the emergency services and SEPA. Effective management of an emergency response relies on emergency plans that are prepared under the Civil Contingencies Act 2004 by Category 1 and 2 Responders. The emergency response by these organisations is co-ordinated through regional and local resilience partnerships. This response may be supported by the work of voluntary organisations.		

Action (ID):	**PLANNING POLICIES** (90010001)		
Objective (ID):	Avoid an overall increase in flood risk (9001) Reduce overall flood risk (9032)		
Delivery lead:	Planning authority		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Scottish Planning Policy and accompanying Planning Advice Notes set out Scottish Ministers' priorities for the operation of the planning system and for the development and use of land. In terms of flood risk management, the policy supports a catchment-scale approach to sustainable flood risk management and aims to build the resilience of our cities and towns, encourage sustainable land management in our rural areas, and to address the long-term vulnerability of parts of our coasts and islands. Under this approach, new development in areas with medium to high likelihood of flooding should be avoided. For further information on the application of national planning policies see Annex 2.		

Stirling (Cornton and Causewayhead) (Potentially Vulnerable Area 09/05)

Local Plan District	Local authority	Main catchment
Forth	Clackmannanshire Council, Stirling Council	River Forth

Summary of flooding impacts



At risk of flooding

- 340 residential properties
- 50 non-residential properties
- £390,000 Annual Average Damages

(damages by flood source shown left)

Summary of objectives to manage flooding

Objectives have been set by SEPA and agreed with flood risk management authorities. These are the aims for managing local flood risk. The objectives have been grouped in three main ways: by reducing risk, avoiding increasing risk or accepting risk by maintaining current levels of management.

Many organisations, such as Scottish Water and energy companies, actively maintain and manage their own assets including their risk from flooding. Where known, these actions are described here. Scottish Natural Heritage and Historic Environment Scotland work with site owners to manage flooding where appropriate at designated environmental and/or cultural heritage sites. These actions are not detailed further in the Flood Risk Management Strategies.

Summary of actions to manage flooding

The actions below have been selected to manage flood risk.

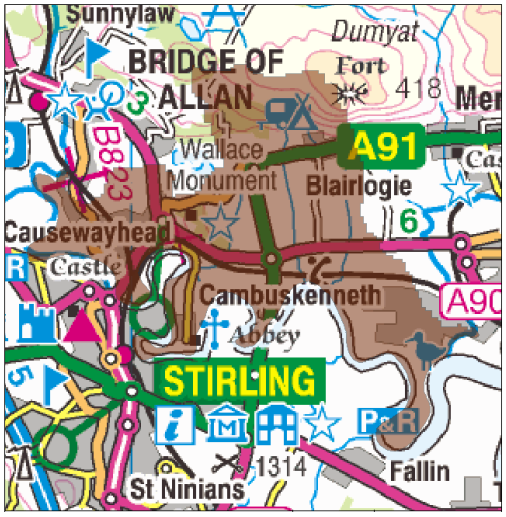
Flood protection scheme/works	*Natural flood management works*	*New flood warning*	*Community flood action groups*	*Property level protection scheme*	*Site protection plans*
Flood protection study	*Natural flood management study*	Maintain flood warning	Awareness raising	*Surface water plan/study*	Emergency plans/response
Maintain flood protection scheme	Strategic mapping and modelling	Flood forecasting	Self help	Maintenance	Planning policies

Stirling (Cornton and Causewayhead), (Potentially Vulnerable Area 09/05)

Local Plan District	Local authority	Main Catchment
Forth	Clackmannanshire Council, Stirling Council	River Forth

Background

This Potentially Vulnerable Area is 15km^2 and part of the Stirling catchment (shown below). It includes the north bank of the lower River Forth where it meets the Firth of Forth and includes the urban areas of Cornton and Causewayhead. Other watercourses in the area include the Logie Burn and the Powis Burn which are small tributaries of the River Forth.



The interaction between river and coastal flooding where the River Forth meets the Firth of Forth is an important factor in flooding in the north of Stirling.

The area has a risk of river, coastal and surface water flooding. The majority of damages in this Potentially Vulnerable Area are caused by river flooding.

There are approximately 340 residential properties and 50 non-residential properties at risk of flooding. The Annual Average Damages from flooding are approximately £390,000.

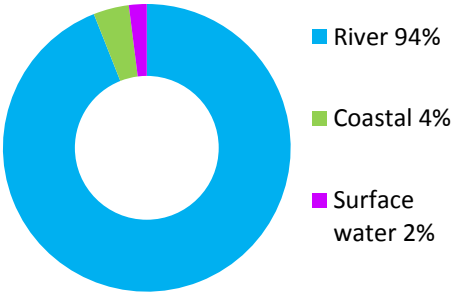


Figure 1: Annual Average Damages by flood source

Summary of flooding impacts

The highest risk of river flooding is from the River Forth and Allan Water to Cornton and Causewayhead.

The risk of flooding to people, property, as well as to community facilities, utilities, the transport network, designated sites and agricultural land is summarised in Table 1.

The damages associated with floods of different likelihood are shown in Figure 2. For this Potentially Vulnerable Area the highest damages are to residential properties followed by damages to non-residential properties. The transport network (including the A84, A907 and the main railway route) is also notably impacted. The location of the impacts of flooding is shown in Figure 3.

The figures presented for Annual Average Damages include damages to residential properties, non-residential properties, transport and agriculture.

	1 in 10 High likelihood	1 in 200 Medium likelihood	1 in 1000 Low likelihood
Residential properties (total 2,600)	<10	340	1,400
Non-residential properties (total 500)	<10	50	310
People	20	740	3,100
Community facilities	0	0	<10 Public services
Utilities	0	<10	20
Transport links (excluding minor roads)	3 A roads, 2 B roads at 18 locations 1 Railway route at 3 locations: Dunblane to Stirling	3 A roads, 2 B roads at 53 locations 1 Railway route at 13 locations: Dunblane to Stirling	3 A roads, 2 B roads at 77 locations 1 Railway route at 16 locations: Dunblane to Stirling
Environmental designated areas (km^2)	0.1	0.1	0.1
Designated cultural heritage sites	6	7	7
Agricultural land (km^2)	1.9	2.9	3.9

Table 1: Summary of flooding impacts

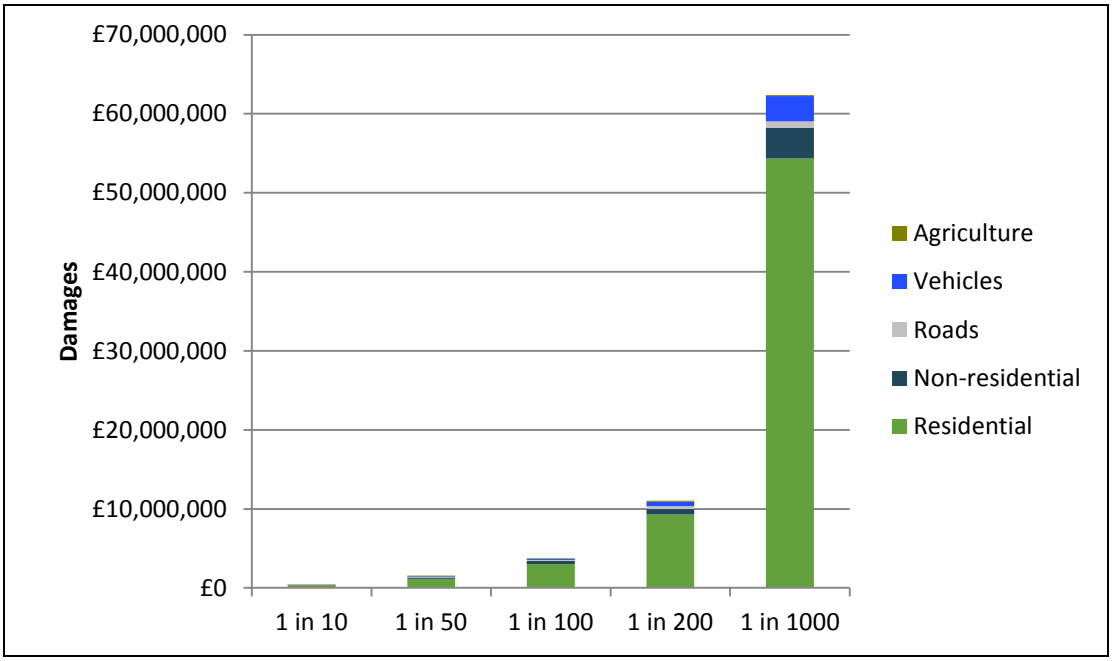


Figure 2: Damages by flood likelihood

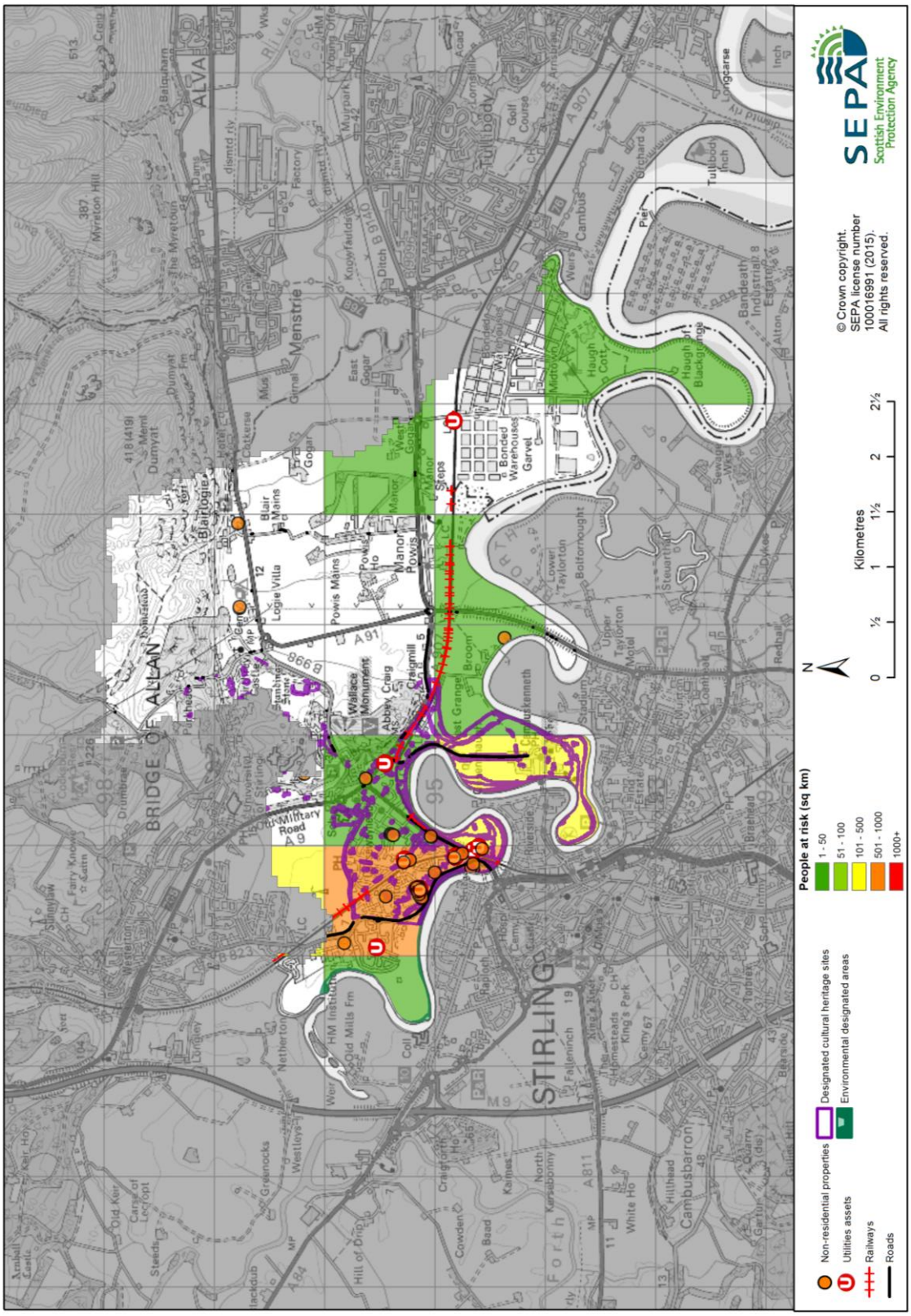


Figure 3: Impacts of flooding

History of flooding

The following significant floods have been recorded in this area:

- 14 December 2006: High levels on the River Allan and River Forth caused significant flooding throughout the area with properties and infrastructure affected in Stirling (Riverside, Bridgehaugh and Cornton), Bridge of Allan and Dunblane. The highest river level recorded at the SEPA gauging station on the River Forth at Craigforth was 3.97m above normal levels.
- 10 January 2005: High levels on the River Allan and River Forth caused flooding throughout the area. Properties and infrastructure were affected in Stirling (Riverside, Bridgehaugh and Cornton). This event was not as damaging as in December 2006.
- 1908: Significant flooding in Stirling area (Riverside and Bridgehaugh).

Objectives to manage flooding in Potentially Vulnerable Area 09/05

Objectives provide a common goal and shared ambition for managing floods. These objectives have been set by SEPA and agreed with flood risk management authorities following consultation. They were identified through an assessment of the underlying evidence of the causes and impacts of flooding. Target areas have been set to focus actions; they do not necessarily correspond to areas at risk in SEPA's flood map. The objectives below have been set for Stirling (Cornton and Causewayhead) Potentially Vulnerable Area.

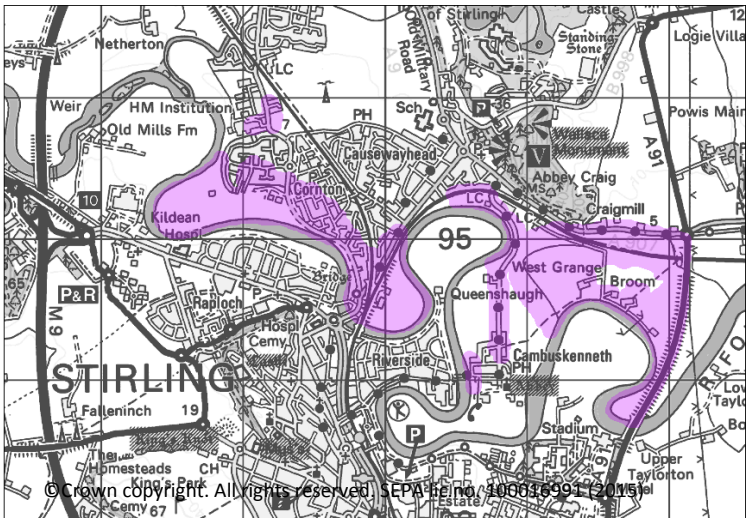
Reduce economic damages to residential and non-residential properties and risk to people in Stirling caused by flooding from the River Forth

Indicators:

- 710 people
- £300,000 Annual Average Damages from residential properties
- £19,000 Annual Average Damages from non-residential properties

Objective ID: 9014, 9015

Target area:



Target area	Objective	ID	Indicators within PVA
Applies across Forth Local Plan District	Avoid an overall increase in flood risk	9001	• 340 residential properties • £390,000 Annual Average Damages
Applies across Forth Local Plan District	Reduce overall flood risk	9032	• 340 residential properties • £390,000 Annual Average Damages
Applies across Forth Local Plan District	Organisations such as Scottish Water, energy companies and Historic Environment Scotland actively maintain and manage their own assets, including the risk of flooding. These actions are not detailed further in the Flood Risk Management Strategies.		

Actions to manage flooding in Potentially Vulnerable Area 09/05

Actions describe where and how flood risk will be managed. These actions have been set by SEPA and agreed with flood risk management authorities following consultation. Selection of actions to deliver the agreed objectives was based on a detailed assessment and comparison of economic, social and environmental criteria. The actions shaded and then described below have been selected as the most appropriate for Stirling (Cornton and Causewayhead) Potentially Vulnerable Area.

Selected actions					
Flood protection scheme/works	*Natural flood management works*	*New flood warning*	*Community flood action groups*	*Property level protection scheme*	*Site protection plans*
Flood protection study	*Natural flood management study*	Maintain flood warning	Awareness raising	*Surface water plan/study*	Emergency plans/response
Maintain flood protection scheme	Strategic mapping and modelling	Flood forecasting	Self help	Maintenance	Planning policies

Action (ID):	**FLOOD PROTECTION SCHEME/WORKS** (90140006)		
Objective (ID):	Reduce economic damages to residential and non-residential properties and risk to people in Stirling caused by flooding from the River Forth (9014, 9015)		
Delivery lead:	Stirling Council		
Priority:	National:	Within local authority:	
	40 of 42	**2 of 3**	
Status:	**Under development**	Indicative delivery:	**2016-2021**
Description:	A flood protection scheme has been proposed for Stirling. The scheme would consist of flood embankments and would provide a 1 in 200 year standard of protection. The scheme has a low benefit to cost ratio, but has been identified as the only option for Stirling. Part of this proposed flood protection scheme is located in PVA 09/07. The benefits and impacts have been assessed for the whole scheme.		
Potential impacts			
Economic:	The proposed scheme has estimated damages avoided of £17.7 million and an estimated benefit cost ratio of 0.69 (Riverside); 0.57 (Raploch); 0.39 (Cornton, Causewayhead); 0.03 (North Cornton).		
Social:	A reduction in flood risk would have a positive benefit to the health and wellbeing of the community and socially vulnerable people located within the flood protection scheme area. In addition there are three utilities and one railway line which have been identified as potentially benefitting from this action. There may be negative impacts through disturbance to the local community during the construction phase.		

Environmental:	Flood protection studies should consider the positive and negative impacts of proposed actions on the ecological quality of the environment. The proposed flood protection study is located on the Upper Forth Estuary (water body ID 200437). The physical condition of this stretch of estuary is identified by SEPA to be at less than good status. Future works could improve the condition of the estuary or degrade it. Opportunities to improve the condition of the estuary should be considered by coordinating with river basin management planning. To be in accord with the FRM Strategy, the responsible authority (and where applicable, the licensing authority) should seek to ensure that the works will not have an adverse effect on the integrity of the River Teith Special Area of Conservation and Firth of Forth Special Protection Area. In addition, a number of nationally and locally designated sites are also present in the study area and could be positively or negatively impacted. These include conservation areas, scheduled monuments and battlefields.

Action (ID):	**STRATEGIC MAPPING AND MODELLING** (90320016)		
Objective (ID):	Reduce overall flood risk (9032)		
Delivery lead:	SEPA		
Status:	**Not started**	Indicative delivery:	**2016-2021**
Description:	SEPA will seek to develop flood mapping in the Dunbar to Stirling area to improve understanding of coastal flood risk. The extent and timing of improvements will depend on detailed scoping and data availability. Where this work coincides with local authority studies, SEPA will work collaboratively to ensure consistent modelling approaches are applied.		

Action (ID):	**STRATEGIC MAPPING AND MODELLING** (90320019)		
Objective (ID):	Reduce overall flood risk (9032)		
Delivery lead:	Scottish Water		
Status:	**Not started**	Indicative delivery:	**2016-2021**
Description:	Scottish Water will review the assessment of flood risk within the highest risk sewer catchments to improve knowledge and understanding of surface water flood risk.		

Action (ID):	**MAINTAIN FLOOD WARNING** (90320030)		
Objective (ID):	Reduce overall flood risk (9032)		
Delivery lead:	SEPA		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Continue to maintain the Bridgehaugh, Cornton and Riverside and Cambuskenneth, flood warning areas which cover the River Forth and are part of the Stirling river flood warning scheme.		

Action (ID):	**FLOOD FORECASTING** (90320009)		
Objective (ID):	Reduce overall flood risk (9032)		
Delivery lead:	SEPA		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	The Scottish Flood Forecasting Service is a joint initiative between SEPA and the Met Office that produces daily, national flood guidance statements which are issued to Category 1 and 2 Responders. The service also provides information which allows SEPA to issue flood warnings, giving people a better chance of reducing the impact of flooding on their home or business. For more information please visit SEPA's website.		

Action (ID):	**SELF HELP** (90320011)		
Objective (ID):	Reduce overall flood risk (9032)		
Delivery lead:	—		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Everyone is responsible for protecting themselves and their property from flooding. Property and business owners can take simple steps to reduce damage and disruption to their homes and businesses should flooding happen. This includes preparing a flood plan and flood kit, installing property level protection, signing up to Floodline and Resilient Communities initiatives, and ensuring that properties and businesses are insured against flood damage.		

Action (ID):	**AWARENESS RAISING** (90320013)		
Objective (ID):	Reduce overall flood risk (9032)		
Delivery lead:	Responsible authorities		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	SEPA and the responsible authorities have a duty to raise public awareness of flood risk. Improved awareness of flood risk and actions that prepare individuals, homes and businesses for flooding can reduce the overall impact. From 2016 SEPA will undertake flood risk education and awareness raising activities. In addition, SEPA will engage with community resilience groups and participate in property level protection events delivered by the Scottish Flood Forum where possible. Local authorities will be undertaking additional awareness raising activities. Further details will be set out in the Local FRM Plan.		

Action (ID):	**MAINTENANCE** (90320007)		
Objective (ID):	Reduce overall flood risk (9032)		
Delivery lead:	Local authorities, asset / land managers		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Local authorities have a duty to assess watercourses and carry out clearance and repair works where such works would substantially reduce flood risk. They produce schedules of clearance and repair works and make these available for public inspection. Scottish Water undertake inspection and repair on the public sewer network. Asset owners and riparian landowners are responsible for the maintenance and management of their own assets including those which help to reduce flood risk.		

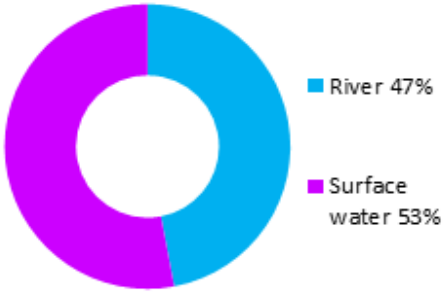
Action (ID):	**EMERGENCY PLANS/RESPONSE** (90320014)		
Objective (ID):	Reduce overall flood risk (9032)		
Delivery lead:	Category 1 and 2 Responders		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Providing an emergency response to flooding is the responsibility of many organisations, including local authorities, the emergency services and SEPA. Effective management of an emergency response relies on emergency plans that are prepared under the Civil Contingencies Act 2004 by Category 1 and 2 Responders. The emergency response by these organisations is co-ordinated through regional and local resilience partnerships. This response may be supported by the work of voluntary organisations.		

Action (ID):	**PLANNING POLICIES** (90010001)		
Objective (ID):	Avoid an overall increase in flood risk (9001) Reduce overall flood risk (9032)		
Delivery lead:	Planning authority		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Scottish Planning Policy and accompanying Planning Advice Notes set out Scottish Ministers' priorities for the operation of the planning system and for the development and use of land. In terms of flood risk management, the policy supports a catchment-scale approach to sustainable flood risk management and aims to build the resilience of our cities and towns, encourage sustainable land management in our rural areas, and to address the long-term vulnerability of parts of our coasts and islands. Under this approach, new development in areas with medium to high likelihood of flooding should be avoided. For further information on the application of national planning policies see Annex 2.		

Gargunnock (Potentially Vulnerable Area 09/06)

Local Plan District	Local authority	Main catchment
Forth	Stirling Council	River Forth

Summary of flooding impacts



At risk of flooding

- 80 residential properties
- 30 non-residential properties
- £590,000 Annual Average Damages

(damages by flood source shown left)

Summary of objectives to manage flooding

Objectives have been set by SEPA and agreed with flood risk management authorities. These are the aims for managing local flood risk. The objectives have been grouped in three main ways: by reducing risk, avoiding increasing risk or accepting risk by maintaining current levels of management.

Many organisations, such as Scottish Water and energy companies, actively maintain and manage their own assets including their risk from flooding. Where known, these actions are described here. Scottish Natural Heritage and Historic Environment Scotland work with site owners to manage flooding where appropriate at designated environmental and/or cultural heritage sites. These actions are not detailed further in the Flood Risk Management Strategies.

Summary of actions to manage flooding

The actions below have been selected to manage flood risk.

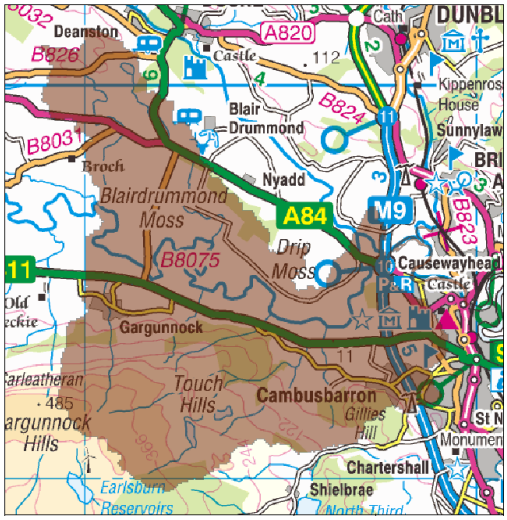
Flood protection scheme/works	*Natural flood management works*	*New flood warning*	*Community flood action groups*	*Property level protection scheme*	*Site protection plans*
Flood protection study	*Natural flood management study*	Maintain flood warning	Awareness raising	Surface water plan/study	Emergency plans/response
Maintain flood protection scheme	Strategic mapping and modelling	Flood forecasting	Self help	Maintenance	Planning policies

Gargunnock (Potentially Vulnerable Area 09/06)

Local Plan District	Local authority	Main catchment
Forth	Stirling Council	River Forth

Background

This Potentially Vulnerable Area is 63km^2 and is part of the River Forth catchment (shown below).It is a steep, rural catchment to the west of Stirling and contains the urban areas of Gargunnock and Cambusbarron. It extends from Deanston in the north to the Touch Hills in the south. The main watercourses are the River Forth and the Gargunnock Burn.



The area has a risk of river and surface water flooding. The highest risk of river flooding is from the Gargunnock Burn to Gargunnock. The highest risk of surface water flooding is also to Gargunnock and Cambusbarron.

There are approximately 80 residential properties and 30 non-residential properties at risk of flooding. The Annual Average Damages from flooding are approximately £590,000.

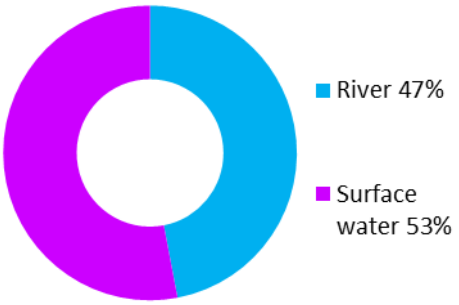


Figure 1: Annual Average Damages by flood source

Summary of flooding impacts

The risk of flooding to people, property, as well as to community facilities, utilities, the transport network, designated sites and agricultural land is summarised in Table 1.

The damages associated with floods of different likelihood are shown in Figure 2. For this Potentially Vulnerable Area the highest damages are to roads followed by damages to residential properties. The location of the impacts of flooding is shown in Figure 3.

The figures presented for Annual Average Damages include damages to residential properties, non-residential properties, transport and agriculture.

	1 in 10 High likelihood	1 in 200 Medium likelihood	1 in 1000 Low likelihood
Residential properties (total 2,700)	20	80	110
Non-residential properties (total 360)	<10	30	60
People	40	170	240
Community facilities	0	0	0
Utilities	<10	<10	<10
Transport links (excluding minor roads)	1 M road (M9), 4 A roads, 3 B roads at 46 locations	1 M road (M9), 4 A roads, 3 B roads at 63 locations	1 M road (M9), 4 A roads, 3 B roads at 74 locations
Environmental designated areas (km^2)	0.6	0.6	0.6
Designated cultural heritage sites	11	15	16
Agricultural land (km^2)	6.9	11.5	6.4

Table 1: Summary of flooding impacts

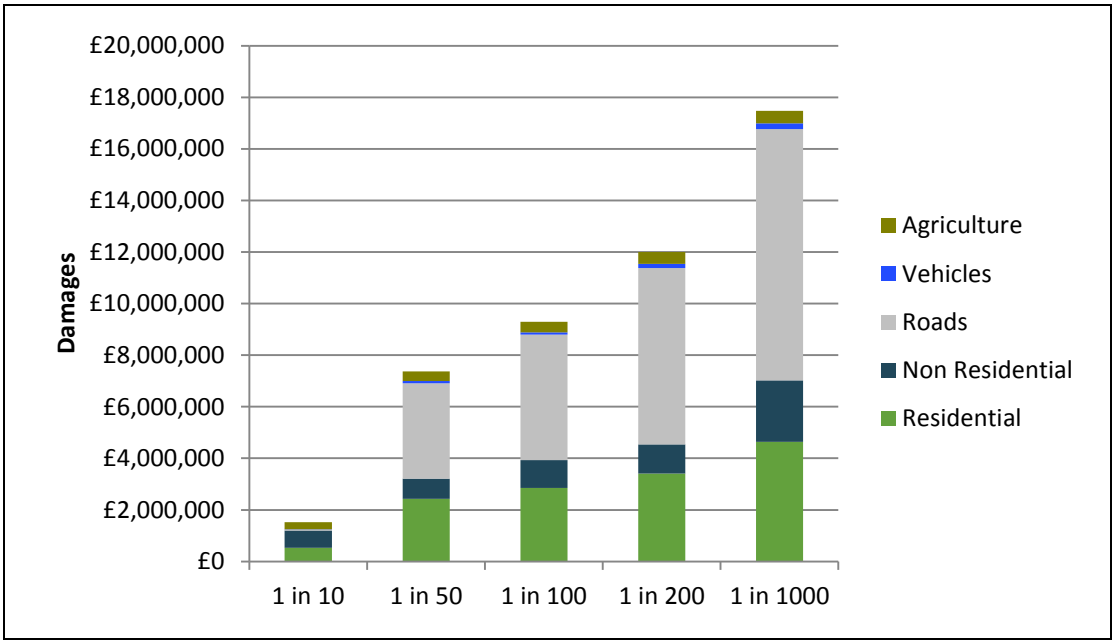


Figure 2: Damages by flood likelihood

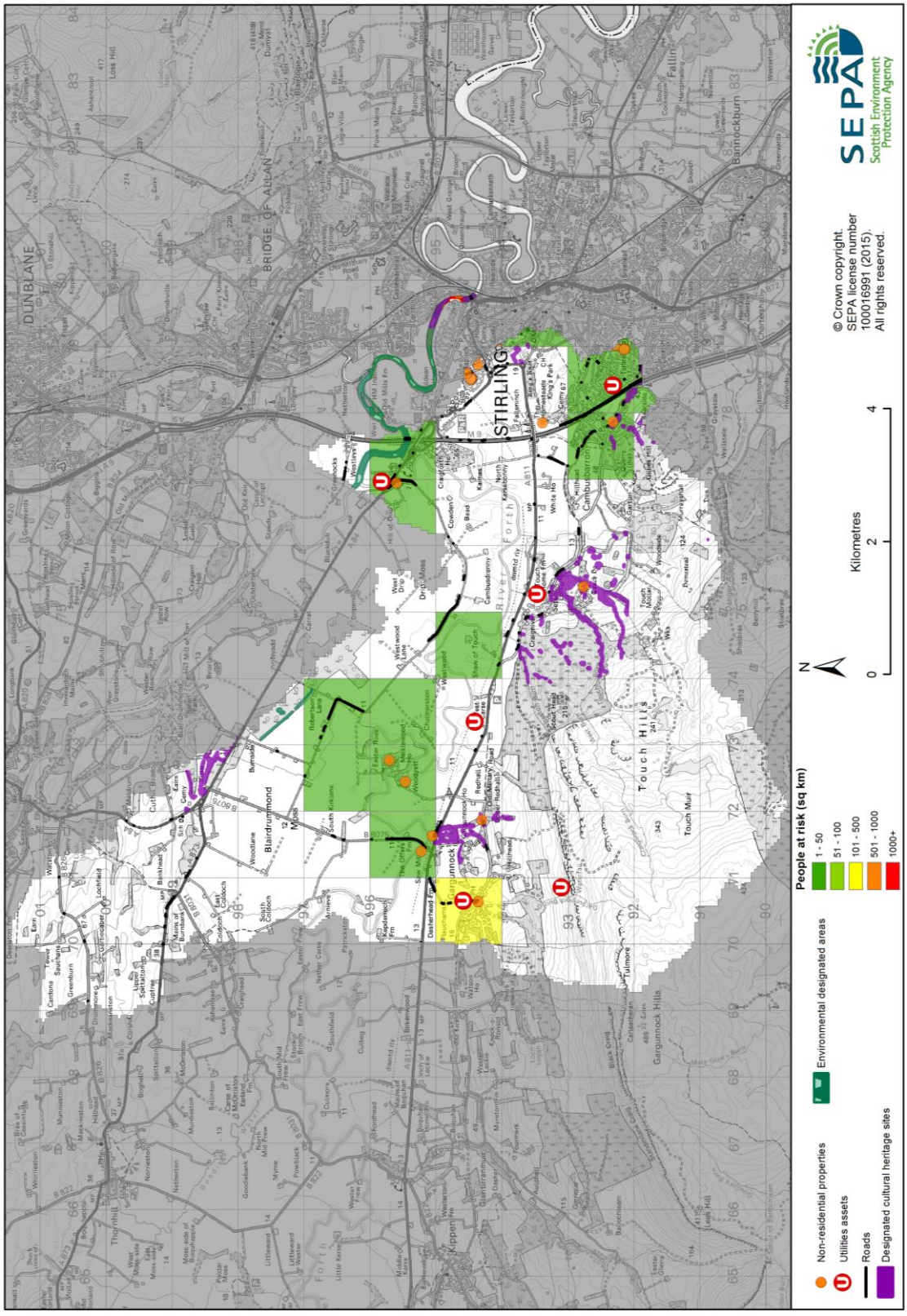


Figure 3: Impacts of flooding

History of flooding

One significant flood has been recorded in this area. In December 2006, flooding from the River Forth affected large areas of the carse, including a number of rural residential properties.

Objectives to manage flooding in Potentially Vulnerable Area 09/06

Objectives provide a common goal and shared ambition for managing floods. These objectives have been set by SEPA and agreed with flood risk management authorities following consultation. They were identified through an assessment of the underlying evidence of the causes and impacts of flooding. Target areas have been set to focus actions; they do not necessarily correspond to areas at risk in SEPA's flood map. The objectives below have been set for Gargunnock Potentially Vulnerable Area.

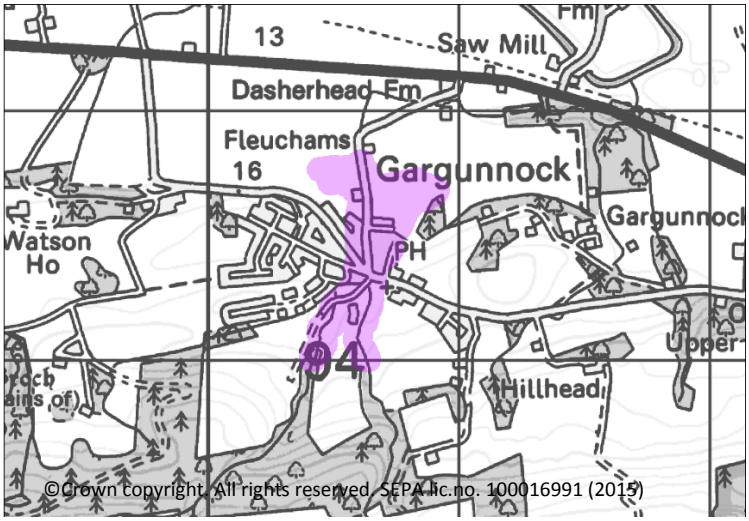
Reduce economic damages to residential and non-residential properties in Gargunnock caused by flooding from the Gargunnock Burn

Indicators:

- £100,000 Annual Average Damages from residential properties
- £670 Annual Average Damages from non-residential properties

Objective ID: 9018

Target area:



Target area	Objective	ID	Indicators within PVA
Stirling and Bridge of Allan	Reduce economic damages and number of residential properties at risk of surface water flooding in Stirling and Bridge of Allan where practical	9016	* See note below
Applies across Forth Local Plan District	Avoid an overall increase in flood risk	9001	• 80 residential properties • £590,000 Annual Average Damages
Applies across Forth Local Plan District	Reduce overall flood risk	9032	• 80 residential properties • £590,000 Annual Average Damages
Applies across Forth Local Plan District	Organisations such as Scottish Water, energy companies and Historic Environment Scotland actively maintain and manage their own assets, including the risk of flooding. These actions are not detailed further in the Flood Risk Management Strategies.		

* This objective will be monitored using surface water flood risk across the Potentially Vulnerable Area. For 09/06 there are 30 residential properties at risk and Annual Average Damages of £320,000.

Actions to manage flooding in Potentially Vulnerable Area 09/06

Actions describe where and how flood risk will be managed. These actions have been set by SEPA and agreed with flood risk management authorities following consultation. Selection of actions to deliver the agreed objectives was based on a detailed assessment and comparison of economic, social and environmental criteria. The actions shaded and then described below have been selected as the most appropriate for Gargunnock Potentially Vulnerable Area.

Selected actions					
Flood protection scheme/works	*Natural flood management works*	*New flood warning*	*Community flood action groups*	*Property level protection scheme*	*Site protection plans*
Flood protection study	*Natural flood management study*	Maintain flood warning	Awareness raising	Surface water plan/study	Emergency plans/response
Maintain flood protection scheme	Strategic mapping and modelling	Flood forecasting	Self help	Maintenance	Planning policies

Action (ID):	**FLOOD PROTECTION STUDY** (90180005)		
Objective (ID):	Reduce economic damages to residential and non-residential properties in Gargunnock caused by flooding from the Gargunnock Burn (9018)		
Delivery lead:	Stirling Council		
Priority:	National:	Within local authority:	
	118 of 168	**2 of 2**	
Status:	**Not started**	Indicative delivery:	**2016-2021**
Description:	A flood protection study has been recommended to assess the level of flood risk in Gargunnock. The area has been identified at risk of flooding by SEPA but no flooding issues were previously identified by Stirling Council. The watercourse should be resurveyed and the model updated in collaboration between SEPA and Stirling Council.		
Potential impacts			
Economic:	The study could benefit 49 residential properties and one non-residential property at risk of flooding in this location, with potential damages avoided of up to £3.5 million.		
Social:	Social impacts will depend on the outcome of the study and recommended actions. A reduction in flood risk would have a positive benefit to the health and wellbeing of the community. In addition, one utility is located within the study area and could benefit from any potential actions.		
Environmental:	Flood protection studies should consider the positive and negative impacts of proposed actions on the ecological quality of the environment and designated sites. Where possible opportunities to enhance and restore the environment should be sought, for example through natural flood management.		

Action (ID):	**SURFACE WATER PLAN/STUDY** (90160018)		
Objective (ID):	Reduce economic damages and number of residential properties at risk of surface water flooding in Stirling and Bridge of Allan where practical (9016)		
Delivery lead:	Stirling Council		
Status:	**Ongoing**	Indicative delivery:	**2016-2027**
Description:	The area must be covered by a surface water management plan or plans that set objectives for the management of surface water flood risk and identify the most sustainable actions to achieve the objectives.		

Action (ID):	**SURFACE WATER PLAN/STUDY** (90160019)		
Objective (ID):	Reduce economic damages and number of residential properties at risk of surface water flooding in Stirling and Bridge of Allan where practical (9016)		
Delivery lead:	Scottish Water in partnership with local authorities		
Status:	**Ongoing**	Indicative delivery:	**2016-2027**
Description:	An integrated catchment study will be carried out to support the surface water management plan process and improve knowledge and understanding of surface water flood risk and interactions with other sources of flooding e.g. with the sewer network, watercourses and the sea.		

Action (ID):	**STRATEGIC MAPPING AND MODELLING** (90320019)		
Objective (ID):	Reduce overall flood risk (9032)		
Delivery lead:	Scottish Water		
Status:	**Not started**	Indicative delivery:	**2016-2021**
Description:	Scottish Water will review the assessment of flood risk within the highest risk sewer catchments to improve knowledge and understanding of surface water flood risk.		

Action (ID):	**MAINTAIN FLOOD WARNING** (90320030)		
Objective (ID):	Reduce overall flood risk (9032)		
Delivery lead:	SEPA		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Continue to maintain the Callander to Stirling flood warning area which covers the River Teith to the confluence with the River Forth and the Bridgehaugh, Cornton and Raploch flood warning areas which cover the River Forth, all of which are part of the Stirling river flood warning scheme.		

Action (ID):	**FLOOD FORECASTING** (90320009)		
Objective (ID):	Reduce overall flood risk (9032)		
Delivery lead:	SEPA		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	The Scottish Flood Forecasting Service is a joint initiative between SEPA and the Met Office that produces daily, national flood guidance statements which are issued to Category 1 and 2 Responders. The service also provides information which allows SEPA to issue flood warnings, giving people a better chance of reducing the impact of flooding on their home or business. For more information please visit SEPA's website.		

Action (ID):	**SELF HELP** (90320011)		
Objective (ID):	Reduce overall flood risk (9032)		
Delivery lead:	—		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Everyone is responsible for protecting themselves and their property from flooding. Property and business owners can take simple steps to reduce damage and disruption to their homes and businesses should flooding happen. This includes preparing a flood plan and flood kit, installing property level protection, signing up to Floodline and Resilient Communities initiatives, and ensuring that properties and businesses are insured against flood damage.		

Action (ID):	**AWARENESS RAISING** (90320013)		
Objective (ID):	Reduce overall flood risk (9032)		
Delivery lead:	Responsible authorities		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	SEPA and the responsible authorities have a duty to raise public awareness of flood risk. Improved awareness of flood risk and actions that prepare individuals, homes and businesses for flooding can reduce the overall impact. SEPA will undertake flood risk education and awareness raising activities. In addition, SEPA will engage with community resilience groups and participate in property level protection events delivered by the Scottish Flood Forum where possible. Local authorities will be undertaking additional awareness raising activities. Further details will be set out in the Local FRM Plan.		

Action (ID):	**MAINTENANCE** (90320007)		
Objective (ID):	Reduce overall flood risk (9032)		
Delivery lead:	Stirling Council, asset / land managers		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Local authorities have a duty to assess watercourses and carry out clearance and repair works where such works would substantially reduce flood risk. They produce schedules of clearance and repair works and make these available for public inspection. Scottish Water undertake inspection and repair on the public sewer network. Asset owners and riparian landowners are responsible for the maintenance and management of their own assets including those which help to reduce flood risk.		

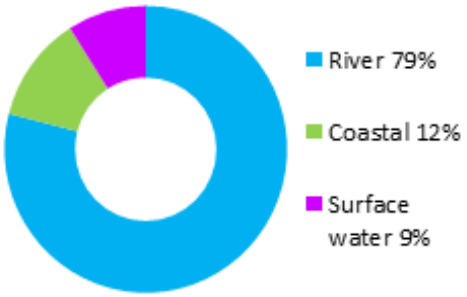
Action (ID):	**EMERGENCY PLANS/RESPONSE** (90320014)		
Objective (ID):	Reduce overall flood risk (9032)		
Delivery lead:	Category 1 and 2 Responders		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Providing an emergency response to flooding is the responsibility of many organisations, including local authorities, the emergency services and SEPA. Effective management of an emergency response relies on emergency plans that are prepared under the Civil Contingencies Act 2004 by Category 1 and 2 Responders. The emergency response by these organisations is co-ordinated through regional and local resilience partnerships. This response may be supported by the work of voluntary organisations.		

Action (ID):	**PLANNING POLICIES** (90010001)		
Objective (ID):	Avoid an overall increase in flood risk (9001) Reduce overall flood risk (9032)		
Delivery lead:	Planning authority		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Scottish Planning Policy and accompanying Planning Advice Notes set out Scottish Ministers' priorities for the operation of the planning system and for the development and use of land. In terms of flood risk management, the policy supports a catchment-scale approach to sustainable flood risk management and aims to build the resilience of our cities and towns, encourage sustainable land management in our rural areas, and to address the long-term vulnerability of parts of our coasts and islands. Under this approach, new development in areas with medium to high likelihood of flooding should be avoided. For further information on the application of national planning policies see Annex 2.		

Stirling (Raploch and Riverside) (Potentially Vulnerable Area 09/07)

Local Plan District	Local authority	Main catchment
Forth	Stirling Council	Stirling coastal

Summary of flooding impacts



At risk of flooding

- 730 residential properties
- 80 non-residential properties
- £850,000 Annual Average Damages

(damages by flood source shown left)

Summary of objectives to manage flooding

Objectives have been set by SEPA and agreed with flood risk management authorities. These are the aims for managing local flood risk. The objectives have been grouped in three main ways: by reducing risk, avoiding increasing risk or accepting risk by maintaining current levels of management.

Many organisations, such as Scottish Water and energy companies, actively maintain and manage their own assets including their risk from flooding. Where known, these actions are described here. Scottish Natural Heritage and Historic Environment Scotland work with site owners to manage flooding where appropriate at designated environmental and/or cultural heritage sites. These actions are not detailed further in the Flood Risk Management Strategies.

Summary of actions to manage flooding

The actions below have been selected to manage flood risk.

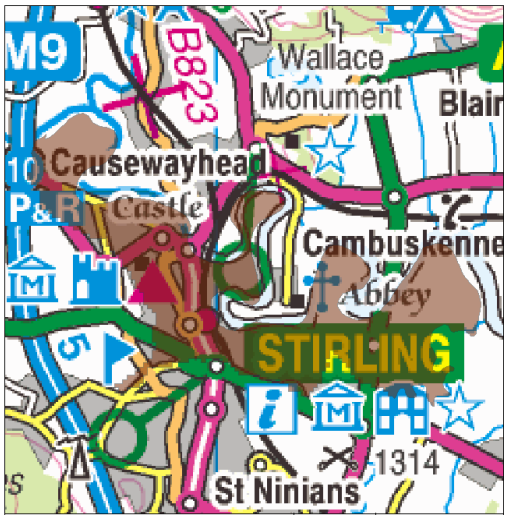
Flood protection scheme/works	*Natural flood management works*	*New flood warning*	*Community flood action groups*	*Property level protection scheme*	*Site protection plans*
Flood protection study	*Natural flood management study*	Maintain flood warning	Awareness raising	Surface water plan/study	Emergency plans/response
Maintain flood protection scheme	Strategic mapping and modelling	Flood forecasting	Self help	Maintenance	Planning policies

Stirling (Raploch and Riverside) (Potentially Vulnerable Area 09/07)

Local Plan District	Local authority	Main catchment
Forth	Stirling Council	Stirling coastal

Background

This Potentially Vulnerable Area is 6km^2 and is part of the Stirling catchment (shown below). The area covers the south bank of the lower River Forth where it meets the Firth of Forth and includes the urban areas of Riverside and Raploch. The interaction between river and coastal flooding where the River Forth meets the Firth of Forth is an important factor in the south of Stirling.



The majority of damages in this Potentially Vulnerable Area are caused by river flooding.

There are approximately 730 residential properties and 80 non-residential properties at risk of flooding. The Annual Average Damages are approximately £850,000.

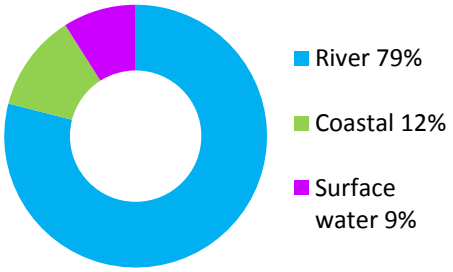


Figure 1: Annual Average Damages by flood source

Summary of flooding impacts

The highest risk of river flooding is from the River Forth to Stirling. The highest risk of surface water flooding is also in Stirling.

The risk of flooding to people, property, as well as to community facilities, utilities, the transport network, designated sites and agricultural land is summarised in Table 1.

The damages associated with floods of different likelihood are shown in Figure 2. For this Potentially Vulnerable Area the highest damages are to residential properties followed by damages to vehicles and roads. The location of the impacts of flooding is shown in Figure 3.

The figures presented for Annual Average Damages include damages to residential properties, non-residential properties, transport and agriculture.

	1 in 10 High likelihood	1 in 200 Medium likelihood	1 in 1000 Low likelihood
Residential properties (total 4,400)	60	730	1,000
Non-residential properties (total 1,600)	10	80	120
People	130	1,600	2,200
Community facilities	0	0	<10 Educational buildings
Utilities	0	<10	20
Transport links (excluding minor roads)	3 A roads, 1 B road at 13 locations 1 Railway route at 1 location: Dunblane to Stirling	3 A roads, 1 B road at 23 locations 1 Railway route at 1 location: Dunblane to Stirling	3 A roads, 1 B road at 33 locations 1 Railway route at 5 locations: Dunblane to Stirling
Environmental designated areas (km^2)	0.1	0.1	0.1
Designated cultural heritage sites	4	4	5
Agricultural land (km^2)	0.9	1.4	1.8

Table 1: Summary of flooding impacts

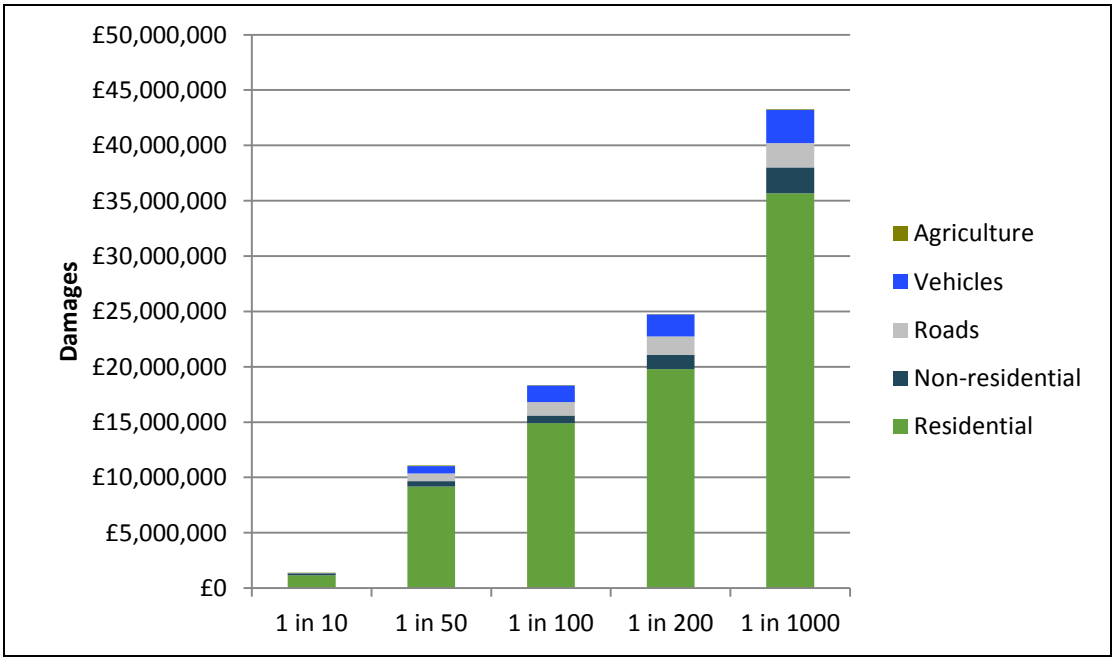


Figure 2: Damages by flood likelihood

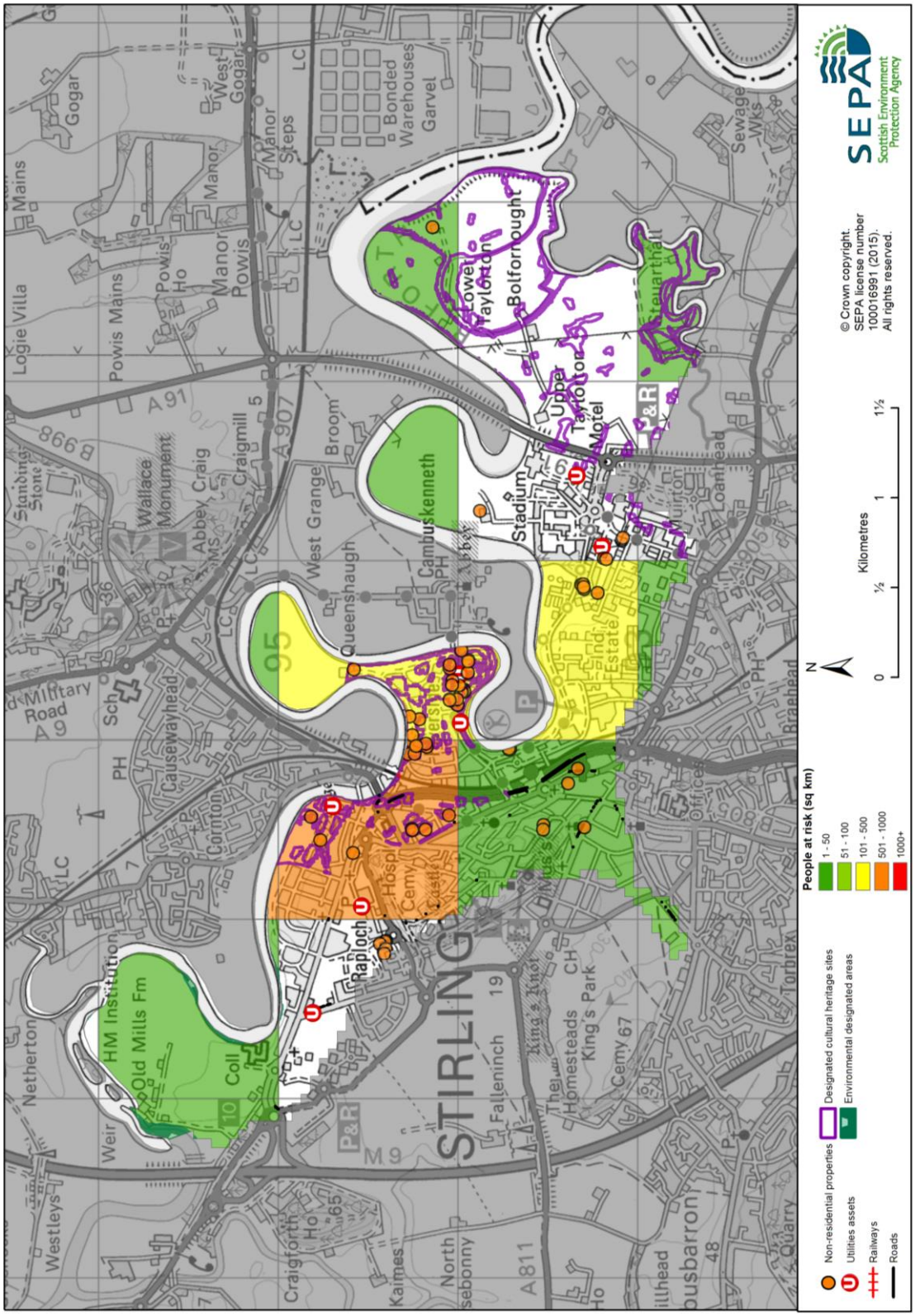


Figure 3: Impacts of flooding

History of flooding

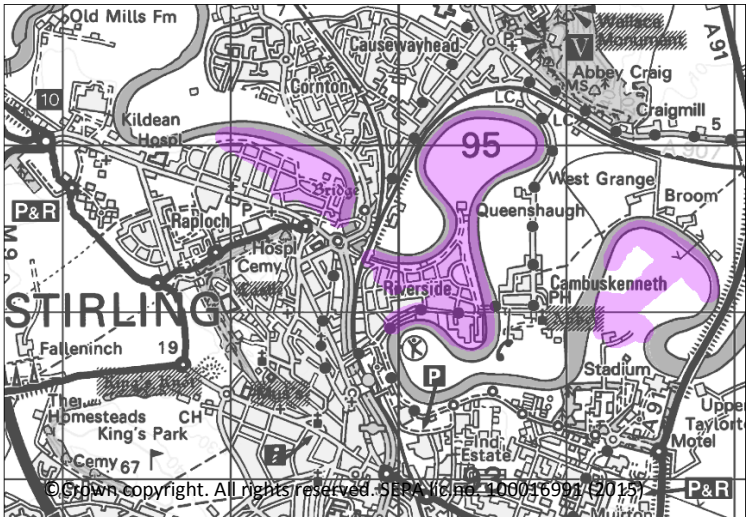
The following significant floods have been recorded in this area:

- 14 December 2006: Flooding from the River Forth in Stirling affected properties and roads in Riverside and resulted in an emergency respite centre being set up. The highest river level recorded at the SEPA gauging station on the River Forth at Craigforth was in December 2006, where the river level reached 3.97m above normal levels.
- January 1993: Properties and roads in Riverside and Bridgehaugh were flooded and residents rescued from flats at Abbeymill.
- 1908: Significant flooding in Stirling area (Riverside and Bridgehaugh).

Objectives to manage flooding in Potentially Vulnerable Area 09/07

Objectives provide a common goal and shared ambition for managing floods. These objectives have been set by SEPA and agreed with flood risk management authorities following consultation. They were identified through an assessment of the underlying evidence of the causes and impacts of flooding. Target areas have been set to focus actions; they do not necessarily correspond to areas at risk in SEPA's flood map. The objectives below have been set for Stirling (Raploch and Riverside) Potentially Vulnerable Area.

Reduce economic damages to residential and non-residential properties and risk to people in Stirling, Riverside and Raploch caused by flooding from the River Forth

Indicators:	Target area:
• 1,500 people • £560,000 Annual Average Damages from residential properties • £19,000 Annual Average Damages from non-residential properties	
Objective ID: 9021, 9022	

Target area	Objective	ID	Indicators within PVA
Stirling and Bridge of Allan	Reduce economic damages and number of residential properties at risk of surface water flooding in Stirling and Bridge of Allan where practical	9016	* See note below
Applies across Forth Local Plan District	Avoid an overall increase in flood risk	9001	• 730 residential properties • £850,000 Annual Average Damages
Applies across Forth Local Plan District	Reduce overall flood risk	9032	• 730 residential properties • £850,000 Annual Average Damages
Applies across Forth Local Plan District	Organisations such as Scottish Water, energy companies and Historic Environment Scotland actively maintain and manage their own assets, including the risk of flooding. These actions are not detailed further in the Flood Risk Management Strategies.		

* This objective will be monitored using surface water flood risk across the Potentially Vulnerable Area. For 09/07 there are 40 residential properties at risk and Annual Average Damages of £75,000.

Actions to manage flooding in Potentially Vulnerable Area 09/07

Actions describe where and how flood risk will be managed. These actions have been set by SEPA and agreed with flood risk management authorities following consultation. Selection of actions to deliver the agreed objectives was based on a detailed assessment and comparison of economic, social and environmental criteria. The actions shaded and then described below have been selected as the most appropriate for Stirling (Raploch and Riverside) Potentially Vulnerable Area.

Selected actions					
Flood protection scheme/works	*Natural flood management works*	*New flood warning*	*Community flood action groups*	*Property level protection scheme*	*Site protection plans*
Flood protection study	*Natural flood management study*	Maintain flood warning	Awareness raising	Surface water plan/study	Emergency plans/response
Maintain flood protection scheme	Strategic mapping and modelling	Flood forecasting	Self help	Maintenance	Planning policies

Action (ID):	**FLOOD PROTECTION SCHEME/WORKS** (90140006)		
Objective (ID):	Reduce economic damages to residential and non-residential properties and risk to people in Stirling, Riverside and Raploch caused by flooding from the River Forth (9021, 9022)		
Delivery lead:	Stirling Council		
Priority:	National:	Within local authority:	
	40 of 42	**2 of 3**	
Status:	**Under development**	Indicative delivery:	**2016-2021**
Description:	A flood protection scheme has been proposed for Stirling. The scheme would consist of flood embankments and would provide a 1 in 200 year standard of protection. The scheme has a low benefit-cost ratio, but has been identified as the only option for Stirling. Part of this proposed flood protection scheme is located in PVA 09/05. The benefits and impacts have been assessed for the whole scheme.		
Potential impacts			
Economic:	The proposed scheme has estimated damages avoided £17.7 million and an estimated benefit cost ratio of 0.69 (Riverside); 0.57 (Raploch); 0.39 (Cornton, Causewayhead); 0.03 (North Cornton).		
Social:	A reduction in flood risk would have a positive benefit to the health and wellbeing of the community and socially vulnerable people located within the flood protection scheme area. In addition there are three utilities and one railway line which have been identified as potentially benefitting from this action. There may be negative impacts through disturbance to the local community during the construction phase.		

Environmental:	Flood protection studies should consider the positive and negative impacts of proposed actions on the ecological quality of the environment. The proposed flood protection study is located on the Upper Forth Estuary (water body ID 200437). The physical condition of this stretch of estuary is identified by SEPA to be at less than good status. Future works could improve the condition of the estuary or degrade it. Opportunities to improve the condition of the estuary should be considered by coordinating with river basin management planning. To be in accord with the FRM Strategy, the responsible authority (and where applicable, the licensing authority) should seek to ensure that the works will not have an adverse effect on the integrity of the River Teith Special Area of Conservation and Firth of Forth Special Protection Area. In addition, a number of nationally and locally designated sites are also present in the study area and could be positively or negatively impacted. These include conservation areas, scheduled monuments and battlefields.

Action (ID):	**SURFACE WATER PLAN/STUDY** (90160018)		
Objective (ID):	Reduce economic damages and number of residential properties at risk of surface water flooding in Stirling and Bridge of Allan where practical (9016)		
Delivery lead:	Stirling Council		
Status:	**Ongoing**	Indicative delivery:	**2016-2027**
Description:	The area must be covered by a surface water management plan or plans that set objectives for the management of surface water flood risk and identify the most sustainable actions to achieve the objectives.		

Action (ID):	**SURFACE WATER PLAN/STUDY** (90160019)		
Objective (ID):	Reduce economic damages and number of residential properties at risk of surface water flooding in Stirling and Bridge of Allan where practical (9016)		
Delivery lead:	Scottish Water in partnership with local authorities		
Status:	**Ongoing**	Indicative delivery:	**2016-2021**
Description:	An integrated catchment study will be carried out to support the surface water management plan process and improve knowledge and understanding of surface water flood risk and interactions with other sources of flooding e.g. with the sewer network, watercourses and the sea.		

Action (ID):	**STRATEGIC MAPPING AND MODELLING** (90320019)		
Objective (ID):	Reduce overall flood risk (9032)		
Delivery lead:	Scottish Water		
Status:	**Not started**	Indicative delivery:	**2016-2021**
Description:	Scottish Water will review the assessment of flood risk within the highest risk sewer catchments to improve knowledge and understanding of surface water flood risk.		

Action (ID):	**MAINTAIN FLOOD WARNING** (90320030)		
Objective (ID):	Reduce overall flood risk (9032)		
Delivery lead:	SEPA		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Continue to maintain the Riverside and Cambuskenneth, Bridgehaugh and Raploch flood warning areas which cover the River Forth and are part of the Stirling river flood warning scheme.		

Action (ID):	**FLOOD FORECASTING** (90320009)		
Objective (ID):	Reduce overall flood risk (9032)		
Delivery lead:	SEPA		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	The Scottish Flood Forecasting Service is a joint initiative between SEPA and the Met Office that produces daily, national flood guidance statements which are issued to Category 1 and 2 Responders. The service also provides information which allows SEPA to issue flood warnings, giving people a better chance of reducing the impact of flooding on their home or business. For more information please visit SEPA's website.		

Action (ID):	**SELF HELP** (90320011)		
Objective (ID):	Reduce overall flood risk (9032)		
Delivery lead:	—		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Everyone is responsible for protecting themselves and their property from flooding. Property and business owners can take simple steps to reduce damage and disruption to their homes and businesses should flooding happen. This includes preparing a flood plan and flood kit, installing property level protection, signing up to Floodline and Resilient Communities initiatives, and ensuring that properties and businesses are insured against flood damage.		

Action (ID):	**AWARENESS RAISING** (90320013)		
Objective (ID):	Reduce overall flood risk (9032)		
Delivery lead:	Responsible authorities		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	SEPA and the responsible authorities have a duty to raise public awareness of flood risk. Improved awareness of flood risk and actions that prepare individuals, homes and businesses for flooding can reduce the overall impact. From 2016 SEPA will engage with the community through local participation in national initiatives, including partnership working with Neighbourhood Watch Scotland. In addition, SEPA will engage with local authorities and community resilience groups where possible. Local authorities will be undertaking additional awareness raising activities. Further details will be set out in the Local FRM Plan.		

Action (ID):	**MAINTENANCE** (90320007)		
Objective (ID):	Reduce overall flood risk (9032)		
Delivery lead:	Stirling Council, asset / land managers		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Local authorities have a duty to assess watercourses and carry out clearance and repair works where such works would substantially reduce flood risk. They produce schedules of clearance and repair works and make these available for public inspection. Scottish Water undertake inspection and repair on the public sewer network. Asset owners and riparian landowners are responsible for the maintenance and management of their own assets including those which help to reduce flood risk.		

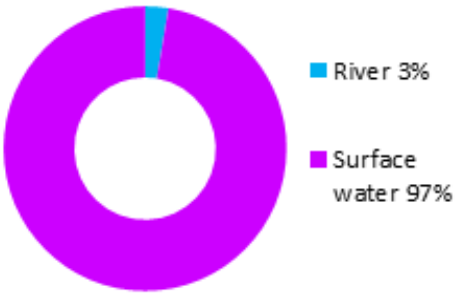
Action (ID):	**EMERGENCY PLANS/RESPONSE** (90320014)		
Objective (ID):	Reduce overall flood risk (9032)		
Delivery lead:	Category 1 and 2 Responders		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Providing an emergency response to flooding is the responsibility of many organisations, including local authorities, the emergency services and SEPA. Effective management of an emergency response relies on emergency plans that are prepared under the Civil Contingencies Act 2004 by Category 1 and 2 Responders. The emergency response by these organisations is co-ordinated through regional and local resilience partnerships. This response may be supported by the work of voluntary organisations.		

Action (ID):	**PLANNING POLICIES** (90010001)		
Objective (ID):	Avoid an overall increase in flood risk (9001) Reduce overall flood risk (9032)		
Delivery lead:	Planning authority		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Scottish Planning Policy and accompanying Planning Advice Notes set out Scottish Ministers' priorities for the operation of the planning system and for the development and use of land. In terms of flood risk management, the policy supports a catchment-scale approach to sustainable flood risk management and aims to build the resilience of our cities and towns, encourage sustainable land management in our rural areas, and to address the long-term vulnerability of parts of our coasts and islands. Under this approach, new development in areas with medium to high likelihood of flooding should be avoided. For further information on the application of national planning policies see Annex 2.		

Stirling (Broomridge and St Ninians) (Potentially Vulnerable Area 09/08)

Local Plan District	Local authority	Main catchment
Forth	Stirling Council	River Forth

Summary of flooding impacts



At risk of flooding

- 80 residential properties
- 30 non-residential properties
- £680,000 Annual Average Damages

(damages by flood source shown left)

Summary of objectives to manage flooding

Objectives have been set by SEPA and agreed with flood risk management authorities. These are the aims for managing local flood risk. The objectives have been grouped in three main ways: by reducing risk, avoiding increasing risk or accepting risk by maintaining current levels of management.

Many organisations, such as Scottish Water and energy companies, actively maintain and manage their own assets including their risk from flooding. Where known, these actions are described here. Scottish Natural Heritage and Historic Environment Scotland work with site owners to manage flooding where appropriate at designated environmental and/or cultural heritage sites. These actions are not detailed further in the Flood Risk Management Strategies.

Summary of actions to manage flooding

The actions below have been selected to manage flood risk.

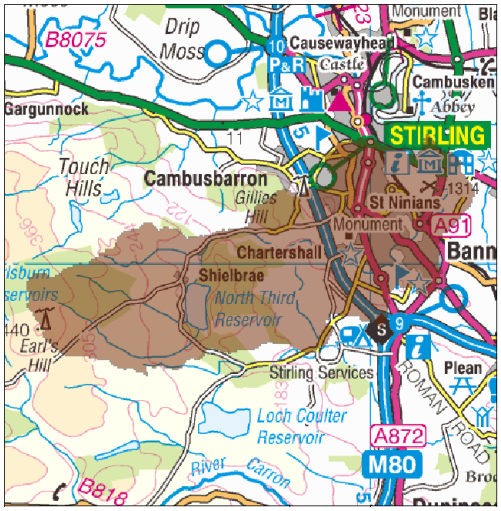
Flood protection scheme/works	*Natural flood management works*	*New flood warning*	*Community flood action groups*	*Property level protection scheme*	*Site protection plans*
Flood protection study	*Natural flood management study*	*Maintain flood warning*	Awareness raising	Surface water plan/study	Emergency plans/response
Maintain flood protection scheme	Strategic mapping and modelling	Flood forecasting	Self help	Maintenance	Planning policies

Stirling (Broomridge and St Ninians), (Potentially Vulnerable Area 09/08)

Local Plan District	Local authority	Main catchment
Forth	Stirling Council	River Forth

Background

This Potentially Vulnerable Area is 35km^2 and is part of the Stirling catchment (shown below). It is a steep, partially urbanised area that extends westward to the headwaters of the Bannock Burn and includes the urban areas of Bannockburn, St Ninians and Broomridge.



The area has a risk of surface water and river flooding. The majority of damages are caused by surface water.

There are approximately 80 residential properties and 30 non-residential properties at risk of flooding. The Annual Average Damages are approximately £680,000.

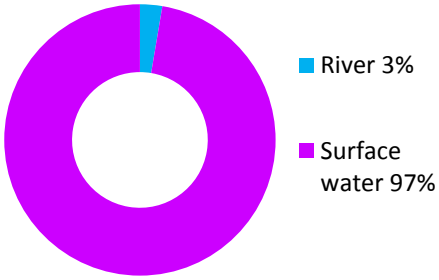


Figure 1: Annual Average Damages by flood source

Summary of flooding impacts

The highest risk of surface water flooding is in the south Stirling area.

The risk of flooding to people, property, as well as to community facilities, utilities, the transport network, designated sites and agricultural land is summarised in Table 1.

The damages associated with floods of different likelihood are shown in Figure 2. For this Potentially Vulnerable Area the highest damages are to roads, notably the M80, followed by damages to non-residential properties. The location of the impacts of flooding is shown in Figure 3.

The figures presented for Annual Average Damages include damages to residential properties, non-residential properties, transport and agriculture.

	1 in 10 High likelihood	1 in 200 Medium likelihood	1 in 1000 Low likelihood
Residential properties (total 9,600)	10	80	140
Non-residential properties (total 840)	<10	30	40
People	30	180	310
Community facilities	0	<10 Educational buildings	<10 Educational buildings
Utilities	<10	<10	10
Transport links (excluding minor roads)	2 M roads (M80, M9), 5 A roads, 1 B road at 56 locations 1 Railway route at 4 locations: Dunblane to Greenhill Lower	2 M roads (M80, M9), 5 A roads, 1 B road at 82 locations 1 Railway route at 7 locations: Dunblane to Greenhill Lower	2 M roads (M80, M9), 5 A roads, 1 B road at 82 locations 1 Railway route at 7 locations: Dunblane to Greenhill Lower
Environmental designated areas (km^2)	<0.1	<0.1	<0.1
Designated cultural heritage sites	2	2	2
Agricultural land (km^2)	0.6	0.8	1.0

Table 1: Summary of flooding impacts

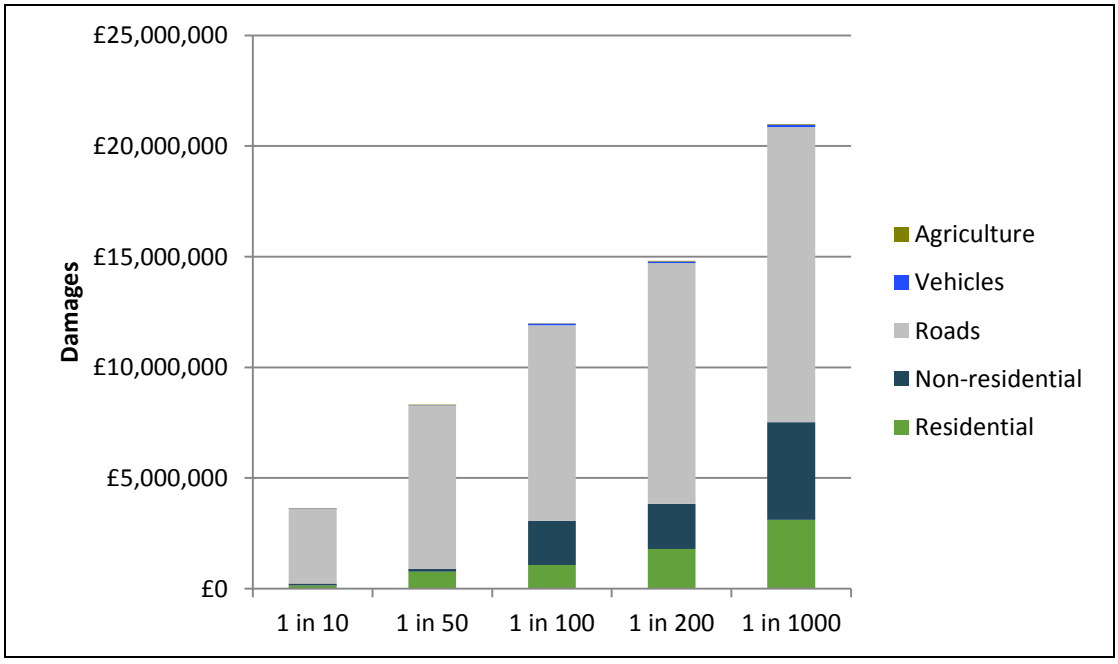


Figure 2: Damages by flood frequency

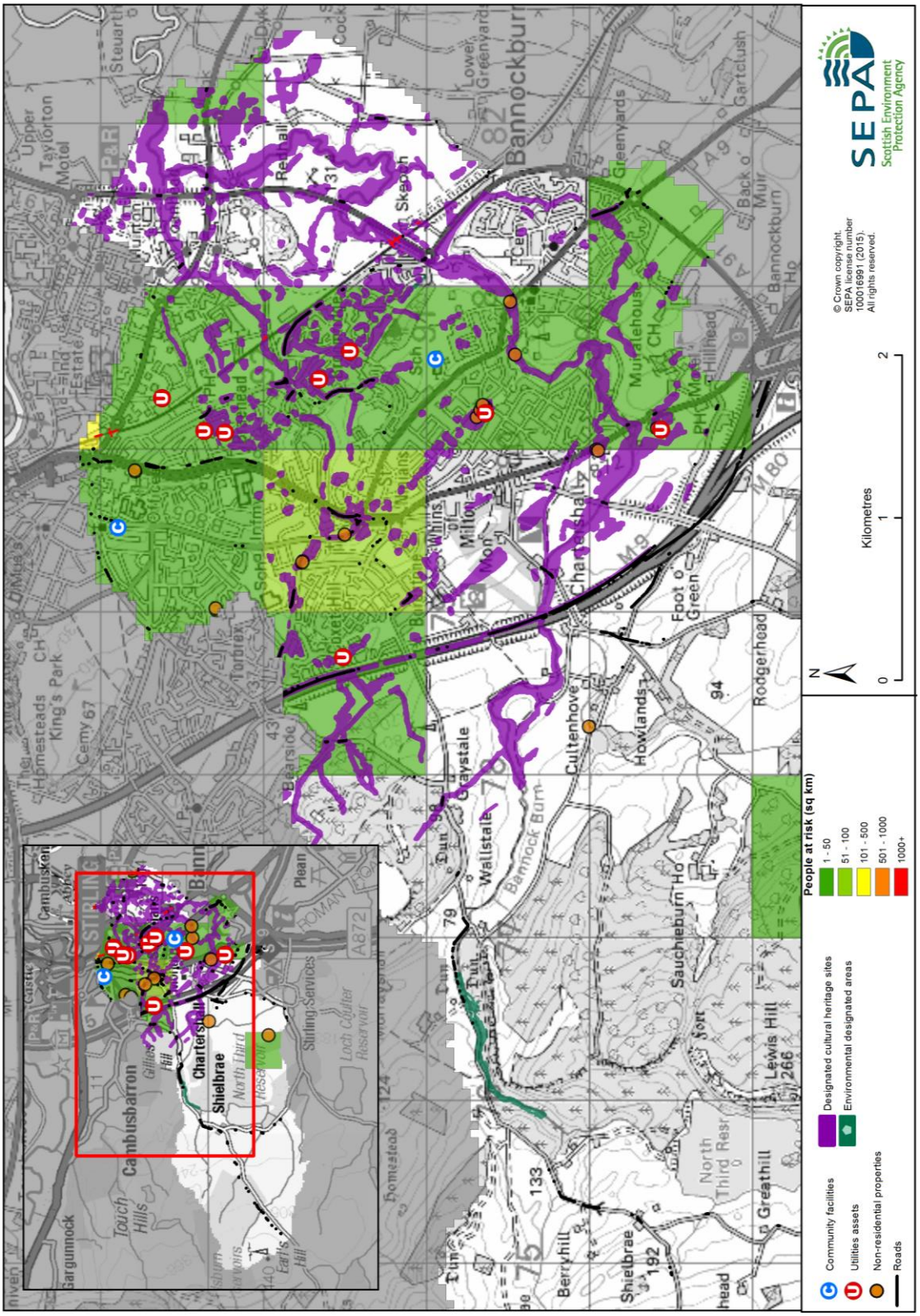


Figure 3: Impacts of flooding

History of flooding

No significant floods have been recorded in this area.

Objectives to manage flooding in Potentially Vulnerable Area 09/08

Objectives provide a common goal and shared ambition for managing floods. These objectives have been set by SEPA and agreed with flood risk management authorities following consultation. They were identified through an assessment of the underlying evidence of the causes and impacts of flooding. Target areas have been set to focus actions; they do not necessarily correspond to areas at risk in SEPA's flood map. The objectives below have been set for Stirling (Broomridge and St Ninians) Potentially Vulnerable Area.

Target area	Objective	ID	Indicators within PVA
Stirling and Bridge of Allan	Reduce economic damages and number of residential properties at risk of surface water flooding in Stirling and Bridge of Allan where practical	9016	* See note below
Applies across Forth Local Plan District	Avoid an overall increase in flood risk	9001	• 80 residential properties • £680,000 Annual Average Damages
Applies across Forth Local Plan District	Reduce overall flood risk	9032	• 80 residential properties • £680,000 Annual Average Damages
Applies across Forth Local Plan District	Organisations such as Scottish Water, energy companies and Historic Environment Scotland actively maintain and manage their own assets, including the risk of flooding. These actions are not detailed further in the Flood Risk Management Strategies.		

* This objective will be monitored using surface water flood risk across the Potentially Vulnerable Area. For 09/08 there are 80 residential properties at risk and Annual Average Damages of £650,000.

Actions to manage flooding in Potentially Vulnerable Area 09/08

Actions describe where and how flood risk will be managed. These actions have been set by SEPA and agreed with flood risk management authorities following consultation. Selection of actions to deliver the agreed objectives was based on a detailed assessment and comparison of economic, social and environmental criteria. The actions shaded and then described below have been selected as the most appropriate for Stirling (Broomridge and St Ninians) Potentially Vulnerable Area.

Selected actions					
Flood protection scheme/works	*Natural flood management works*	*New flood warning*	*Community flood action groups*	*Property level protection scheme*	*Site protection plans*
Flood protection study	*Natural flood management study*	*Maintain flood warning*	Awareness raising	Surface water plan/study	Emergency plans/response
Maintain flood protection scheme	Strategic mapping and modelling	Flood forecasting	Self help	Maintenance	Planning policies

Action (ID):	**SURFACE WATER PLAN/STUDY** (90160018)		
Objective (ID):	Reduce economic damages and number of residential properties at risk of surface water flooding in Stirling and Bridge of Allan where practical (9016)		
Delivery lead:	Stirling Council		
Status:	**Ongoing**	Indicative delivery:	**2016-2027**
Description:	The area must be covered by a surface water management plan or plans that set objectives for the management of surface water flood risk and identify the most sustainable actions to achieve the objectives.		

Action (ID):	**SURFACE WATER PLAN/STUDY** (90160019)		
Objective (ID):	Reduce economic damages and number of residential properties at risk of surface water flooding in Stirling and Bridge of Allan where practical (9016)		
Delivery lead:	Scottish Water in partnership with local authorities		
Status:	**Ongoing**	Indicative delivery:	**2016-2021**
Description:	An integrated catchment study will be carried out to support the surface water management plan process and improve knowledge and understanding of surface water flood risk and interactions with other sources of flooding e.g. with the sewer network, watercourses and the sea.		

Action (ID):	**STRATEGIC MAPPING AND MODELLING** (90320019)		
Objective (ID):	Reduce overall flood risk (9032)		
Delivery lead:	Scottish Water		
Status:	**Not started**	Indicative delivery:	**2016-2021**
Description:	Scottish Water will review the assessment of flood risk within the highest risk sewer catchments to improve knowledge and understanding of surface water flood risk.		

Action (ID):	**FLOOD FORECASTING** (90320009)		
Objective (ID):	Reduce overall flood risk (9032)		
Delivery lead:	SEPA		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	The Scottish Flood Forecasting Service is a joint initiative between SEPA and the Met Office that produces daily, national flood guidance statements which are issued to Category 1 and 2 Responders. The service also provides information which allows SEPA to issue flood warnings, giving people a better chance of reducing the impact of flooding on their home or business. For more information please visit SEPA's website.		

Action (ID):	**SELF HELP** (90320011)		
Objective (ID):	Reduce overall flood risk (9032)		
Delivery lead:	—		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Everyone is responsible for protecting themselves and their property from flooding. Property and business owners can take simple steps to reduce damage and disruption to their homes and businesses should flooding happen. This includes preparing a flood plan and flood kit, installing property level protection, signing up to Floodline and Resilient Communities initiatives, and ensuring that properties and businesses are insured against flood damage.		

Action (ID):	**AWARENESS RAISING** (90320013)		
Objective (ID):	Reduce overall flood risk (9032)		
Delivery lead:	Responsible authorities		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	SEPA and the responsible authorities have a duty to raise public awareness of flood risk. Improved awareness of flood risk and actions that prepare individuals, homes and businesses for flooding can reduce the overall impact. From 2016 SEPA will engage with the community through local participation in national initiatives, including partnership working with Neighbourhood Watch Scotland. In addition, SEPA will engage with local authorities and community resilience groups where possible. Local authorities will be undertaking additional awareness raising activities. Further details will be set out in the Local FRM Plan.		

Action (ID):	**MAINTENANCE** (90320007)		
Objective (ID):	Reduce overall flood risk (9032)		
Delivery lead:	Stirling Council, asset / land managers		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Local authorities have a duty to assess watercourses and carry out clearance and repair works where such works would substantially reduce flood risk. They produce schedules of clearance and repair works and make these available for public inspection. Scottish Water undertake inspection and repair on the public sewer network. Asset owners and riparian landowners are responsible for the maintenance and management of their own assets including those which help to reduce flood risk.		

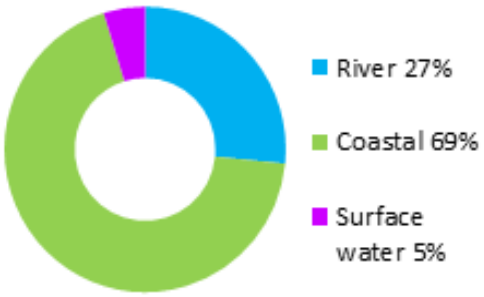
Action (ID):	**EMERGENCY PLANS/RESPONSE** (90320014)		
Objective (ID):	Reduce overall flood risk (9032)		
Delivery lead:	Category 1 and 2 Responders		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Providing an emergency response to flooding is the responsibility of many organisations, including local authorities, the emergency services and SEPA. Effective management of an emergency response relies on emergency plans that are prepared under the Civil Contingencies Act 2004 by Category 1 and 2 Responders. The emergency response by these organisations is co-ordinated through regional and local resilience partnerships. This response may be supported by the work of voluntary organisations.		

Action (ID):	**PLANNING POLICIES** (90010001)		
Objective (ID):	Avoid an overall increase in flood risk (9001) Reduce overall flood risk (9032)		
Delivery lead:	Planning authority		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Scottish Planning Policy and accompanying Planning Advice Notes set out Scottish Ministers' priorities for the operation of the planning system and for the development and use of land. In terms of flood risk management, the policy supports a catchment-scale approach to sustainable flood risk management and aims to build the resilience of our cities and towns, encourage sustainable land management in our rural areas, and to address the long-term vulnerability of parts of our coasts and islands. Under this approach, new development in areas with medium to high likelihood of flooding should be avoided. For further information on the application of national planning policies see Annex 2.		

Stirling (Eastern Villages) (Potentially Vulnerable Area 09/09)

Local Plan District	Local authority	Main catchment
Forth	Falkirk Council, Stirling Council	Stirling coastal

Summary of flooding impacts



At risk of flooding

- 20 residential properties
- 10 non-residential properties
- £120,000 Annual Average Damages

(damages by flood source shown left)

Summary of objectives to manage flooding

Objectives have been set by SEPA and agreed with flood risk management authorities. These are the aims for managing local flood risk. The objectives have been grouped in three main ways: by reducing risk, avoiding increasing risk or accepting risk by maintaining current levels of management.

Many organisations, such as Scottish Water and energy companies, actively maintain and manage their own assets including their risk from flooding. Where known, these actions are described here. Scottish Natural Heritage and Historic Environment Scotland work with site owners to manage flooding where appropriate at designated environmental and/or cultural heritage sites. These actions are not detailed further in the Flood Risk Management Strategies.

Summary of actions to manage flooding

The actions below have been selected to manage flood risk.

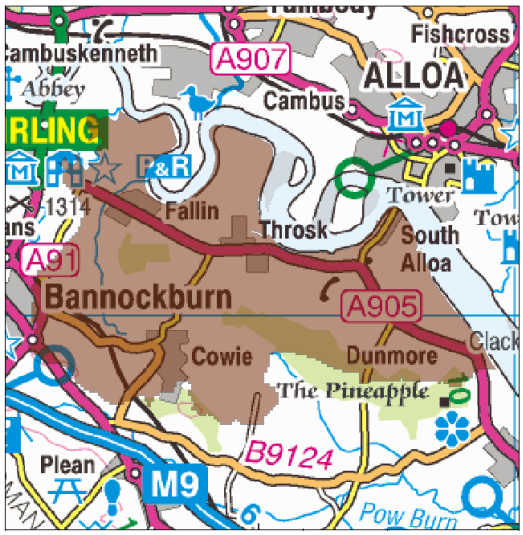
Flood protection scheme/works	*Natural flood management works*	*New flood warning*	*Community flood action groups*	*Property level protection scheme*	*Site protection plans*
Flood protection study	*Natural flood management study*	*Maintain flood warning*	Awareness raising	*Surface water plan/study*	Emergency plans/response
Maintain flood protection scheme	Strategic mapping and modelling	Flood forecasting	Self help	Maintenance	Planning policies

Stirling (Eastern Villages) (Potentially Vulnerable Area 09/09)

Local Plan District	Local authority	Main catchment
Forth	Falkirk Council, Stirling Council	Stirling coastal

Background

This Potentially Vulnerable Area is 23km^2 and is part of the Stirling catchment (shown below). It lies along the south bank of the River Forth and includes the small urban areas of Fallin and South Alloa along with villages to the east of Stirling. The interaction between river and coastal flooding where the River Forth meets the Firth of Forth is an important factor in this area.



The area has a risk of river, coastal and surface water flooding. The majority of damages are caused by coastal flooding with smaller proportions caused by river and surface water flooding.

There are approximately 20 residential properties and 10 non-residential properties at risk of flooding. The Annual Average Damages are approximately £120,000.

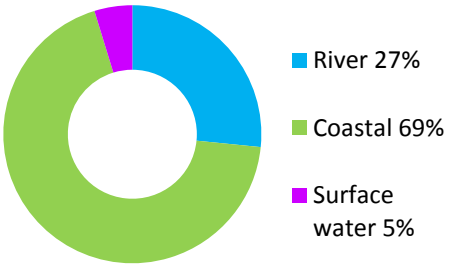


Figure 1: Annual Average Damages by flood source

Summary of flooding impacts

Small pockets of flood risk are spread across this area, notably near South Alloa, north east of Fallin and north of Cowie.

The risk of flooding to people, property, as well as to community facilities, utilities, the transport network, designated sites and agricultural land is summarised in Table 1.

The damages associated with floods of different likelihood are shown in Figure 2. For this Potentially Vulnerable Area the highest damages are to residential properties followed by damages to non-residential properties. The location of the impacts of flooding is shown in Figure 3.

The figures presented for Annual Average Damages include damages to residential properties, non-residential properties, transport and agriculture.

	1 in 10 High likelihood	1 in 200 Medium likelihood	1 in 1000 Low likelihood
Residential properties (total 2,600)	10	20	30
Non-residential properties (total 240)	10	10	10
People	20	40	70
Community facilities	0	0	0
Utilities	<10	<10	<10
Transport links (excluding minor roads)	1 A road, 1 B road at 10 locations	1 A road, 1 B road at 10 locations	1 A road, 1 B road at 12 locations
Environmental designated areas (km^2)	0.2	0.2	0.2
Designated cultural heritage sites	3	3	3
Agricultural land (km^2)	1.2	1.3	1.4

Table 1: Summary of flooding impacts

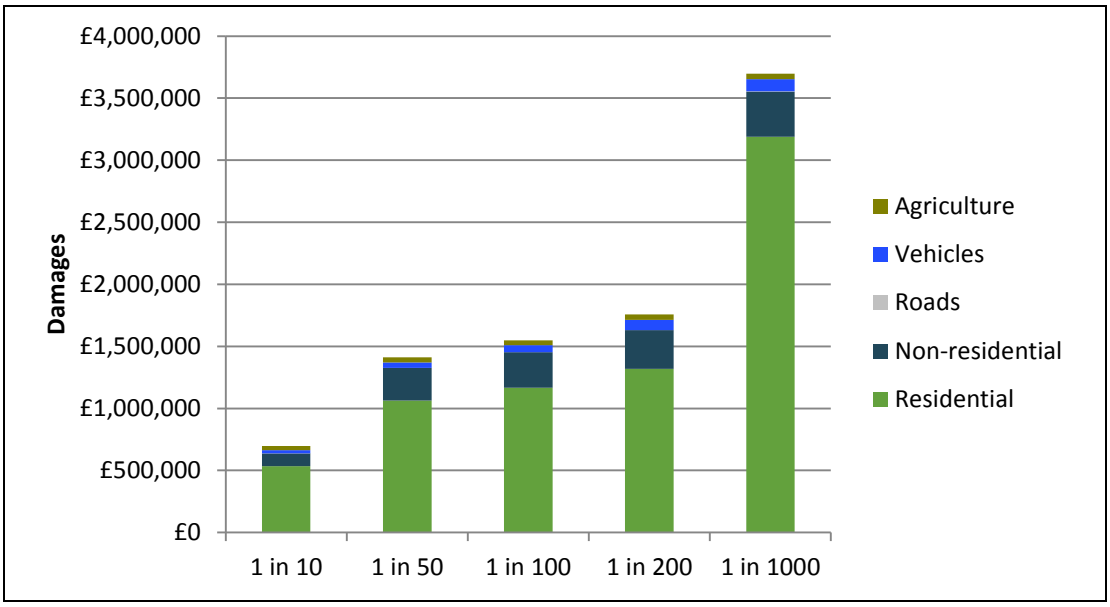


Figure 2: Damages by flood likelihood

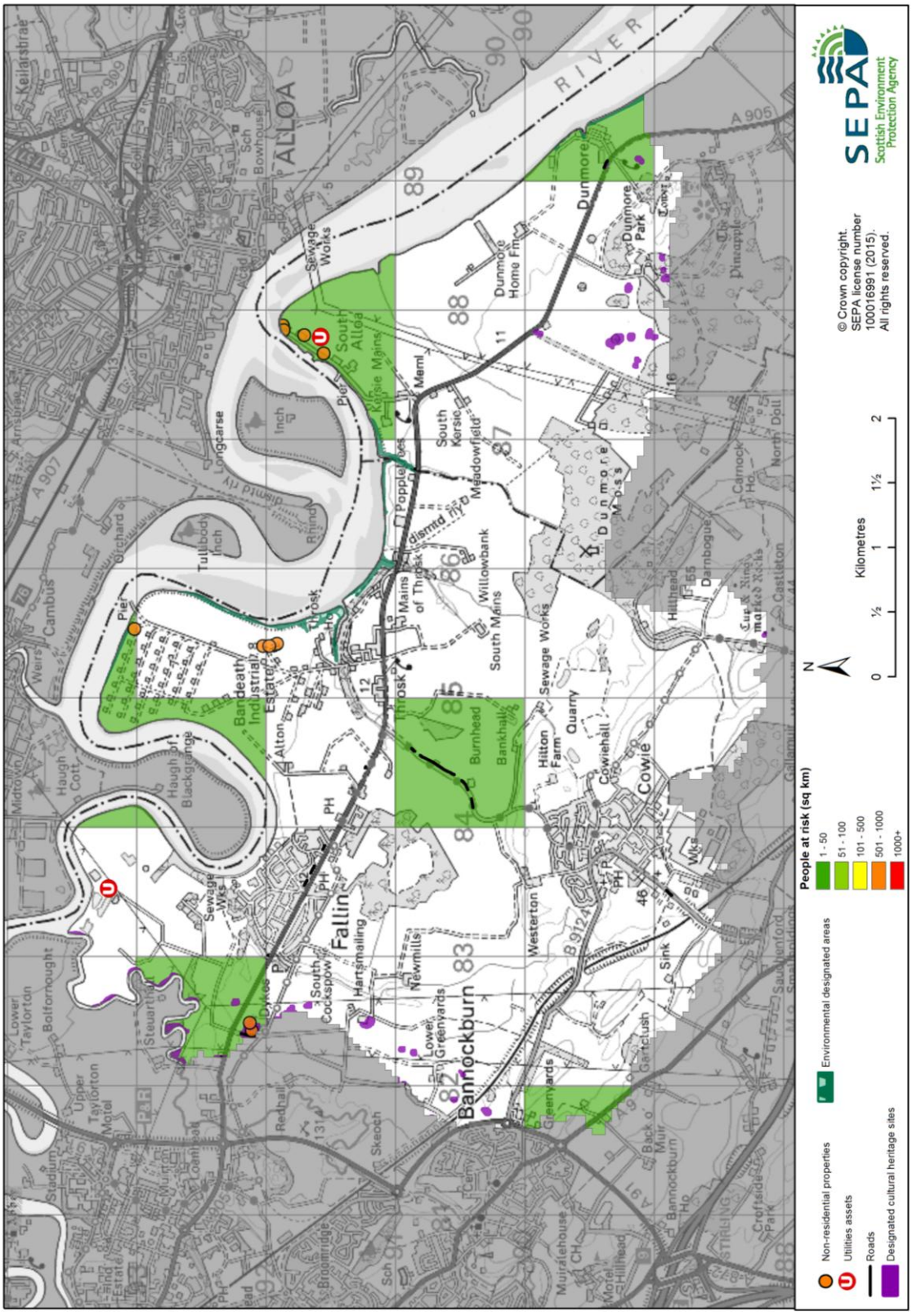


Figure 3: Impacts of flooding

History of flooding

No significant floods have been recorded in this area.

Objectives to manage flooding in Potentially Vulnerable Area 09/09

Objectives provide a common goal and shared ambition for managing floods. These objectives have been set by SEPA and agreed with flood risk management authorities following consultation. They were identified through an assessment of the underlying evidence of the causes and impacts of flooding. Target areas have been set to focus actions; they do not necessarily correspond to areas at risk in SEPA's flood map. The objectives below have been set for Stirling (Eastern Villages) Potentially Vulnerable Area.

Target area	Objective	ID	Indicators within PVA
Applies across Forth Local Plan District	Avoid an overall increase in flood risk	9001	• 20 residential properties • £120,000 Annual Average Damages
Applies across Forth Local Plan District	Reduce overall flood risk	9032	• 20 residential properties • £120,000 Annual Average Damages
Applies across Forth Local Plan District	Organisations such as Scottish Water, energy companies and Historic Environment Scotland actively maintain and manage their own assets, including the risk of flooding. These actions are not detailed further in the Flood Risk Management Strategies.		

Actions to manage flooding in Potentially Vulnerable Area 09/09

Actions describe where and how flood risk will be managed. These actions have been set by SEPA and agreed with flood risk management authorities following consultation. Selection of actions to deliver the agreed objectives was based on a detailed assessment and comparison of economic, social and environmental criteria. The actions shaded and then described below have been selected as the most appropriate for Stirling (Eastern Villages) Potentially Vulnerable Area.

Selected actions					
Flood protection scheme/works	*Natural flood management works*	*New flood warning*	*Community flood action groups*	*Property level protection scheme*	*Site protection plans*
Flood protection study	*Natural flood management study*	*Maintain flood warning*	Awareness raising	*Surface water plan/study*	Emergency plans/response
Maintain flood protection scheme	Strategic mapping and modelling	Flood forecasting	Self help	Maintenance	Planning policies

Action (ID):	**STRATEGIC MAPPING AND MODELLING** (90320016)		
Objective (ID):	Reduce overall flood risk (9032)		
Delivery lead:	SEPA		
Status:	**Not started**	Indicative delivery:	**2016-2021**
Description:	SEPA will seek to develop flood mapping in the Dunbar to Stirling area to improve understanding of coastal flood risk. The extent and timing of improvements will depend on detailed scoping and data availability. Where this work coincides with local authority studies, SEPA will work collaboratively to ensure consistent modelling approaches are applied.		

Action (ID):	**STRATEGIC MAPPING AND MODELLING** (90320019)		
Objective (ID):	Reduce overall flood risk (9032)		
Delivery lead:	Scottish Water		
Status:	**Not started**	Indicative delivery:	**2016-2021**
Description:	Scottish Water will review the assessment of flood risk within the highest risk sewer catchments to improve knowledge and understanding of surface water flood risk.		

Action (ID):	**FLOOD FORECASTING** (90320009)		
Objective (ID):	Reduce overall flood risk (9032)		
Delivery lead:	SEPA		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	The Scottish Flood Forecasting Service is a joint initiative between SEPA and the Met Office that produces daily, national flood guidance statements which are issued to Category 1 and 2 Responders. The service also provides information which allows SEPA to issue flood warnings, giving people a better chance of reducing the impact of flooding on their home or business. For more information please visit SEPA's website.		

Action (ID):	**SELF HELP** (90320011)		
Objective (ID):	Reduce overall flood risk (9032)		
Delivery lead:	—		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Everyone is responsible for protecting themselves and their property from flooding. Property and business owners can take simple steps to reduce damage and disruption to their homes and businesses should flooding happen. This includes preparing a flood plan and flood kit, installing property level protection, signing up to Floodline and Resilient Communities initiatives, and ensuring that properties and businesses are insured against flood damage.		

Action (ID):	**AWARENESS RAISING** (90320013)		
Objective (ID):	Reduce overall flood risk (9032)		
Delivery lead:	Responsible authorities		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	SEPA and the responsible authorities have a duty to raise public awareness of flood risk. Improved awareness of flood risk and actions that prepare individuals, homes and businesses for flooding can reduce the overall impact. From 2016 SEPA will engage with the community through local participation in national initiatives, including partnership working with Neighbourhood Watch Scotland. In addition, SEPA will engage with local authorities and community resilience groups where possible. Local authorities will be undertaking additional awareness raising activities. Further details will be set out in the Local FRM Plan.		

Action (ID):	**MAINTENANCE** (90320007)		
Objective (ID):	Reduce overall flood risk (9032)		
Delivery lead:	Falkirk Council and Stirling Council, asset / land managers		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Local authorities have a duty to assess watercourses and carry out clearance and repair works where such works would substantially reduce flood risk. They produce schedules of clearance and repair works and make these available for public inspection. Scottish Water undertake inspection and repair on the public sewer network. Asset owners and riparian landowners are responsible for the maintenance and management of their own assets including those which help to reduce flood risk.		

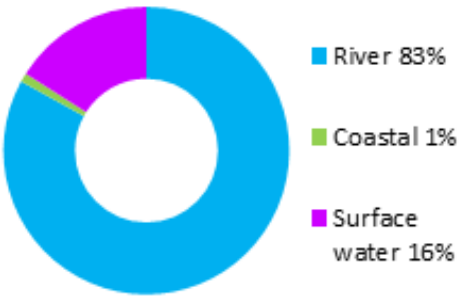
Action (ID):	**EMERGENCY PLANS/RESPONSE** (90320014)		
Objective (ID):	Reduce overall flood risk (9032)		
Delivery lead:	Category 1 and 2 Responders		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Providing an emergency response to flooding is the responsibility of many organisations, including local authorities, the emergency services and SEPA. Effective management of an emergency response relies on emergency plans that are prepared under the Civil Contingencies Act 2004 by Category 1 and 2 Responders. The emergency response by these organisations is co-ordinated through regional and local resilience partnerships. This response may be supported by the work of voluntary organisations.		

Action (ID):	**PLANNING POLICIES** (90010001)		
Objective (ID):	Avoid an overall increase in flood risk (9001) Reduce overall flood risk (9032)		
Delivery lead:	Planning authority		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Scottish Planning Policy and accompanying Planning Advice Notes set out Scottish Ministers' priorities for the operation of the planning system and for the development and use of land. In terms of flood risk management, the policy supports a catchment-scale approach to sustainable flood risk management and aims to build the resilience of our cities and towns, encourage sustainable land management in our rural areas, and to address the long-term vulnerability of parts of our coasts and islands. Under this approach, new development in areas with medium to high likelihood of flooding should be avoided. For further information on the application of national planning policies see Annex 2.		

Cambus, Alloa and Sauchie (Potentially Vulnerable Area 09/10)

Local Plan District	Local authority	Main catchment
Forth	Clackmannanshire Council	Stirling coastal

Summary of flooding impacts



At risk of flooding

- 350 residential properties
- 50 non-residential properties
- £1.4 million Annual Average Damages

(damages by flood source shown left)

Summary of objectives to manage flooding

Objectives have been set by SEPA and agreed with flood risk management authorities. These are the aims for managing local flood risk. The objectives have been grouped in three main ways: by reducing risk, avoiding increasing risk or accepting risk by maintaining current levels of management.

Many organisations, such as Scottish Water and energy companies, actively maintain and manage their own assets including their risk from flooding. Where known, these actions are described here. Scottish Natural Heritage and Historic Environment Scotland work with site owners to manage flooding where appropriate at designated environmental and/or cultural heritage sites. These actions are not detailed further in the Flood Risk Management Strategies.

Summary of actions to manage flooding

The actions below have been selected to manage flood risk.

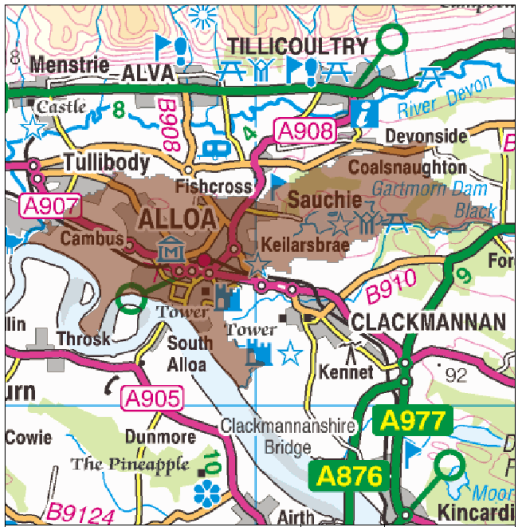
Flood protection scheme/works	*Natural flood management works*	New flood warning	*Community flood action groups*	*Property level protection scheme*	*Site protection plans*
Flood protection study	*Natural flood management study*	*Maintain flood warning*	Awareness raising	Surface water plan/study	Emergency plans/response
Maintain flood protection scheme	Strategic mapping and modelling	Flood forecasting	Self help	Maintenance	Planning policies

Cambus, Alloa and Sauchie (Potentially Vulnerable Area 09/10)

Local Plan District	Local authority	Main catchment
Forth	Clackmannanshire Council	Stirling coastal

Background

This Potentially Vulnerable Area is 20km^2 and is part of the Stirling catchment (shown below). This is a small, partially urbanised area which lies along the north bank of the River Forth. It contains the town of Alloa, extending eastward into the Gartmornhill area.



The main sources of river flooding are to Alloa from the Brothie Burn, Fairy Burn and Sauchie Burn. The highest risk of surface water flooding is in Inglewood, Sauchie and Alloa. The majority of flood damages are caused by river flooding.

There are approximately 350 residential properties and 50 non-residential properties at risk of flooding. The Annual Average Damages are approximately £1.4 million.

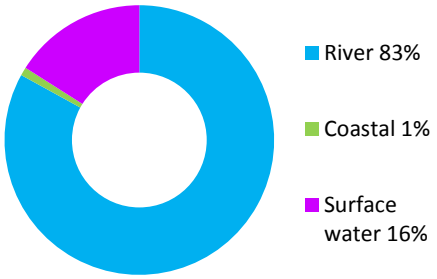


Figure 1: Annual Average Damages by flood source

Summary of flooding impacts

The greatest risk of flooding is to Alloa from river flooding. This area has a number of culverted watercourses within the town.

The risk of flooding to people, property, as well as to community facilities, utilities, the transport network, designated sites and agricultural land is summarised in Table 1.

The damages associated with floods of different likelihood are shown in Figure 2. For this Potentially Vulnerable Area the highest damages are to non-residential properties followed by damages to residential properties. The location of the impacts of flooding is shown in Figure 3.

The figures presented for Annual Average Damages include damages to residential properties, non-residential properties, transport and agriculture.

The risk of flooding to utilities in Table 1 does not include Scottish Water data. Scottish Water undertook a national assessment of above ground assets at medium likelihood of flooding (including water treatment works, wastewater treatment works and pumping stations). Within this Potentially Vulnerable Area there are two assets identified as being at risk of flooding.

In Alloa there is a lower level of confidence in the flood maps produced by SEPA. SEPA and Clackmannanshire Council are working together to improve the understanding of flooding in this area.

	1 in 10 High likelihood	1 in 200 Medium likelihood	1 in 1000 Low likelihood
Residential properties (total 9,500)	40	350	480
Non-residential properties (total 1,000)	<10	50	80
People	90	760	1,100
Community facilities	0	0	0
Utilities	<10	20	20
Transport links (excluding minor roads)	2 A roads, 3 B roads at 23 locations	2 A roads, 3 B roads at 73 locations	2 A roads, 3 B roads at 109 locations
Environmental designated areas (km^2)	0.9	0.9	0.9
Designated cultural heritage sites	3	5	5
Agricultural land (km^2)	1.0	1.3	1.3

Table 1: Summary of flooding impacts

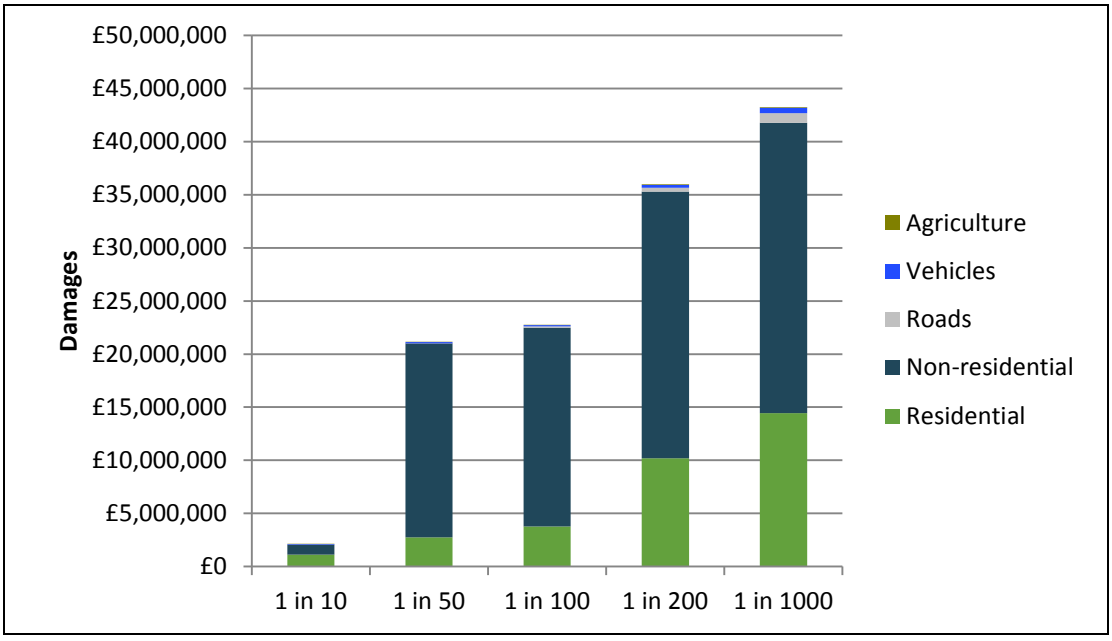


Figure 2: Damages by flood likelihood

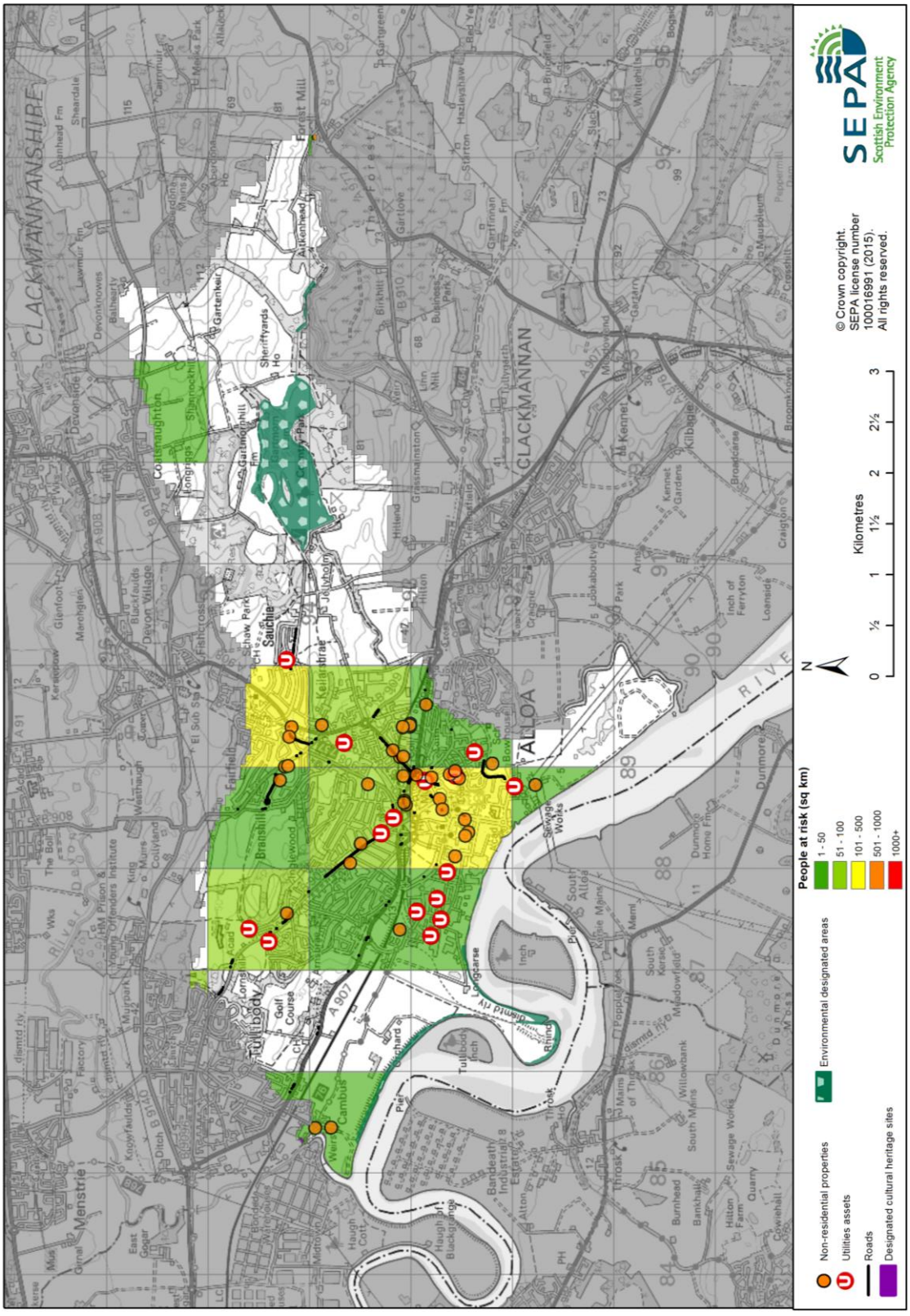


Figure 3: Impacts of flooding

History of flooding

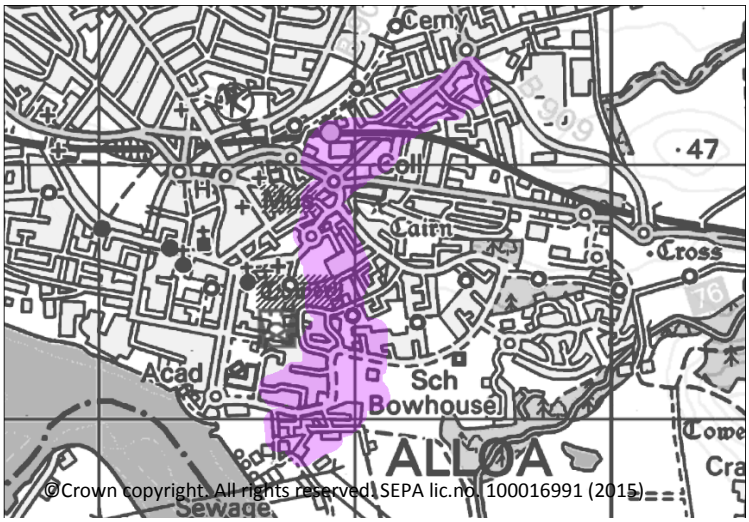
A number of floods have been recorded in this area. These include:

- 18 July 2012: Gartmorn Road in Sauchie was closed due to heavy rainfall in the area resulting in surface water flooding.
- December 2006: Flooding of the River Forth resulted in large areas of the carse being affected including a number of residential properties.
- 14 December 1907: Fairy Burn culvert in Alloa was overwhelmed resulting in the loss of gas supply to the town. Roads and paths were flooded up to 0.9m in Tullibody and homes throughout the district flooded.
- 18 December 1921: Coastal flooding resulting in Tullibody Island being submerged, minor damage to shipyards with timber washed off the quay and damage to agriculture.
- 25 January 1890: Alloa Harbour submerged due to highest tide in 17 years.
- 1 October 1849: Alloa Harbour flooded due to a high tide event.

Objectives to manage flooding in Potentially Vulnerable Area 09/10

Objectives provide a common goal and shared ambition for managing floods. These objectives have been set by SEPA and agreed with flood risk management authorities following consultation. They were identified through an assessment of the underlying evidence of the causes and impacts of flooding. Target areas have been set to focus actions; they do not necessarily correspond to areas at risk in SEPA's flood map. The objectives below have been set for Cambus, Alloa and Sauchie Potentially Vulnerable Area.

Reduce economic damages to residential and non-residential properties and risk to people in Alloa caused by flooding from the Brothie Burn

Indicators:	Target area:
• 430 people • £75,000 Annual Average Damages from residential properties • £1.0 million Annual Average Damages from non-residential properties	
Objective ID: 9028, 9029	

Target area	Objective	ID	Indicators within PVA
Alloa, Alva, Menstrie, Tillicoultry, Coalsnaughton and Devonside	Reduce economic damages and number of residential properties at risk of surface water flooding in Alloa, Alva, Menstrie, Tillicoultry, Coalsnaughton and Devonside where practical	9026	* See note below
Applies across Forth Local Plan District	Avoid an overall increase in flood risk	9001	• 350 residential properties • £1.4 million Annual Average Damages
Applies across Forth Local Plan District	Reduce overall flood risk	9032	• 350 residential properties • £1.4 million Annual Average Damages
Applies across Forth Local Plan District	Organisations such as Scottish Water, energy companies and Historic Environment Scotland actively maintain and manage their own assets, including the risk of flooding. These actions are not detailed further in the Flood Risk Management Strategies.		

* This objective will be monitored using surface water flood risk across the Potentially Vulnerable Area. For 09/10 there are 150 residential properties at risk and Annual Average Damages of £230,000.

Actions to manage flooding in Potentially Vulnerable Area 09/10

Actions describe where and how flood risk will be managed. These actions have been set by SEPA and agreed with flood risk management authorities following consultation. Selection of actions to deliver the agreed objectives was based on a detailed assessment and comparison of economic, social and environmental criteria. The actions shaded and then described below have been selected as the most appropriate for Cambus, Alloa and Sauchie Potentially Vulnerable Area.

Selected actions					
Flood protection scheme/works	*Natural flood management works*	New flood warning	*Community flood action groups*	*Property level protection scheme*	*Site protection plans*
Flood protection study	*Natural flood management study*	*Maintain flood warning*	Awareness raising	Surface water plan/study	Emergency plans/response
Maintain flood protection scheme	Strategic mapping and modelling	Flood forecasting	Self help	Maintenance	Planning policies

Action (ID):	**NEW FLOOD WARNING** (90320010)		
Objective (ID):	Reduce overall flood risk (9032)		
Delivery lead:	SEPA		
Status:	**Not started**	Indicative delivery:	**2016-2021**
Description:	Flood warning is required for properties at risk of coastal flooding in the Alloa Harbour area for public safety reasons. Delivery of new warnings in this area can potentially be undertaken through an extension to the existing Firth of Forth and Tay flood forecasting system and warning scheme.		

Action (ID):	**SURFACE WATER PLAN/STUDY** (90260018)		
Objective (ID):	Reduce economic damages and number of residential properties at risk of surface water flooding in Alloa, Alva, Menstrie, Tillicoultry, Coalsnaughton and Devonside where practical (9026)		
Delivery lead:	Clackmannanshire Council		
Status:	**Not started**	Indicative delivery:	**2016-2027**
Description:	The area must be covered by a surface water management plan or plans that set objectives for the management of surface water flood risk and identify the most sustainable actions to achieve the objectives.		

Action (ID):	**SURFACE WATER PLAN/STUDY** (90260019)		
Objective (ID):	Reduce economic damages and number of residential properties at risk of surface water flooding in Alloa, Alva, Menstrie, Tillicoultry, Coalsnaughton and Devonside where practical (9026)		
Delivery lead:	Scottish Water in partnership with local authorities		
Status:	**Ongoing**	Indicative delivery:	**2016-2027**
Description:	An integrated catchment study will be carried out to support the surface water management plan process and improve knowledge and understanding of surface water flood risk and interactions with other sources of flooding e.g. with the sewer network, watercourses and the sea.		

Action (ID):	**STRATEGIC MAPPING AND MODELLING** (90290016)		
Objective (ID):	Reduce economic damages to residential and non-residential properties and risk to people in Alloa caused by flooding from the Brothie Burn (9028, 9029)		
Delivery lead:	Clackmannanshire Council		
Status:	**Not started**	Indicative delivery:	**2016-2021**
Description:	Further survey work is required on the Brothie Burn to establish the level of flood risk in this area. The local authority will work collaboratively with SEPA to improve understanding of flood risk.		

Action (ID):	**STRATEGIC MAPPING AND MODELLING** (90320016)		
Objective (ID):	Reduce overall flood risk (9032)		
Delivery lead:	SEPA		
Status:	**Not started**	Indicative delivery:	**2016-2021**
Description:	SEPA will seek to develop flood mapping in the Dunbar to Stirling area to improve understanding of coastal flood risk. The extent and timing of improvements will depend on detailed scoping and data availability.		

Action (ID):	**STRATEGIC MAPPING AND MODELLING** (90320019)		
Objective (ID):	Reduce overall flood risk (9032)		
Delivery lead:	Scottish Water		
Status:	**Not started**	Indicative delivery:	**2016-2021**
Description:	Scottish Water will review the assessment of flood risk within the highest risk sewer catchments to improve knowledge and understanding of surface water flood risk.		

Action (ID):	**FLOOD FORECASTING** (90320009)		
Objective (ID):	Reduce overall flood risk (9032)		
Delivery lead:	SEPA		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	The Scottish Flood Forecasting Service is a joint initiative between SEPA and the Met Office that produces daily, national flood guidance statements which are issued to Category 1 and 2 Responders. The service also provides information which allows SEPA to issue flood warnings, giving people a better chance of reducing the impact of flooding on their home or business. For more information please visit SEPA's website.		

Action (ID):	**SELF HELP** (90320011)		
Objective (ID):	Reduce overall flood risk (9032)		
Delivery lead:	—		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Everyone is responsible for protecting themselves and their property from flooding. Property and business owners can take simple steps to reduce damage and disruption to their homes and businesses should flooding happen. This includes preparing a flood plan and flood kit, installing property level protection, signing up to Floodline and Resilient Communities initiatives, and ensuring that properties and businesses are insured against flood damage.		

Action (ID):	**AWARENESS RAISING** (90320013)		
Objective (ID):	Reduce overall flood risk (9032)		
Delivery lead:	Responsible authorities		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	SEPA and the responsible authorities have a duty to raise public awareness of flood risk. Improved awareness of flood risk and actions that prepare individuals, homes and businesses for flooding can reduce the overall impact. From 2016 SEPA will engage with the community through local participation in national initiatives, including partnership working with Neighbourhood Watch Scotland. In addition, SEPA will engage with local authorities and community resilience groups where possible. Local authorities will be undertaking additional awareness raising activities. Further details will be set out in the Local FRM Plan.		

Action (ID):	**MAINTENANCE** (90320007)		
Objective (ID):	Reduce overall flood risk (9032)		
Delivery lead:	Clackmannanshire Council, asset / land managers		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Local authorities have a duty to assess watercourses and carry out clearance and repair works where such works would substantially reduce flood risk. They produce schedules of clearance and repair works and make these available for public inspection. Scottish Water undertake inspection and repair on the public sewer network. Asset owners and riparian landowners are responsible for the maintenance and management of their own assets including those which help to reduce flood risk.		

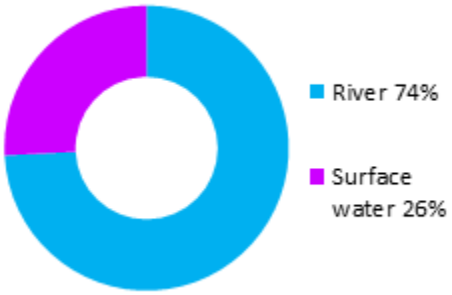
Action (ID):	**EMERGENCY PLANS/RESPONSE** (90320014)		
Objective (ID):	Reduce overall flood risk (9032)		
Delivery lead:	Category 1 and 2 Responders		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Providing an emergency response to flooding is the responsibility of many organisations, including local authorities, the emergency services and SEPA. Effective management of an emergency response relies on emergency plans that are prepared under the Civil Contingencies Act 2004 by Category 1 and 2 Responders. The emergency response by these organisations is co-ordinated through regional and local resilience partnerships. This response may be supported by the work of voluntary organisations.		

Action (ID):	**PLANNING POLICIES** (90010001)		
Objective (ID):	Avoid an overall increase in flood risk (9001) Reduce overall flood risk (9032)		
Delivery lead:	Planning authority		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Scottish Planning Policy and accompanying Planning Advice Notes set out Scottish Ministers' priorities for the operation of the planning system and for the development and use of land. In terms of flood risk management, the policy supports a catchment-scale approach to sustainable flood risk management and aims to build the resilience of our cities and towns, encourage sustainable land management in our rural areas, and to address the long-term vulnerability of parts of our coasts and islands. Under this approach, new development in areas with medium to high likelihood of flooding should be avoided. For further information on the application of national planning policies see Annex 2.		

Clackmannan and Forestmill (Potentially Vulnerable Area 09/11)

Local Plan District	Local authority	Main catchment
Forth	Clackmannanshire Council, Fife Council	Stirling coastal

Summary of flooding impacts



At risk of flooding

- <10 residential properties
- 10 non-residential properties
- £96,000 Annual Average Damages

(damages by flood source shown left)

Summary of objectives to manage flooding

Objectives have been set by SEPA and agreed with flood risk management authorities. These are the aims for managing local flood risk. The objectives have been grouped in three main ways: by reducing risk, avoiding increasing risk or accepting risk by maintaining current levels of management.

Many organisations, such as Scottish Water and energy companies, actively maintain and manage their own assets including their risk from flooding. Where known, these actions are described here. Scottish Natural Heritage and Historic Environment Scotland work with site owners to manage flooding where appropriate at designated environmental and/or cultural heritage sites. These actions are not detailed further in the Flood Risk Management Strategies.

Summary of actions to manage flooding

The actions below have been selected to manage flood risk.

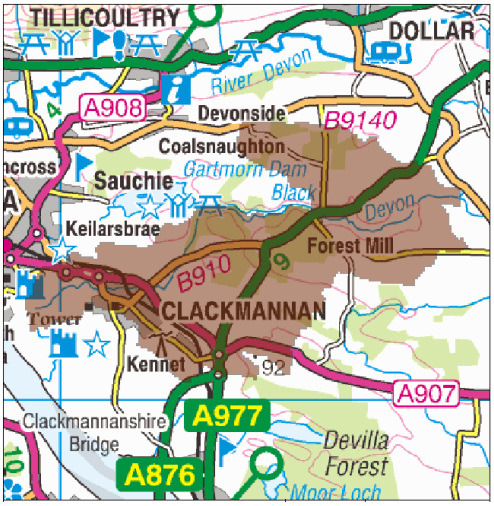
Flood protection scheme/works	*Natural flood management works*	*New flood warning*	*Community flood action groups*	*Property level protection scheme*	*Site protection plans*
Flood protection study	*Natural flood management study*	*Maintain flood warning*	Awareness raising	*Surface water plan/study*	Emergency plans/response
Maintain flood protection scheme	Strategic mapping and modelling	Flood forecasting	Self help	Maintenance	Planning policies

Clackmannan and Forestmill (Potentially Vulnerable Area 09/11)

Local Plan District	Local authority	Main catchment
Forth	Clackmannanshire Council, Fife Council	Stirling coastal

Background

This Potentially Vulnerable Area is 23km^2 and is part of the Stirling catchment (shown below). This is a large, mainly rural catchment to the east of Alloa and includes the small urban areas of Clackmannan and Forestmill.



The main watercourses which cause flooding are the Black Devon and its tributary, the Goudnie Burn.

The area has a risk of river and surface water flooding. The majority of damages are caused by river flooding.

There are fewer than 10 residential properties and approximately 10 non-residential properties at risk of flooding. The Annual Average Damages are approximately £96,000.

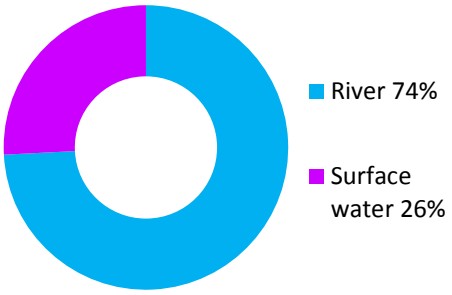


Figure 1: Annual Average Damages by flood source

Summary of flooding impacts

Work carried out since the National Flood Risk Assessment in 2011 has concluded that the risk of flooding in this Potentially Vulnerable Area is now relatively low. The designation of this Potentially Vulnerable Area will be reviewed in the next flood risk management planning cycle.

The greatest risk of flooding is to Clackmannan from the Black Devon. The risk of flooding to people and property, as well as to community facilities, utilities, the transport network, designated sites and agricultural land is summarised in Table 1.

The damages associated with floods of different likelihood are shown in Figure 2. For this Potentially Vulnerable Area the highest damages are to residential properties followed by damages to roads, notably the A907. The location of the impacts of flooding is shown in Figure 3.

The figures presented for Annual Average Damages include damages to residential properties, non-residential properties, transport and agriculture.

	1 in 10 High likelihood	1 in 200 Medium likelihood	1 in 1000 Low likelihood
Residential properties (total 1,700)	<10	<10	10
Non-residential properties (total 130)	<10	10	20
People	20	20	20
Community facilities	0	0	0
Utilities	0	<10	<10
Transport links (excluding minor roads)	2 A roads, 1 B road at 40 locations	2 A roads, 1 B road at 40 locations	2 A roads, 1 B road at 55 locations
Environmental designated areas km^2)	0.1	0.1	0.1
Designated cultural heritage sites	0	0	0
Agricultural land (km^2)	1.0	1.2	1.3

Table 1: Summary of flooding impacts

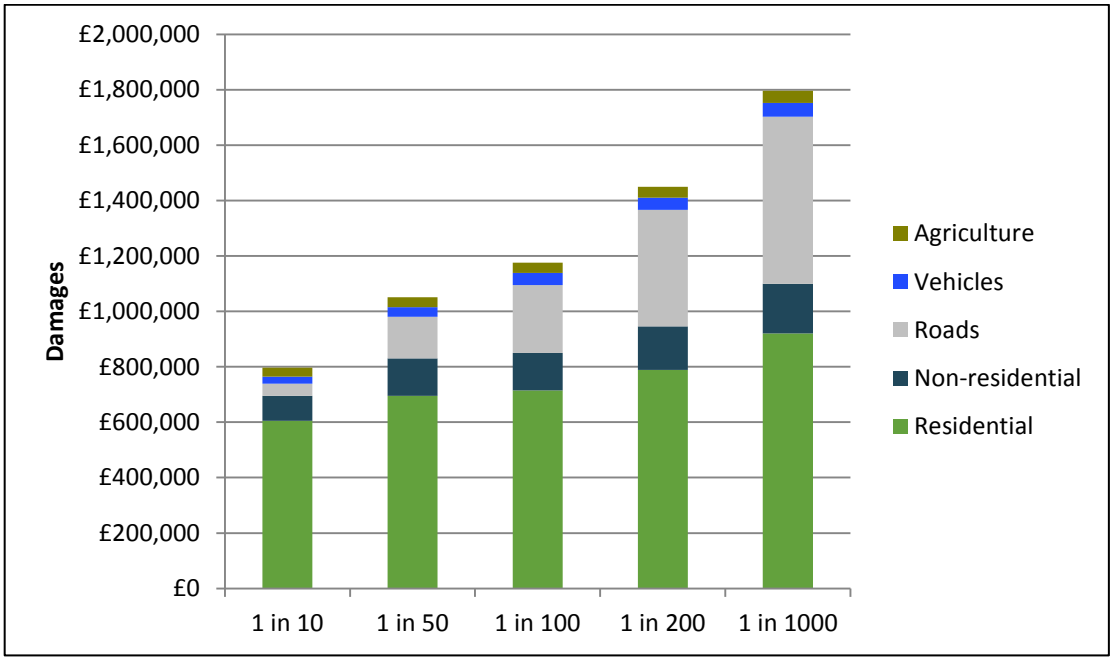


Figure 2: Damages by flood likelihood

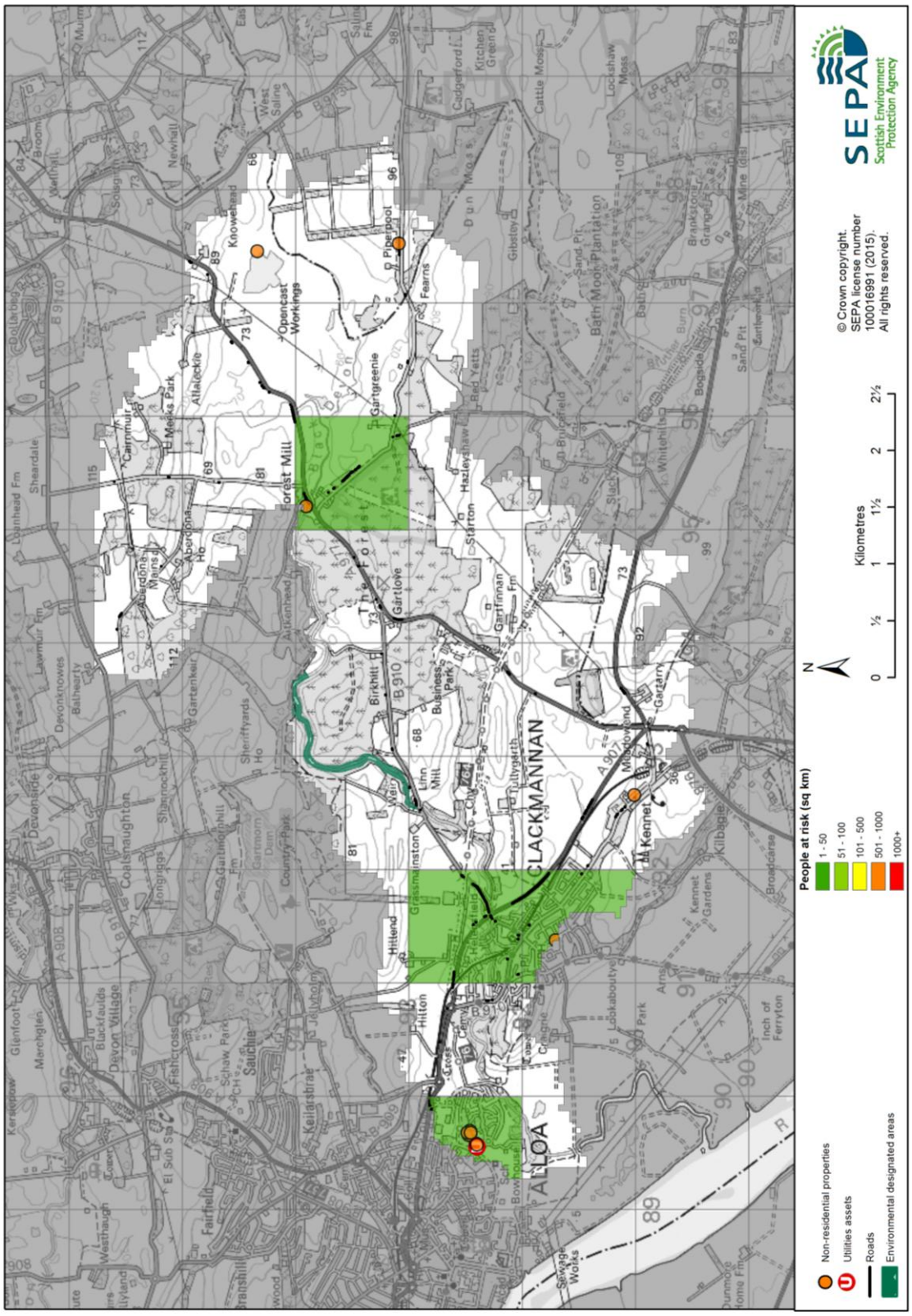


Figure 3: Impacts of flooding

History of flooding

There is a record of one significant flood in this area. In December 2006 the River Forth flooded resulting in large areas of the carse being inundated, including a number of rural residential properties.

Objectives to manage flooding in Potentially Vulnerable Area 09/11

Objectives provide a common goal and shared ambition for managing floods. These objectives have been set by SEPA and agreed with flood risk management authorities following consultation. They were identified through an assessment of the underlying evidence of the causes and impacts of flooding. Target areas have been set to focus actions; they do not necessarily correspond to areas at risk in SEPA's flood map. The objectives below have been set for Clackmannan and Forestmill Potentially Vulnerable Area.

Target area	Objective	ID	Indicators within PVA
Applies across Forth Local Plan District	Avoid an overall increase in flood risk	9001	• 10 non-residential properties • £96,000 Annual Average Damages
Applies across Forth Local Plan District	Reduce overall flood risk	9032	• 10 non-residential properties • £96,000 Annual Average Damages
Applies across Forth Local Plan District	Organisations such as Scottish Water, energy companies and Historic Environment Scotland actively maintain and manage their own assets, including the risk of flooding. These actions are not detailed further in the Flood Risk Management Strategies.		

Actions to manage flooding in Potentially Vulnerable Area 09/11

Actions describe where and how flood risk will be managed. These actions have been set by SEPA and agreed with flood risk management authorities following consultation. Selection of actions to deliver the agreed objectives was based on a detailed assessment and comparison of economic, social and environmental criteria. The actions shaded and then described below have been selected as the most appropriate for Clackmannan and Forestmill Potentially Vulnerable Area.

Selected actions					
Flood protection scheme/works	*Natural flood management works*	*New flood warning*	*Community flood action groups*	*Property level protection scheme*	*Site protection plans*
Flood protection study	*Natural flood management study*	*Maintain flood warning*	Awareness raising	*Surface water plan/study*	Emergency plans/response
Maintain flood protection scheme	Strategic mapping and modelling	Flood forecasting	Self help	Maintenance	Planning policies

Action (ID):	**STRATEGIC MAPPING AND MODELLING** (90320019)		
Objective (ID):	Reduce overall flood risk (9032)		
Delivery lead:	Scottish Water		
Status:	**Not started**	Indicative delivery:	**2016-2021**
Description:	Scottish Water will review the assessment of flood risk within the highest risk sewer catchments to improve knowledge and understanding of surface water flood risk.		

Action (ID):	**FLOOD FORECASTING** (90320009)		
Objective (ID):	Reduce overall flood risk (9032)		
Delivery lead:	SEPA		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	The Scottish Flood Forecasting Service is a joint initiative between SEPA and the Met Office that produces daily, national flood guidance statements which are issued to Category 1 and 2 Responders. The service also provides information which allows SEPA to issue flood warnings, giving people a better chance of reducing the impact of flooding on their home or business. For more information please visit SEPA's website.		

Action (ID):	**SELF HELP** (90320011)		
Objective (ID):	Reduce overall flood risk (9032)		
Delivery lead:	—		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Everyone is responsible for protecting themselves and their property from flooding. Property and business owners can take simple steps to reduce damage and disruption to their homes and businesses should flooding happen. This includes preparing a flood plan and flood kit, installing property level protection, signing up to Floodline and Resilient Communities initiatives, and ensuring that properties and businesses are insured against flood damage.		

Action (ID):	**AWARENESS RAISING** (90320013)		
Objective (ID):	Reduce overall flood risk (9032)		
Delivery lead:	Responsible authorities		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	SEPA and the responsible authorities have a duty to raise public awareness of flood risk. Improved awareness of flood risk and actions that prepare individuals, homes and businesses for flooding can reduce the overall impact. From 2016 SEPA will engage with the community through local participation in national initiatives, including partnership working with Neighbourhood Watch Scotland. In addition, SEPA will engage with local authorities and community resilience groups where possible. Local authorities will be undertaking additional awareness raising activities. Further details will be set out in the Local FRM Plan.		

Action (ID):	**MAINTENANCE** (90320007)		
Objective (ID):	Reduce overall flood risk (9032)		
Delivery lead:	Clackmannanshire Council and Fife Council, asset / land managers		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Local authorities have a duty to assess watercourses and carry out clearance and repair works where such works would substantially reduce flood risk. They produce schedules of clearance and repair works and make these available for public inspection. Scottish Water undertake inspection and repair on the public sewer network. Asset owners and riparian landowners are responsible for the maintenance and management of their own assets including those which help to reduce flood risk.		

Action (ID):	**EMERGENCY PLANS/RESPONSE** (90320014)		
Objective (ID):	Reduce overall flood risk (9032)		
Delivery lead:	Category 1 and 2 Responders		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Providing an emergency response to flooding is the responsibility of many organisations, including local authorities, the emergency services and SEPA. Effective management of an emergency response relies on emergency plans that are prepared under the Civil Contingencies Act 2004 by Category 1 and 2 Responders. The emergency response by these organisations is co-ordinated through regional and local resilience partnerships. This response may be supported by the work of voluntary organisations.		

Action (ID):	**PLANNING POLICIES** (90010001)		
Objective (ID):	Avoid an overall increase in flood risk (9001) Reduce overall flood risk (9032)		
Delivery lead:	Planning authority		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Scottish Planning Policy and accompanying Planning Advice Notes set out Scottish Ministers' priorities for the operation of the planning system and for the development and use of land. In terms of flood risk management, the policy supports a catchment-scale approach to sustainable flood risk management and aims to build the resilience of our cities and towns, encourage sustainable land management in our rural areas, and to address the long-term vulnerability of parts of our coasts and islands. Under this approach, new development in areas with medium to high likelihood of flooding should be avoided. For further information on the application of national planning policies see Annex 2.		

Blackford (Candidate Potentially Vulnerable Area 09/12c)

Local Plan District	Local authority	Main catchment
Forth	Perth and Kinross Council, Stirling Council	Allan Water

Summary of flooding impacts

At risk of flooding

- 50 residential properties
- 20 non-residential properties
- £270,000 Annual Average Damages

(damages by flood source shown left)

Summary of objectives to manage flooding

Objectives have been set by SEPA and agreed with flood risk management authorities. These are the aims for managing local flood risk. The objectives have been grouped in three main ways: by reducing risk, avoiding increasing risk or accepting risk by maintaining current levels of management.

Many organisations, such as Scottish Water and energy companies, actively maintain and manage their own assets including their risk from flooding. Where known, these actions are described here. Scottish Natural Heritage and Historic Environment Scotland work with site owners to manage flooding where appropriate at designated environmental and/or cultural heritage sites. These actions are not detailed further in the Flood Risk Management Strategies.

Summary of actions to manage flooding

The actions below have been selected to manage flood risk.

Flood protection scheme/works	*Natural flood management works*	*New flood warning*	*Community flood action groups*	*Property level protection scheme*	*Site protection plans*
Flood protection study	*Natural flood management study*	*Maintain flood warning*	Awareness raising	*Surface water plan/study*	Emergency plans/response
Maintain flood protection scheme	*Strategic mapping and modelling*	Flood forecasting	Self help	Maintenance	Planning policies

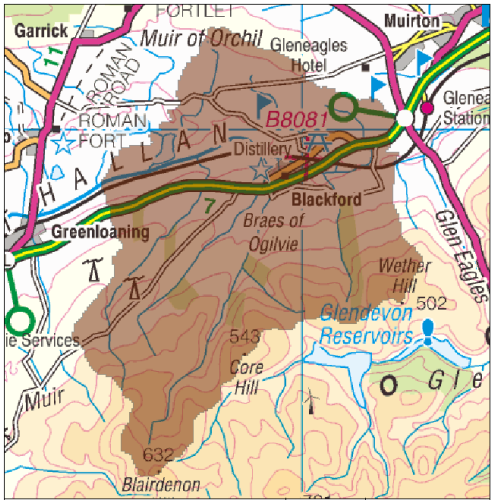
Blackford (Candidate Potentially Vulnerable Area 09/12c)

Local Plan District	Local authority	Main catchment
Forth	Perth and Kinross Council, Stirling Council	Allan Water

Background

This candidate Potentially Vulnerable Area is 47km^2 and is part of the Stirling catchment (shown right). It is a small, mainly rural catchment which lies near the source of the Allan Water and includes a number of smaller watercourses such as the Burn of Ogilvie, Danny Burn, Back Burn and Kinpauch Burn. It includes the urban area of Blackford. All damages in this area are caused by river flooding.

There are approximately 50 residential properties and 20 non-residential properties at risk of flooding. The Annual Average Damages are approximately £270,000.



Summary of flooding impacts

Whilst this area was not identified as a Potentially Vulnerable Area in 2011, the information on flood risk from the new hazard maps identified that this area should be regarded as a candidate future Potentially Vulnerable Area due to the potential risk to people and property.

The highest risk of flooding is from the Danny Burn to Blackford.

The risk of flooding to people, property, as well as to community facilities, utilities, the transport network, designated sites and agricultural land is summarised in Table 1.

The damages associated with floods of different likelihood are shown in Figure 1. For this candidate Potentially Vulnerable Area the highest damages are to residential properties. The location of the impacts of flooding is shown in Figure 2.

The figures presented for Annual Average Damages include damages to residential properties, non-residential properties, transport and agriculture.

	1 in 10 High likelihood	1 in 200 Medium likelihood	1 in 1000 Low likelihood
Residential properties (total 370)	30	50	60
Non-residential properties (total 110)	<10	20	20
People	60	110	140
Community facilities	0	0	0
Utilities	<10	<10	<10
Transport links (excluding minor roads)	1 A road at 2 locations	1 A road at 2 locations	1 A road at 4 locations
Environmental designated areas (km^2)	0.9	1.0	1.0
Designated cultural heritage sites	1	1	1
Agricultural land (km^2)	1.6	1.9	2.2

Table 1: Summary of flooding impacts

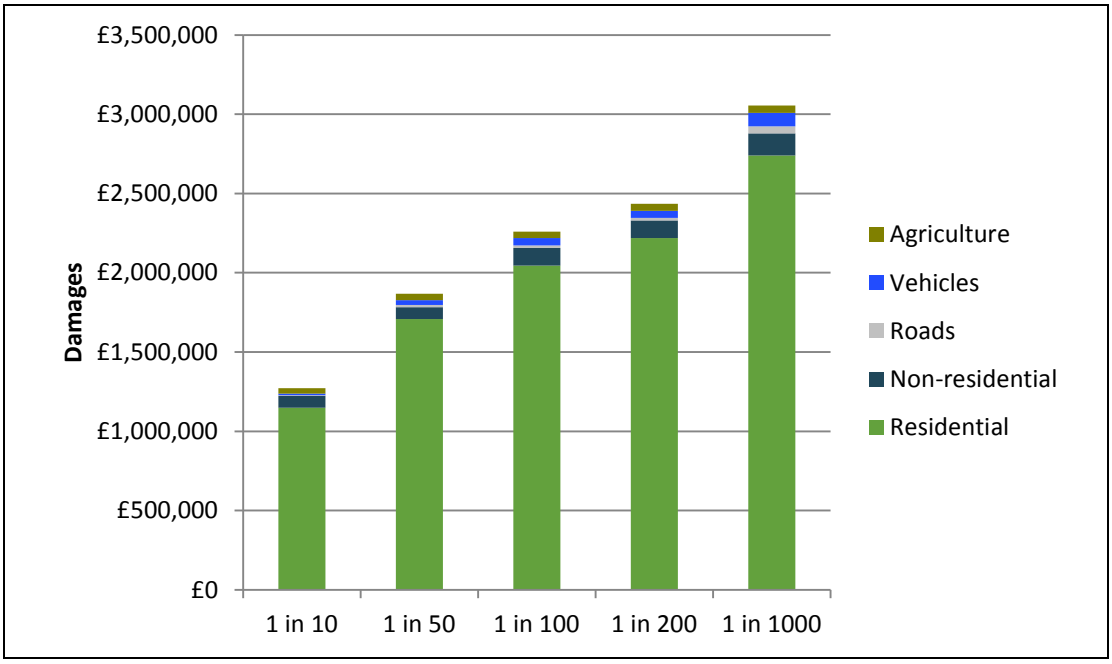


Figure 1: Damages by flood likelihood

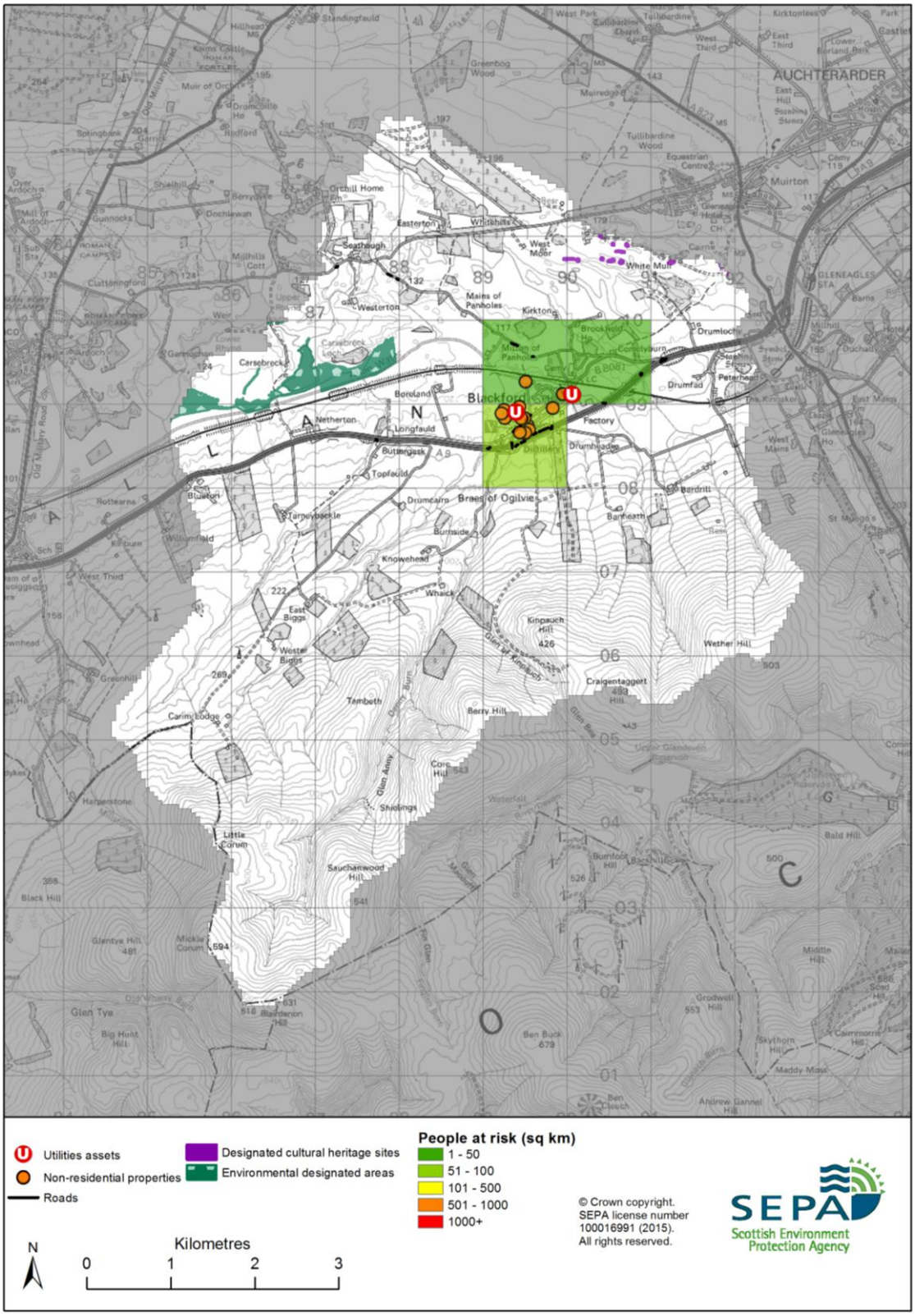


Figure 2: Impacts of flooding

History of flooding

One significant river flood has been recorded in this area. On 13 December 2006 properties in Abercairney Place, Blackford and surrounding areas were flooded. This was associated with widespread flooding over the Perth and Kinross area.

Objectives to manage flooding in Potentially Vulnerable Area 09/12c

Objectives provide a common goal and shared ambition for managing floods. These objectives have been set by SEPA and agreed with flood risk management authorities following consultation. They were identified through an assessment of the underlying evidence of the causes and impacts of flooding. Target areas have been set to focus actions; they do not necessarily correspond to areas at risk in SEPA's flood map. The objectives below have been set for Blackford Candidate Potentially Vulnerable Area.

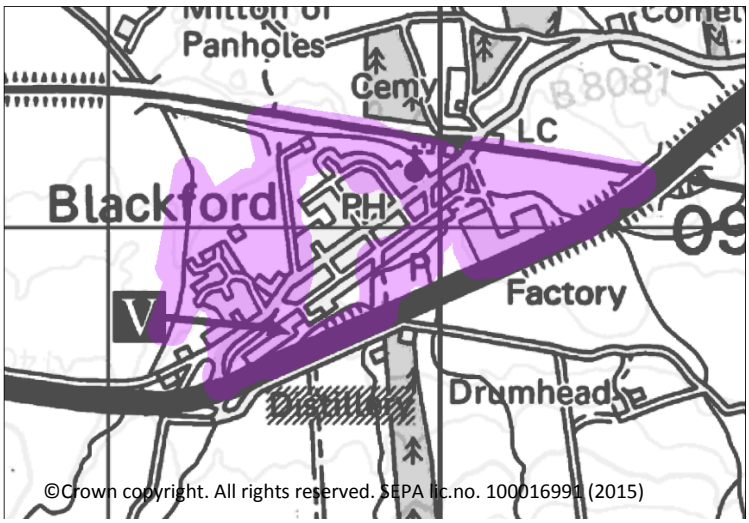
Reduce economic damages to residential and non-residential properties in Blackford caused by flooding from the Allan Water, Danny Burn, Burn of Ogilvie, Back Burn and Kinpauch Burn

Indicators:

- £140,000 Annual Average Damages from residential properties
- £97,000 Annual Average Damages from non-residential properties

Objective ID: 9031

Target area:



Target area	Objective	ID	Indicators within PVA
Applies across Forth Local Plan District	Avoid an overall increase in flood risk	9001	• 50 residential properties • £270,000 Annual Average Damages
Applies across Forth Local Plan District	Reduce overall flood risk	9032	• 50 residential properties • £270,000 Annual Average Damages
Applies across Forth Local Plan District	Organisations such as Scottish Water, energy companies and Historic Environment Scotland actively maintain and manage their own assets, including the risk of flooding. These actions are not detailed further in the Flood Risk Management Strategies.		

Actions to manage flooding in Potentially Vulnerable Area 09/12c

Actions describe where and how flood risk will be managed. These actions have been set by SEPA and agreed with flood risk management authorities following consultation. Selection of actions to deliver the agreed objectives was based on a detailed assessment and comparison of economic, social and environmental criteria. The actions shaded and then described below have been selected as the most appropriate for Blackford Candidate Potentially Vulnerable Area.

Selected actions					
Flood protection scheme/works	*Natural flood management works*	*New flood warning*	*Community flood action groups*	*Property level protection scheme*	*Site protection plans*
Flood protection study	*Natural flood management study*	*Maintain flood warning*	Awareness raising	*Surface water plan/study*	Emergency plans/response
Maintain flood protection scheme	*Strategic mapping and modelling*	Flood forecasting	Self help	Maintenance	Planning policies

Action (ID):	**FLOOD PROTECTION STUDY** (90310005)		
Objective (ID):	Reduce economic damages to residential and non-residential properties in Blackford caused by flooding from the Allan Water, Danny Burn, Burn of Ogilvie, Back Burn and Kinpauch Burn (9031)		
Delivery lead:	Perth and Kinross Council		
Priority:	National:	Within local authority:	
	43 of 168	**3 of 6**	
Status:	**Not started**	Indicative delivery:	**2016-2021**
Description:	A flood protection study has been recommended for Blackford to assess whether flood defences, modification of conveyance, sediment management and natural flood management could reduce flood risk. The study should also investigate the viability of property level protection. Natural flood management options that should be considered include runoff control and sediment management. The study should take a catchment approach and consider the potential benefits and disbenefits and interaction between actions upstream and downstream.		
Potential impacts			
Economic:	The study could benefit 50 residential properties and 17 non-residential properties at risk of flooding in this location, with potential damages avoided of up to £7.7 million. Thirty-three of these residential and non-residential properties are at risk from high likelihood flooding and may benefit from natural flood management actions.		
Social:	Social impacts will depend on the outcome of the study and recommended actions. A reduction in flood risk would have a positive benefit to the health and wellbeing of the community. Natural flood management actions can restore and enhance natural environments		

Social:	and create opportunities for recreation and tourism.
Environmental:	Flood protection studies should consider the positive and negative impacts of proposed actions on the ecological quality of the environment and designated sites. Where possible opportunities to enhance and restore the environment should be sought, for example through natural flood management. Allan Water (water body ID 4601) is located within the study area and the physical condition of this river is identified by SEPA to be at less than good status. Opportunities to improve the condition of the river should be considered by coordinating with river basin management planning. To be in accord with the FRM Strategy, the responsible authority should seek to ensure as part of the study that the action will not have an adverse effect on the integrity of the Shelforkie Moss Special Area of Conservation and South Tayside Goose Roosts Special Protection Area.

Action (ID):	**FLOOD FORECASTING** (90320009)		
Objective (ID):	Reduce overall flood risk (9032)		
Delivery lead:	SEPA		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	The Scottish Flood Forecasting Service is a joint initiative between SEPA and the Met Office that produces daily, national flood guidance statements which are issued to Category 1 and 2 Responders. The service also provides information which allows SEPA to issue flood warnings, giving people a better chance of reducing the impact of flooding on their home or business. For more information please visit SEPA's website.		

Action (ID):	**SELF HELP** (90320011)		
Objective (ID):	Reduce overall flood risk (9032)		
Delivery lead:	—		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Everyone is responsible for protecting themselves and their property from flooding. Property and business owners can take simple steps to reduce damage and disruption to their homes and businesses should flooding happen. This includes preparing a flood plan and flood kit, installing property level protection, signing up to Floodline and Resilient Communities initiatives, and ensuring that properties and businesses are insured against flood damage.		

Action (ID):	**AWARENESS RAISING** (90320013)		
Objective (ID):	Reduce overall flood risk (9032)		
Delivery lead:	Responsible authorities		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	SEPA and the responsible authorities have a duty to raise public awareness of flood risk. Improved awareness of flood risk and actions that prepare individuals, homes and businesses for flooding can reduce the overall impact. From 2016 SEPA will engage with the community through local participation in national initiatives, including partnership working with Neighbourhood Watch Scotland. In addition, SEPA will engage with local authorities and community resilience groups where possible. Local authorities will be undertaking additional awareness raising activities. Further details will be set out in the Local FRM Plan.		

Action (ID):	**MAINTENANCE** (90320007)		
Objective (ID):	Reduce overall flood risk (9032)		
Delivery lead:	Local authorities, asset / land managers		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Local authorities have a duty to assess watercourses and carry out clearance and repair works where such works would substantially reduce flood risk. They produce schedules of clearance and repair works and make these available for public inspection. Scottish Water undertake inspection and repair on the public sewer network. Asset owners and riparian landowners are responsible for the maintenance and management of their own assets including those which help to reduce flood risk.		

Action (ID):	**EMERGENCY PLANS/RESPONSE** (90320014)		
Objective (ID):	Reduce overall flood risk (9032)		
Delivery lead:	Category 1 and 2 Responders		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Providing an emergency response to flooding is the responsibility of many organisations, including local authorities, the emergency services and SEPA. Effective management of an emergency response relies on emergency plans that are prepared under the Civil Contingencies Act 2004 by Category 1 and 2 Responders. The emergency response by these organisations is co-ordinated through regional and local resilience partnerships. This response may be supported by the work of voluntary organisations.		

Action (ID):	**PLANNING POLICIES** (90010001)		
Objective (ID):	Avoid an overall increase in flood risk (9001) Reduce overall flood risk (9032)		
Delivery lead:	Planning authority		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	Scottish Planning Policy and accompanying Planning Advice Notes set out Scottish Ministers' priorities for the operation of the planning system and for the development and use of land. In terms of flood risk management, the policy supports a catchment-scale approach to sustainable flood risk management and aims to build the resilience of our cities and towns, encourage sustainable land management in our rural areas, and to address the long-term vulnerability of parts of our coasts and islands. Under this approach, new development in areas with medium to high likelihood of flooding should be avoided. For further information on the application of national planning policies see Annex 2.		

Flood Risk Management Strategy

Forth Local Plan District

This section provides supplementary information on the characteristics and impacts of river, coastal and surface water flooding. Future impacts due to climate change, the potential for natural flood management and links to river basin management are also described within these chapters.

Detailed information about the objectives and actions to manage flooding are provided in Section 2.

Section 3: Supporting information

3.1 Introduction

In the Forth Local Plan District, river flooding is reported across two distinct river catchments. Coastal flooding and surface water flooding are reported across the whole Local Plan District.

A summary of the number of properties and Annual Average Damages from river, coastal and surface water flooding is outlined in Table 1.

	Total number of properties at risk[1]	Annual Average Damages	Local authority
River catchments			
River Forth catchment	430	£1.4 million	Stirling Council
Stirling catchment group	3,100	£4.1 million	Clackmannanshire Council Fife Council Perth and Kinross Council Stirling Council
Coastal flooding			
Forth coastal area	190	£240,000	Clackmannanshire Council Stirling Council
Surface water flooding			
Forth Local Plan District	950	£2.3 million	Clackmannanshire Council Fife Council Perth and Kinross Council Stirling Council

Table 1: Summary of flood risk from various sources within the Forth Local Plan District

[1] Total number of residential and non-residential properties at risk of flooding.

3.2 River flooding

Forth Local Plan District

This section provides supplementary information on river flooding at the catchment level. It provides an overview of the catchment's natural characteristics, flood risk and the existing actions to manage flooding. It outlines the likely impact of climate change and the potential for natural flood management.

Detailed information about the objectives and actions to manage flooding are provided in Section 2.

In the Forth Local Plan District, river flooding is reported across two distinct river catchments, shown below.

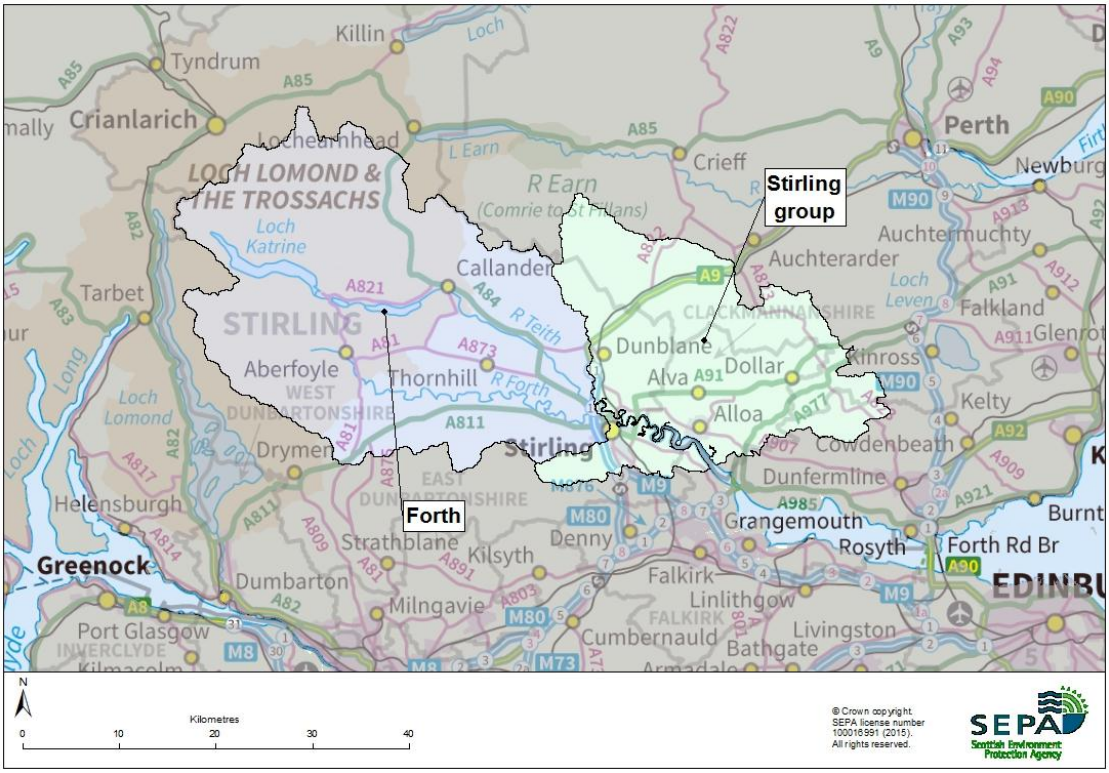


Figure 1: River catchments within the Forth Local Plan District

River flooding
River Forth catchment

Catchment overview

The River Forth drains a catchment area of 1,028km^2 before it discharges into the Forth Estuary. This is a large, predominately rural catchment with three main tributaries: the River Forth, the River Teith and the Allan Water. The rivers have very steep headwaters before flowing across expansive floodplains and joining immediately upstream of Stirling.

Land use in the low-lying parts of the catchment is dominated by agriculture. In the south of the catchment there are large areas of rough grassland and coniferous woodland. The north of the catchment is dominated by acid grassland, upland heather and montane habitats.

The largest lochs in the catchment include Loch Katrine, Loch Lubnaig and Loch Venachar, all of which are in the River Teith catchment.

The annual rainfall for this catchment is average for Scotland, with 900-1000mm falling in the lower catchment, rising to 2000-3000mm in the upper catchment.

Flood risk in the catchment

Within the River Forth catchment approximately 310 residential properties and 120 non-residential properties are at risk of river flooding. It is estimated that 76% of these properties are located within Potentially Vulnerable Areas. There are two Potentially Vulnerable Areas at risk of river flooding in this catchment area (Figure 1):

- Trossachs (09/01)
- Gargunnock (09/06).

Main areas at risk

The main areas with a risk of river flooding can be seen in Table 1. The table shows the number of properties at risk and the Annual Average Damages caused by river flooding. This includes damages to residential and non-residential properties, transport and agriculture.

	Residential and non-residential properties at risk of river flooding	Annual Average Damages
Aberfoyle	100	£320,000
Callander	70	£88,000
Gargunnock	50	£120,000
Strathyre	20	£71,000
Balquihidder	10	£46,000

Table 1: Main areas at risk of river flooding

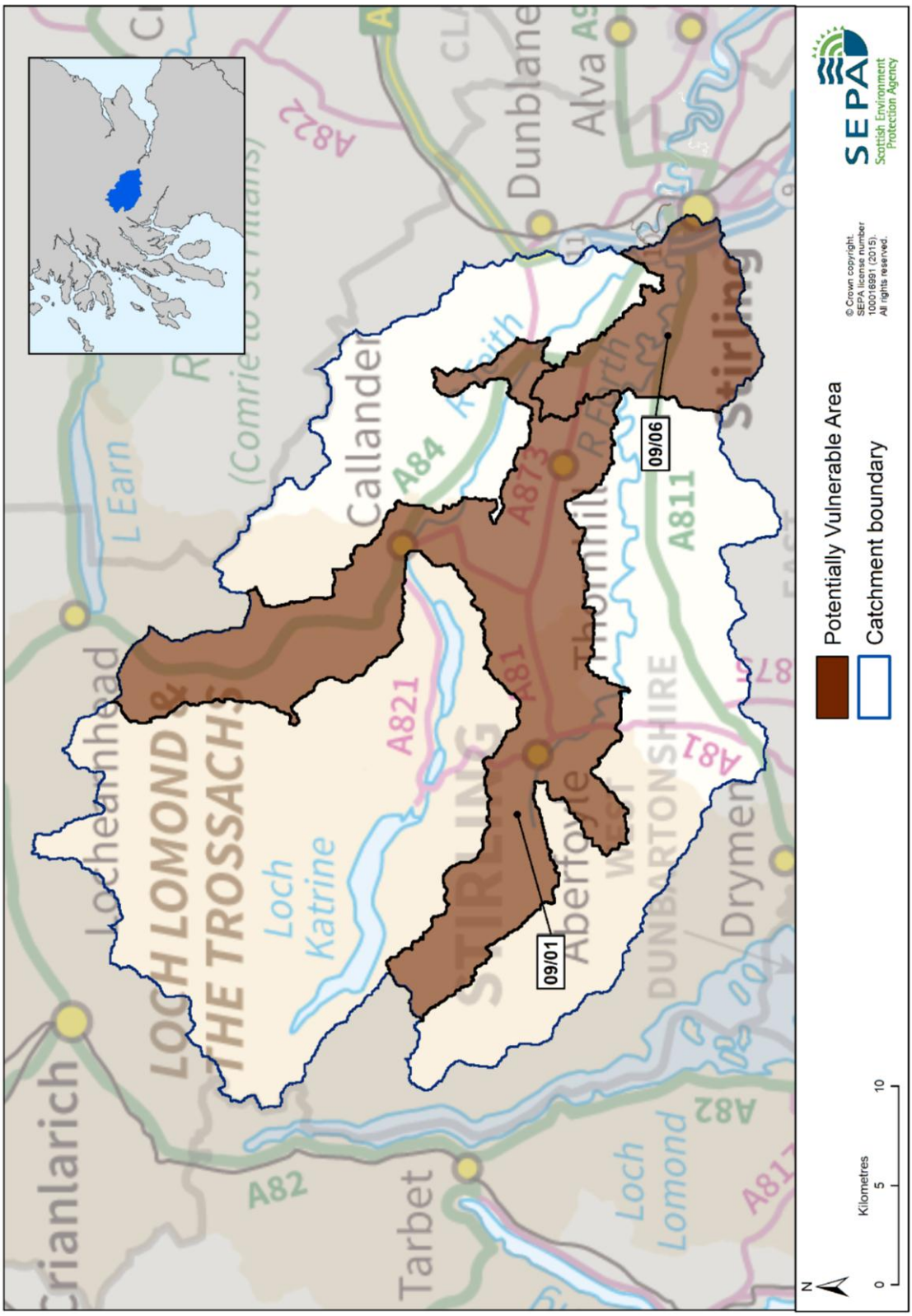


Figure 1: The River Forth catchment

Economic activity and infrastructure at risk

The Annual Average Damages caused by river flooding in the River Forth catchment are approximately £1.4 million. The damages are distributed as follows:

- 45% residential properties (£630,000)
- 35% non-residential properties (£480,000)
- 8% emergency services (£110,000)
- 6% agriculture (£90,000)
- 4% roads (£60,000)
- 2% vehicles (£30,000).

Figure 2 shows the Annual Average Damages throughout the catchment. The highest damages can be seen south of Aberfoyle, Gargunnock and in north west Stirling.

Table 2 shows further information about infrastructure and agricultural land at risk of flooding within this catchment.

	Number at risk	Further detail
Community facilities	<10	Includes: educational buildings and emergency services.
Utility assets	<10	Includes: electricity substations, fuel extraction sites and telephone exchanges.
Roads (excluding minor roads)	14	1 M road (M9) at 8 locations 6 A roads at 220 locations 7 B roads at 176 locations
Railway routes	0	
Agricultural land (km^2)	45.6	

Table 2: Infrastructure and agricultural land at risk of river flooding

Designated environmental and cultural heritage sites at risk

Within the catchment it is estimated that 41 designated cultural heritage sites are at risk of river flooding. These sites include scheduled monuments, gardens and designed landscapes, battlefield sites and listed buildings.

Approximately 26 environmental designated areas have a risk of river flooding. This includes three Special Areas of Conservation, a Special Protection Area and 22 Sites of Special Scientific Interest, including Flanders Moss, Ben Lomond and the Trossachs Woods.

The Loch Lomond and the Trossachs National Park is located within the boundary of the River Forth catchment. The National Park is recognised for the outstanding national importance of its natural and cultural heritage and some of these features may be at risk of flooding.

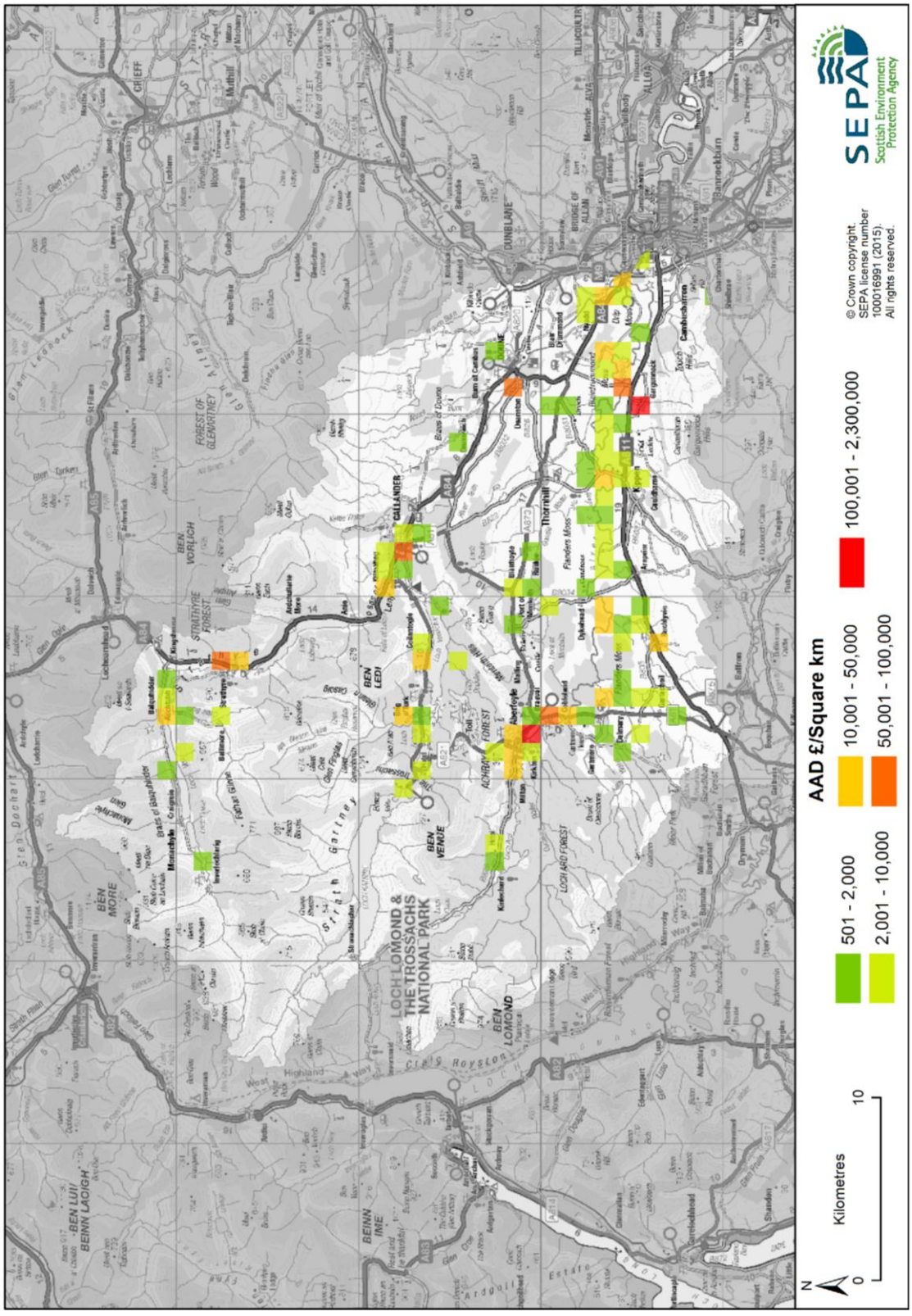


Figure 2: Annual Average Damages from river flooding

History of river flooding

The River Forth has a long history of flooding. The highest river level recorded at the SEPA's Craigforth gauging station on the River Forth was in December 2006, where the river level reached 3.97m above normal levels. This caused significant flooding from the River Allan, River Teith and the River Forth with properties and infrastructure affected in Stirling (Riverside, Bridgehaugh and Cornton), Bridge of Allan, Dunblane, Aberfoyle (Main Street) and Callander (Main Street). The campsite flooded at Strathyre and the A84 closed between Strathyre and Callander.

A recent flood occurred on 19 November 2012 with flooding to Main Street, Aberfoyle and Loch Ard Road from the River Forth. The flood affected five residential properties, 10 businesses, an electricity sub-station, a Scottish Water pumping station and the B829 road. People required rescue by boat on the main street in Aberfoyle.

The earliest flood on record occurred in June 1905 when several properties on Main Street and Leny Road in Callander flooded from the River Teith.

Further detail about the history of flooding in this area is available in the relevant Potentially Vulnerable Area chapters.

Managing flood risk

A range of public bodies have responsibility for managing flood risk in Scotland and they are working closer than ever before to target action in the areas where the greatest benefit can be gained. Members of the public also have a role to play and are the first line of defence against flooding by taking action to protect themselves and their property from flooding. Further information about roles and responsibilities is provided in Section 1.

This section describes the existing actions that are in place to manage flood risk and are in addition to the information presented in the relevant Potentially Vulnerable Area chapters.

River flood warning schemes

There are two river flood warning areas within this catchment as shown in Table 3 and Figure 3. Table 3 shows the total number of properties in the flood warning area and the percentage of those properties that have signed up to receive flood warnings. Please note that this is not the number of properties at risk of flooding.

Flood warning area (FWA)	River	Number of properties within FWA	% of properties registered July 2014
Bridgehaugh	River Forth	39	44%
Callander	River Teith	238	29%
Callander to Stirling	River Teith	59	12%

Table 3: Flood warning areas

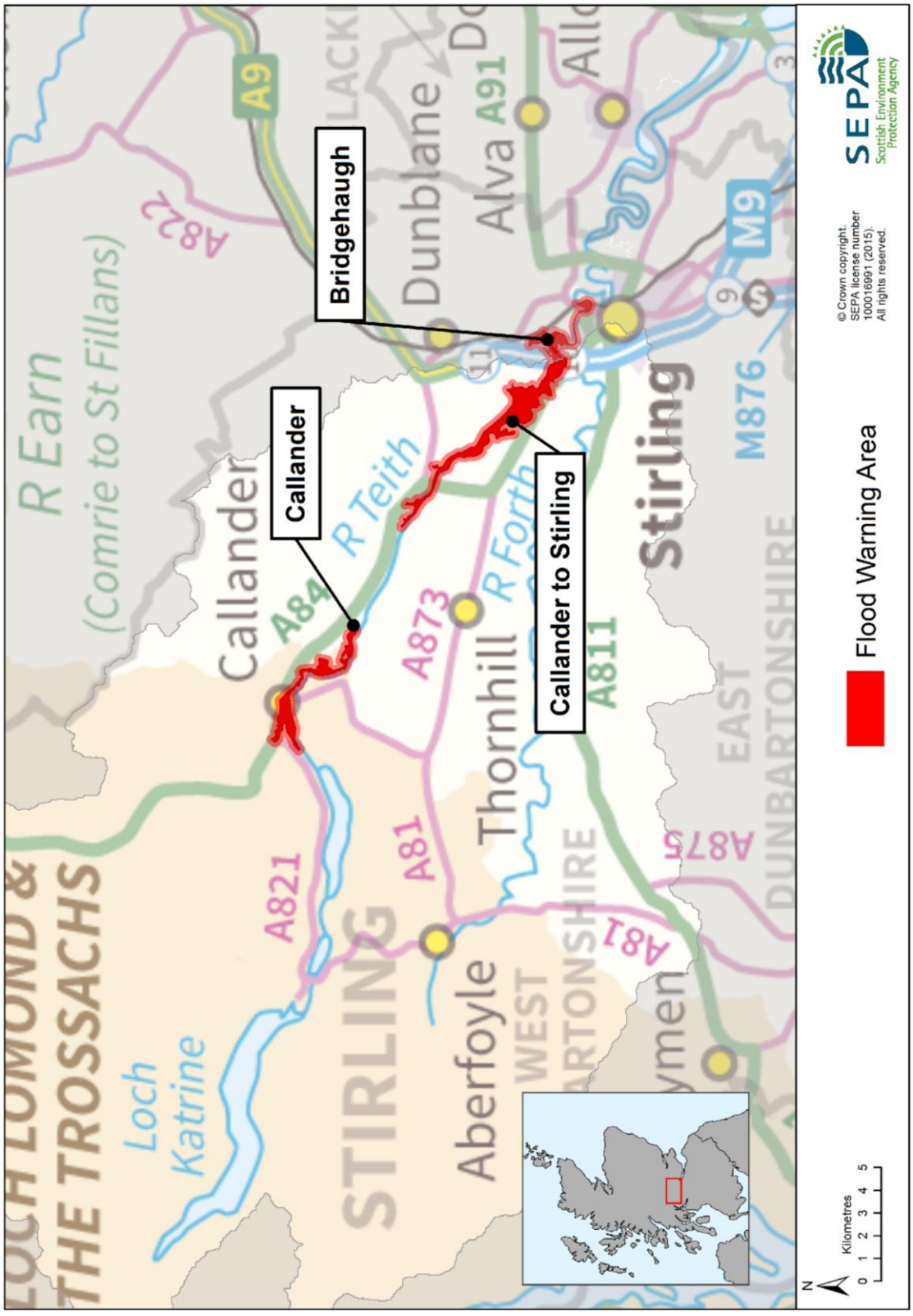


Figure 3: Flood warning areas

Awareness raising campaigns and community groups

The following community groups are known to be active within this catchment:

- Callander Flood Action Group established in 2012
- Aberfoyle Flood Forum established in 2013.

Property level protection

Each local authority has its own incentives or subsidies to help property owners with property level protection.

Climate change and future flood risk

The UK Climate Projections (UKCP09) report predicts that climate change may lead to warmer and drier summers, warmer and wetter winters with less snow, and more extreme temperature and rainfall events. The predicted increase in rainfall and river flows may increase the potential for river flooding.

Under the UKCP09 high emissions scenario for 2080, average peak river flows for the River Forth catchment may increase by 33%[1]. This would potentially increase the number of residential properties at risk of river flooding from approximately 310 to 410 and the number of non-residential properties from approximately 120 to 180.

The predicted increases in flood risk are solely based on the impact of a changing climate on the magnitude of flooding; they do not take into account any potential increase due to population change, development pressures or urban creep, nor do they take into account any mitigation as a result of actions contained in this or future Flood Risk Management Strategies.

Potential for natural flood management

The assessment of the potential for natural flood management is shown on SEPA's flood maps (http://www.sepa.org.uk/environment/water/flooding/flood-maps/). The maps indicate the potential for runoff reduction, floodplain storage and sediment management. They show areas where natural flood management could be effective and where further detailed assessment should take place. This information was used to identify where local authorities could include natural flood management as part of flood risk management schemes and studies. The proposed schemes and studies are listed in the relevant Potentially Vulnerable Area chapters of this document.

Natural flood management initiatives are already underway in this catchment:

- Allan Water natural flood management project
- Duchray catchment natural flood management study
- Callander optioneering report.

Runoff reduction

As might be expected, there is potential for runoff reduction in the upper reaches of tributaries in the Trossachs Potentially Vulnerable Area (09/01). These opportunities are either partially or wholly located within Loch Lomond and The Trossachs National

[1] From the study 'An assessment of the vulnerability of Scotland's river catchments and coasts to the impacts of climate change' (CEH, 2011)

Park. The Duchray catchment, Loch Voil catchment and Loch Katrine catchment all show significant areas of moderate and high runoff reduction potential, which may help to reduce flows within this Potentially Vulnerable Area. There is also a small runoff potential site upstream of the Gargunnock Burn in the Touch Hills. The viability of these potential runoff sites would first require local assessment before quantifying the expected flow reduction benefits.

Floodplain storage

There is potential for floodplain storage within the Duchray catchment, which is currently the subject of a detailed natural flood management study. Prominent moderate and high potential sites are also situated on the Goodie Water upstream of Gargunnock Potentially Vulnerable Area (09/06).

Sediment management

Across the catchment, high sediment deposition and erosion have been identified on the River Forth, River Teith, Loch Ard and Duchray Water. Some of these have been modified by human activity, mainly on the Goodie Water and in southern tributaries of the River Forth. This could partly account for some of the high sediment erosion and deposition but further detailed investigation would be required to determine whether sediment management would be beneficial.

River flooding
Stirling catchment group

Catchment overview

The Stirling catchment group covers an area of 581km^2 and comprises a number of smaller watercourses. The main rivers in this group include the lower River Forth where it meets the Forth Estuary, Bannock Burn, Allan Water, River Devon and Black Devon.

Most of the rivers in this group are relatively steep, flowing from a peak of 721m in the Ochils. These steeper rivers are characteristic of rapid water runoff and can therefore be prone to flash flooding. The lower valleys tend to be broad and relatively flat.

The annual rainfall for this catchment is average for Scotland, with 900mm-1000mm falling in the lower part of the catchment, rising to 1500mm-2000mm in the upper catchment.

Flood risk in the catchment

Within the Stirling catchment group approximately 2,200 residential and 300 non-residential properties are at risk of river flooding. It is estimated that 96% of these properties are located within Potentially Vulnerable Areas. There are nine Potentially Vulnerable Areas and one candidate Potentially Vulnerable Area (09/12c) at risk of river flooding in this catchment group (Figure 1):

- Braco (09/02)
- Dunblane and Bridge of Allan (09/03)
- Hillfoots Villages (09/04)
- Stirling (Cornton and Causewayhead) (09/05)
- Stirling (Raploch and Riverside) (09/07)
- Stirling (Broomridge and St Ninians) (09/08)
- Stirling (Eastern villages) (09/09)
- Cambus, Alloa and Sauchie (09/10)
- Clackmannan and Forestmill (09/11)
- Blackford (09/12c).

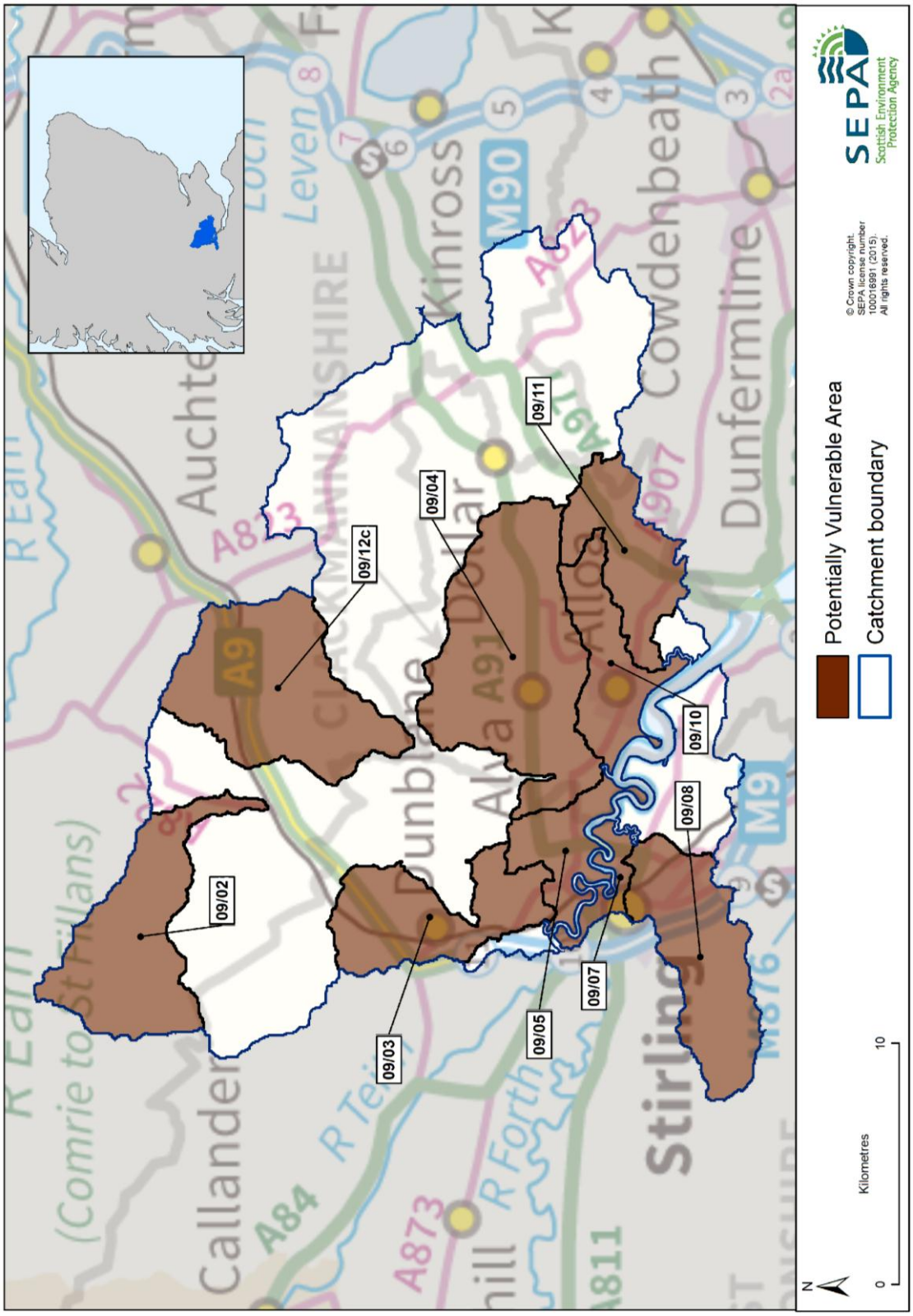


Figure 1: The Stirling catchment group

Main areas at risk

The main areas with a risk of river flooding can be seen in Table 1, along with the number of properties at risk and the Annual Average Damages caused by river flooding. This includes damages to residential and non-residential properties, transport and agriculture.

	Residential and non-residential properties at risk of river flooding	Annual Average Damages
Stirling	1,100	£1.0 million
Tillicoultry	420	£540,000
Bridge of Allan	300	£320,000
Alloa	210	£1.1 million
Menstrie	160	£250,000
Alva	80	£47,000
Blackford	70	£260,000
Braco	30	£26,000
Dollar	20	£150,000
Dunblane	20	£19,000
South Alloa	10	£27,000
Greenloaning	10	£26,000
Forestmill	<10	£33,000
Clackmannan	<10	£33,000
Cambus	<10	£11,000

Table 1: Main areas with a risk of river flooding

Economic activity and infrastructure at risk

The Annual Average Damages caused by river flooding in the Stirling catchment group are estimated to be approximately £4.1 million. The damages are distributed as follows:

- 54% residential properties (£2.2 million)
- 36% non-residential properties (£1.5 million)
- 6% emergency services (£240,000)
- 2% vehicles (£100,000)
- 1% agriculture (£50,000)
- 1% roads (£40,000).

Figure 2 shows the Annual Average Damages throughout the catchment group. The highest can be seen around Stirling due to the high density both residential and non-residential properties at flood risk from the River Forth.

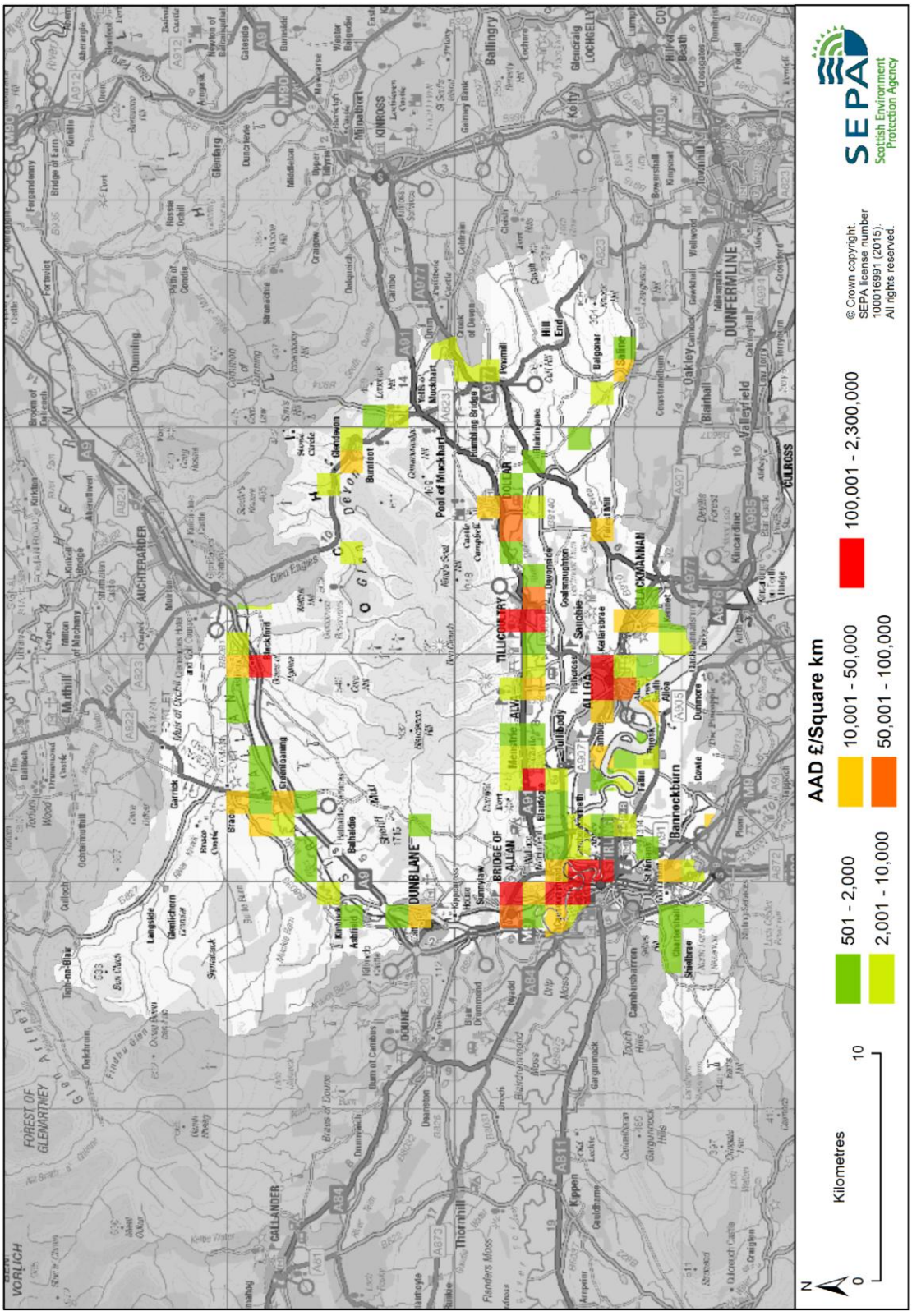


Figure 2: Annual Average Damages from river flooding

Table 2 shows further information about infrastructure and agricultural land at risk of flooding within this catchment group.

	Number at risk	Further detail
Community facilities	<10	Includes: educational buildings, public services and emergency services.
Utility assets	30	Includes: electricity substations, gas regulation and telephone exchanges.
Roads (excluding minor roads)	19	1 M road (M9) at 12 locations 9 A roads at 198 locations 9 B roads at 138 locations
Railway routes	2	Dunblane to Stirling/ Larbert (17 locations at risk), Dundee to Dunblane (25 locations at risk).
Agricultural land (km²)	27.1	

Table 2: Infrastructure and agricultural land at risk of river flooding

Designated environmental and cultural heritage sites at risk

Within this catchment group it is estimated that approximately 16 designated cultural heritage sites are at risk of river flooding. These sites include scheduled monuments, gardens and designed landscapes, battlefield sites and listed buildings.

Approximately 18 environmental designated areas are at risk of river flooding. These include three Special Areas of Conservation, two Special Protection Areas and 13 Sites of Special Scientific Interest. Amongst these areas are Kippenrait Glen, Shelforkie Moss and Back Burn Wood and Meadows.

History of river flooding

The River Forth and the River Devon have a long history of flooding. One of the most significant floods occurred in December 2006 when the highest flood level was recorded at the SEPA Craigforth gauging station from the River Forth with a peak level of 3.97m above normal levels. This caused significant flooding throughout the area from the River Allan and River Forth with properties and infrastructure affected in Stirling (Riverside, Bridgehaugh and Cornton), Bridge of Allan and Dunblane. At Alva, roads crossing the River Devon, including the B908, were impassable due to out of bank flow. During the same event, areas in Perth and Kinross were also affected and Blackford and the surrounding flooded affecting properties.

The highest flood level on record from the River Devon occurred in January 2011 with a peak level of 4.23m above normal levels at Glenochil. All of the main access roads to the Hillfoots Villages were closed due to flooding and a caravan park flooded at Dollarfield, Dollar.

A recent flood occurred on 29 August 2012 when the Menstrie Burn flooded approximately 20 properties and Menstrie House care home required evacuation. The A91 road was closed and a landslide blocked the railway line about half a mile north of Bridge of Allan.

The earliest floods on record date back to November 1786 when a boy was swept away when crossing a bridge in the vicinity of Tillicoultry and in 1785 when the bridge over the River Devon collapsed at Racks Mill, Dollar.

Further detail about the history of flooding in this area is available in the relevant Potentially Vulnerable Area chapters.

Managing flood risk

A range of public bodies have responsibility for managing flood risk in Scotland and they are working closer than ever before to target action in the areas where the greatest benefit can be gained. Members of the public also have a role to play and are the first line of defence against flooding by taking action to protect themselves and their property from flooding. Further information about roles and responsibilities is provided in Section 1.

This section describes the existing actions that are in place to manage flood risk and are in addition to the information presented in the relevant Potentially Vulnerable Area chapters.

Flood protection schemes

There are two formal flood protection schemes to reduce the risk of river flooding:

- Bridge of Allan Flood Prevention Scheme
- Tillicoultry Mixed Leisure Route embankment raising that provides protection to the properties of Elistoun Drive from the River Devon.

River flood warning schemes

There are 12 river flood warning areas within this catchment as shown in Table 3 and Figure 3. Table 3 shows the total number of properties in the flood warning area and the percentage of those properties that have signed up to receive flood warnings. Please note that this is not the number of properties at risk of flooding.

Community groups

The following community groups are known to be active within this catchment group:

- Tillicoultry Flood Action Group (Elistoun Drive)
- Cochrane Crescent/ Grodwell Drive Community Flood Action Group (Alva)
- The Charrier, Menstrie Flood Action Group.

Property level protection

Each local authority has its own incentives or subsidies to help property owners with property level protection.

Flood warning area (FWA)	River	Number of properties within FWA	% of properties registered July 2014
Bridge of Allan	Allan Water	353	27%
Bridgehaugh	River Forth	39	44%
Cornton	River Forth	746	28%
Dunblane	Allan Water	95	19%
Glenfoot Bridge at Marchglen	River Devon	7	29%
Menstrie Industrial Site	River Devon	2	100%
Rackmill Dollar	River Devon	17	65%
Raploch	River Forth	371	18%
River Devon at Alva	River Devon	36	14%
River Devon at Cambus Weir	River Devon	0	N/A
Riverside and Cambuskenneth	River Forth	647	45%
Sterling Mills Tillicoultry	River Devon	138	28%

Table 3: River flood warning areas

Climate change and future flood risk

The UK Climate Projections (UKCP09) report predicts that climate change may lead to warmer and drier summers, warmer and wetter winters with less snow, and more extreme temperature and rainfall events. The predicted increase in rainfall and river flows may increase the potential for river flooding.

Under the UKCP09 high emissions scenario for 2080, average peak river flows for the Stirling catchment group may increase by 39%[1]. This would increase the number of residential properties at risk of river flooding from approximately 2,200 to 4,300 and the number of non-residential properties from approximately 300 to 600.

The predicted increases in flood risk are solely based on the impact of a changing climate on the magnitude of flooding; they do not take into account any potential increase due to population change, development pressures or urban creep, nor do they take into account any mitigation as a result of actions contained in this or future Flood Risk Management Strategies.

[1] From the study 'An assessment of the vulnerability of Scotland's river catchments and coasts to the impacts of climate change' (CEH, 2011)

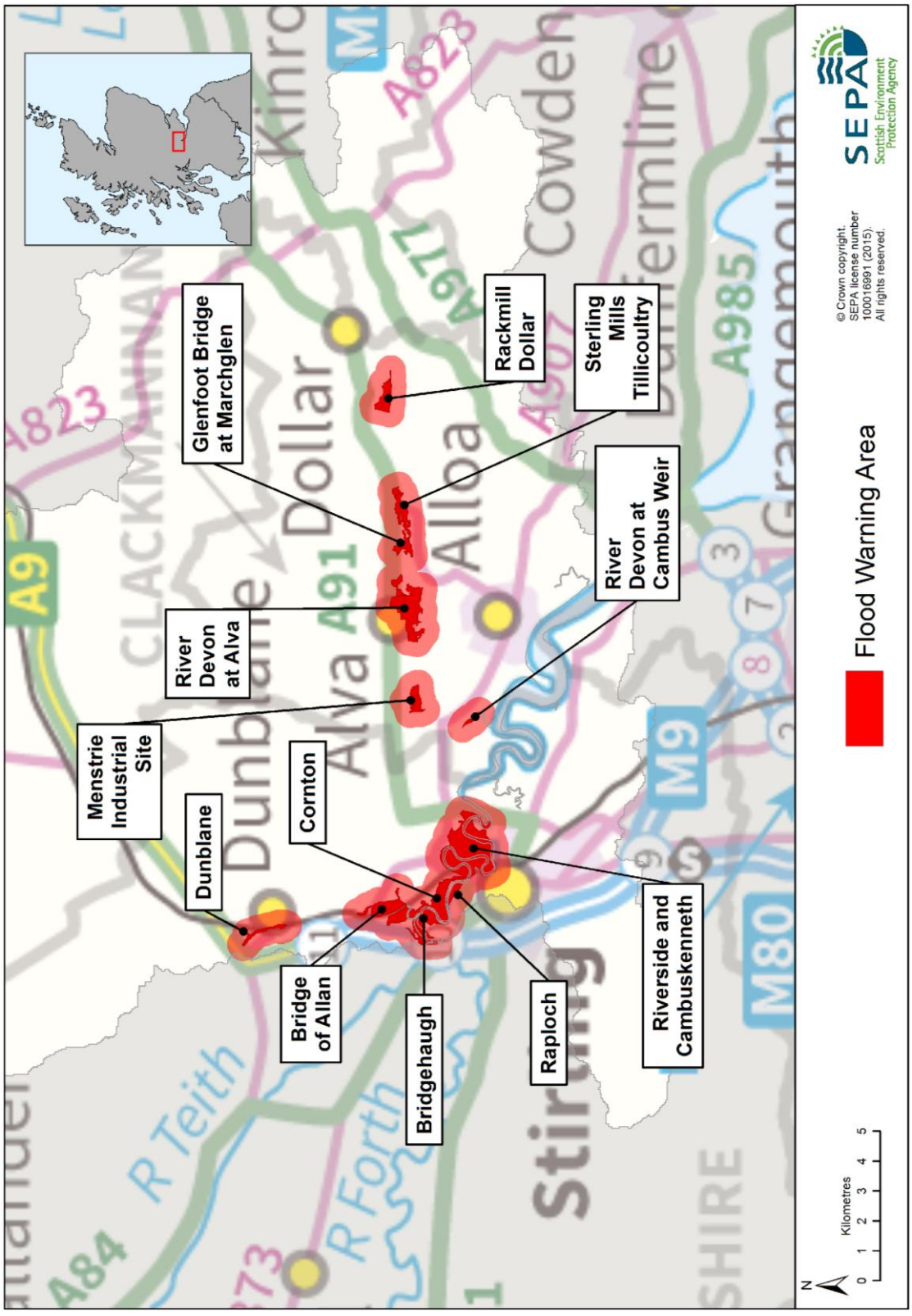


Figure 3: River flood warning areas

Potential for natural flood management

The assessment of the potential for natural flood management is shown on SEPA's flood maps (http://www.sepa.org.uk/environment/water/flooding/flood-maps/). The maps indicate the potential for runoff reduction, floodplain storage and sediment management. They show areas where natural flood management could be effective and where further detailed assessment should take place. This information was used to identify where local authorities could include natural flood management as part of flood risk management schemes and studies. The proposed schemes and studies are listed in the relevant Potentially Vulnerable Area chapters of this document.

Runoff reduction

Areas with potential to reduce runoff are scattered throughout the catchment group. Most notable are those located centrally in the Ochil Hills in the north west of the catchment, and north of the Allan Water and Dunblane. These sites in particular could play a role in managing flood risk within the Hillfoots villages (09/04) and Braco (09/02) Potentially Vulnerable Areas.

Floodplain storage

The potential floodplain storage sites are scattered throughout the catchment. A number of sites indicate high storage potential and these are located along the length of the lower River Forth, the River Devon and the Allan Water. These sites in particular lie either wholly or partly within the boundaries of Potentially Vulnerable Areas and could help reduce flooding to Dunblane and Bridge of Allan (09/03), Tillicoultry and Alva (09/04), Blackford (09/12c) and Stirling (09/05 and 09/07). However, previous studies carried out by Stirling Council have indicated that natural floodplain storage for Stirling is limited in this area and would not provide the required standard of protection.

Sediment management

Sediment erosion and deposition occurs throughout the catchment. High deposition occurs in several locations, including the upstream and downstream reaches of the Black Devon, north east of Clackmannan and south of Alloa. Further deposition occurs upstream of the Allan Water and south of the River Devon where it meets the Menstrie Burn. While much of this may be attributed to natural processes, there may some locations that could benefit from sediment management such as improvement of bank side vegetation.

3.3 Coastal flooding

Forth Local Plan District

This chapter provides supplementary information on flooding for coastal areas. It provides an overview of the natural characteristics of the coast, a summary of flood risk within the coastal area and a brief history of flooding. It also outlines the likely impact of climate change and the potential for natural flood management.

Information about the objectives and actions to manage flood risk are provided in in Section 2.

Coastal overview

The Forth Local Plan District has 74km of coastline. It includes the lower reaches of the River Forth and River Devon and centres on Stirling where the River Forth meets the Forth Estuary. It includes the inner Firth of Forth and extends out to Alloa along the north bank and to Dunmore along the south bank.

The interaction between coastal and river flooding on the River Forth and River Devon is important. It is less influenced by waves due to the sheltering effects of the estuary but is still influenced by storm surges.

Flood risk

Within the Forth Local Plan District approximately 150 residential properties and 30 non-residential properties are at risk of coastal flooding. It is estimated that 98% of residential and non-residential properties at risk of coastal flooding are located within Potentially Vulnerable Areas. There are five Potentially Vulnerable Areas in this Local Plan District that have a risk of coastal flooding (Figure 1):

- Stirling (Cornton and Causewayhead) (09/05)
- Gargunnock (09/06)
- Stirling (Raploch and Riverside) (09/07)
- Stirling (Eastern villages) (09/09)
- Cambus, Alloa and Sauchie (09/10).

Main areas at risk

The main areas at risk of coastal flooding, the number of properties at risk and the total Annual Average Damages caused by coastal flooding are shown in Table 1. The Annual Average Damages include damages to residential and non-residential properties, transport, emergency services and agriculture.

	Residential and non-residential properties at risk of coastal flooding	Annual Average Damages
Stirling	140	£110,000
South Alloa	10	£70,000
Alloa, Cambus, Blackgrange	<10	£10,000

Table 1: Main areas at risk of coastal flooding

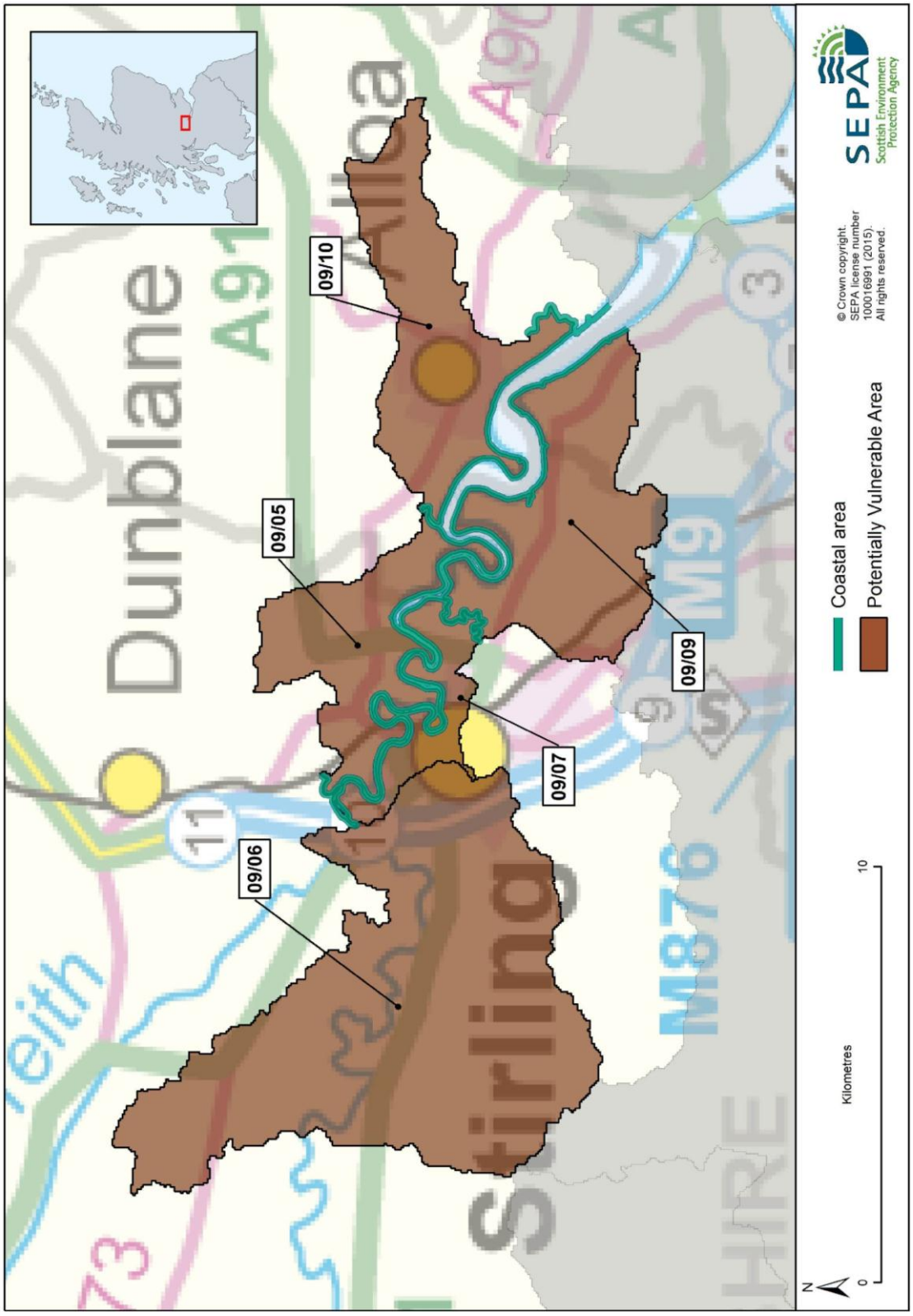


Figure 1: Forth Local Plan District coastal area and Potentially Vulnerable Areas with a coastal flood risk

Economic activity and infrastructure at risk

The Annual Average Damages caused by coastal flooding in the Forth Local Plan District are approximately £240,000. The damages are distributed as follows:

- 68% residential properties (£160,000)
- 10% non-residential properties (£23,000)
- 7% roads (£17,000)
- 6% agriculture (£15,000)
- 5% emergency services (£12,000)
- 4% vehicles (£10,000).

Figure 2 shows the distribution of Annual Average Damages throughout the coastal area. The highest Annual Average Damages are found around Stirling and South Alloa due to the high density of businesses and residential properties.

Table 2 shows further information about infrastructure and agricultural land at risk of coastal flooding.

	Number at risk	Further detail
Community facilities	0	
Utility assets	<10	Includes electricity substations
Roads (excluding minor roads)	6	1 M road (M9) at 2 locations 4 A roads at 8 locations 1 B road at 1 locations
Railway routes	1	Dunblane to Stirling/Larbert (4 locations at risk)
Agricultural land (km²)	7.7	

Table 2: Infrastructure and agricultural land at risk of coastal flooding

Designated environmental and cultural heritage sites at risk

Within the coastal area there are approximately nine designated cultural heritage sites at risk of coastal flooding. These include scheduled monuments, battlefield sites and listed buildings.

Approximately three environmental designated areas are at risk of coastal flooding. These include a Special Area of Conservation, a Special Protection Area and a Site of Special Scientific Interest, comprising of the River Teith and the Firth of Forth.

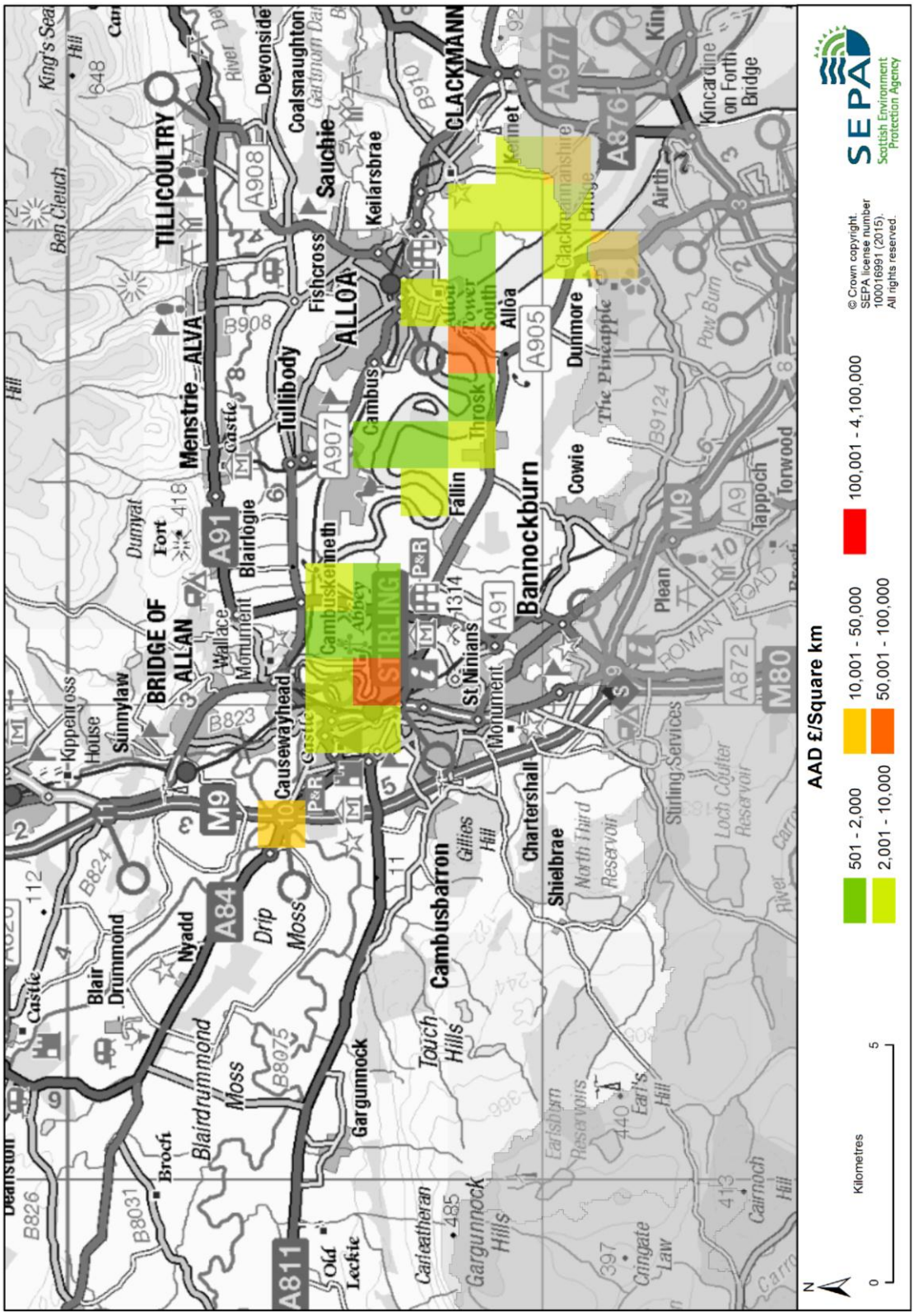


Figure 2: Annual Average Damages from coastal flooding

History of coastal flooding

Probably the most damaging coastal flood occurred on 25 January 1890 when Alloa harbour experienced flooding to non-residential properties due to the highest tide in 17 years.

A recent coastal flood occurred in January 2014 with Alloa affected by high tide/storm surge event in the Firth of Forth. However, no damages were recorded.

The earliest coastal flood on record dates back to 1 October 1849 when Alloa Harbour flooded due to a high tide event.

Further details about the history of flooding in this area are available in the relevant Potentially Vulnerable Area chapters in Section 2.

Managing flood risk

A range of public bodies have responsibility for managing flood risk in Scotland and they are working closer than ever before to target action in the areas where the greatest benefit can be gained. Members of the public also have a role to play and are the first line of defence against flooding by taking action to protect themselves and their property from flooding. Further information about roles and responsibilities is provided in Section 1.

This section describes the existing actions that are in place to manage flood risk and are in addition to the information presented in the relevant Potentially Vulnerable Area chapters.

Coastal flood warning schemes

There are no coastal flood warning areas in the Forth Local Plan District. However, some of the river flood warning areas around Stirling take into account coastal and tidal data. These river flood warning areas are Riverside, Cambuskenneth and Raploch.

Property level protection

Each local authority has its own incentives or subsidies to help property owners with property level protection.

Climate change and future flood risk

UK Climate Projections (UKCP09) predicts that climate change may increase sea levels. The magnitude of sea level rise varies around the coastline.

For the UKCP09 high emissions scenario, the predicted average increase for inner Firth of Forth is 0.47m by 2080. This may increase the number of residential properties at risk of coastal flooding from approximately 150 to 370 and the number of non-residential properties from approximately 30 to 50. Coastal flood modelling by SEPA has not taken into account the impacts of a future climate on wave overtopping or storminess, which could increase the number of people affected by coastal flooding.

The predicted increases in flood risk are solely based on the impact of a changing climate on the magnitude of flooding; they do not take into account any potential

increase due to population change, development pressures or urban creep, nor do they take into account any mitigation as a result of actions contained in this or future Flood Risk Management Strategies.

Potential for natural flood management

The assessment of the potential for natural flood management is shown on SEPA's flood maps (http://www.sepa.org.uk/environment/water/flooding/flood-maps/). The maps indicate the potential for wave attenuation and estuarine surge attenuation. They show areas where natural flood management could be effective and where further detailed assessment should take place.

This information was used to identify where local authorities could include natural flood management as part of flood risk management schemes and studies. The proposed schemes and studies are listed in the relevant Potentially Vulnerable Area chapters.

Wave energy

The assessment for the Forth coastal area shows that there is medium to high potential for estuarine surge attenuation along the inner Firth of Forth coastline. This may help to manage coastal flood risk around Alloa and Stirling.

3.4 Surface water flooding

Forth Local Plan District

This section provides supporting information on surface water flooding across the Local Plan District. It provides an overview of the main areas at risk and the history of surface water flooding. The predicted impacts on infrastructure are also identified. The impacts on environmental sites and agricultural land have not been assessed Information about the objectives and actions to manage flood risk are provided in Section 2.

Flood risk

Within the Forth Local Plan District approximately 700 residential properties and 260 non-residential properties are at risk of surface water flooding. It is estimated that 96% of these properties are located within Potentially Vulnerable Areas.

Main areas at risk

The main areas at risk of surface water flooding can be seen in Table 1, which shows the number of properties at risk and the Annual Average Damages caused by surface water flooding. The damages include impacts to residential and non-residential properties, vehicles, emergency services and roads.

	Residential and non-residential properties at risk of surface water flooding	Annual Average Damages
Alloa-Tullibody	210	£260,000
Stirling	200	£350,000
Alva	150	£340,000
Tillicoultry	100	£200,000
Dunblane	70	£120,000
Bridge of Allan	40	£53,000
Gargunnock	20	£76,000
Doune	20	£26,000
Dollar	<10	£12,000
Clackmannan	<10	£1,000

Table 1: Main areas at risk of surface water flooding

Economic activity and infrastructure at risk

The Annual Average Damages caused by surface water flooding in the Forth Local Plan District are approximately £2.3 million. The damages are distributed as follows:

- 56% roads (£1,300,000)
- 29% residential properties (£670,000)
- 11% non-residential properties (£270,000)
- 3% emergency services (£65,000)
- 1% vehicles (£18,000).

Figure 1 shows the distribution of Annual Average Damages throughout the Local Plan District. High economic damages from surface water flooding can be seen on the M9 motorway south of Stirling which is a major transport route for business travelling both north and south. High damages can also be found around the urban areas of Stirling and Alloa due to the high number of residential properties in these areas.

Table 2 shows the approximate numbers of further infrastructure assets which are at risk of flooding within this Local Plan District.

	Number at risk	Further detail
Community facilities	<10	Includes: educational buildings and healthcare services
Utility assets	60	Includes: electricity substations and fuel extraction sites
Roads (excluding minor roads)	40	2 M roads (M9 and M80) at 40 locations 15 A roads at 340 locations 24 B roads at 200 locations
Railway routes	2	Dunblane to Stirling/Larbert (20 locations at risk) Dundee to Dunblane (20 locations at risk)

Table 2: Infrastructure at risk of surface water flooding

Designated environmental and cultural heritage sites at risk

Within the Local Plan District it is estimated that approximately 52 designated cultural heritage sites have a risk of surface water flooding. These sites include scheduled monuments, gardens and designed landscapes, battlefield sites and listed buildings.

The impact of surface water flooding on environmental sites has not been assessed and is assumed to be relatively low.

History of surface water flooding

The flood records for surface water flooding in this area indicate flood events in January 2011 and widespread flooding in August 2012.

On 16 January 2011 heavy rainfall combined with snow melt caused many roads to close including Elistoun Drive, Tillicoultry. Local businesses were also affected in Alva and Dollar.

In August 2012 a number of locations were affected following very heavy rainfall. These included Dollar on 6 August and 21 August 2012 when heavy rainfall caused a large surface water flood and properties were affected around Princes Crescent, Tarmangie Drive, The Ness and White Wisp Gardens. On 29 August 2012 extreme rainfall (64mm within 2 hours) caused localised flooding in Bridge of Allan and Dunblane and flooding to properties and infrastructure. Approximately 25 properties were affected in Bridge of Allan and a further 10 properties in Dunblane. The railway was closed in Dunblane and a road was washed out in Bridge of Allan.

Further detail about the history of flooding is available in the relevant Potentially Vulnerable Area chapters of this document.

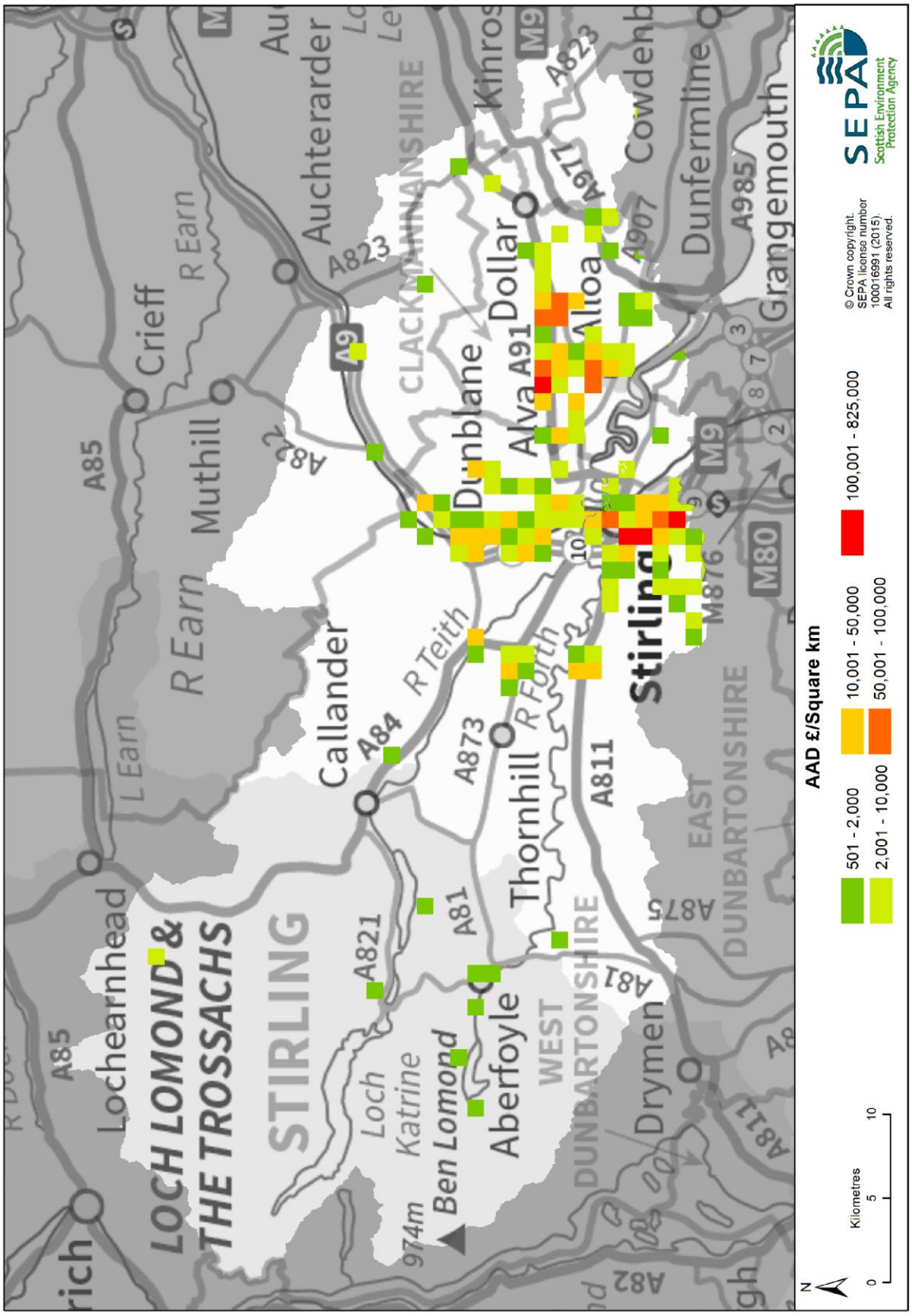


Figure 1: Annual Average Damages from surface water flooding

Managing flood risk

A range of public bodies have responsibility for managing flood risk in Scotland and they are working closer than ever before to target action in the areas where the greatest benefit can be gained. Members of the public also have a role to play and are the first line of defence against flooding by taking action to protect themselves and their property from flooding. Further information about roles and responsibilities is provided in Section 1.

Surface water management priority areas

The areas at highest risk from surface water flooding have been prioritised. These priority areas were identified using SEPA flood models, supplemented with historical flood information and, where available, more detailed modelling from local authorities. These priority areas require the preparation of surface water management plans, the details of which can be found in Section 2.

Community groups

The following community groups are also known to operate within the Forth Local Plan District:

- Alva (Cochrane Crescent/Grodwell Drive) Community Flood Action Group
- Aberfoyle Flood Forum Group
- Callander Flood Forum
- The Charrier - Menstrie Flood Action Group
- Tillicoultry Flood Action Group.

Property level protection

Each local authority has its own incentives or subsidies to help property owners with property level protection:

- Clackmannanshire Council has established a store with flood protection products (flood pod) at The Charrier, Menstrie with the agreement of the The Charrier, Menstrie Flood Action Group
- Clackmannanshire Council and Scottish Flood Forum have a joint project to promote resilience with Tillicoultry Flood Action Group
- Fife Council provides Aquasacs for use in emergencies and these are available from stores throughout Fife.

Climate change and future flood risk

UK Climate Projections (UKCP09) predicts that climate change may lead to warmer and drier summers, warmer and wetter winters with less snow, and more extreme temperature and rainfall. The pluvial modelling undertaken considered climate change scenarios with a 20% increase in rainfall intensity.

Under these conditions it is estimated that the number of residential properties at risk of surface water flooding may increase from approximately 700 to 970 and the number of non-residential properties from approximately 260 to 390.

The predicted increases in flood risk are solely based on the impact of a changing climate on the magnitude of flooding; they do not take into account any potential increase due to population change, development pressures or urban creep, nor do they take into account any mitigation as a result of actions contained in this or future Flood Risk Management Strategies.

Annex 1: Glossary

Term	Definition
Accretion	Accumulation of sediment.
Actions	Actions describe where and how flood risk will be managed. These actions have been set by SEPA and agreed with flood risk management authorities following consultation. Selection of actions to deliver the agreed objectives has been based on a detailed assessment and comparison of economic, social and environmental criteria.
Annual Average Damages (AAD)	Depending on its size or severity each flood will cause a different amount of damage to a given area. Annual Average Damages are the theoretical average economic damages caused by flooding when considered over a very long period of time. It does not mean that damage will occur every year: in many years there will be no damages, in some years minor damages and in a few years major damages may occur. High likelihood events, which occur more regularly, contribute proportionally more to AADs than rarer events. Within the Flood Risk Management Strategies AADs incorporate economic damages to the following receptors: residential properties, non-residential properties, vehicles, emergency services, agriculture and roads. They have been calculated based on the principles set out in the Flood Hazard Research Centre Multi-Coloured Handbook (2010).
Appraisal	Appraisal is the process of defining objectives, examining options and weighing up the costs, benefits, risks and uncertainties before a decision is made. The FRM Strategy appraisal method is designed to set objectives and identify the most sustainable combination of actions to tackle flooding from rivers, sea and surface water.
Appraisal baseline	Defines the existing level of flood risk under the current flood risk management regime.
Awareness raising	Public awareness, participation and community support are essential components of sustainable flood risk management. SEPA and the responsible authorities have a duty to raise public awareness of flood risk. This is undertaken both individually and collaboratively by a range of organisations. Improved awareness of flood risk and actions that prepare individuals, homes and businesses for flooding can reduce the overall impact.
Bathing waters	Bathing waters are classed as protected areas under Annex IV of the Water Framework Directive (WFD). There are 84 designated bathing waters in Scotland. [i]
Benefit cost ratio (BCR)	A benefit cost ratio summarises the overall value for money of an action or project. It is expressed as the ratio of benefits to costs (both expressed as present value monetary values). A ratio of greater than 1:1 indicates that the economic benefits associated with an action are greater than the economic costs of implementation; therefore this is taken as the threshold of economic viability. It should be acknowledged that it is not always possible to accurately estimate economic values for all elements of benefit, and BCR is just one a number of techniques used in appraisal.
Blue infrastructure	Blue infrastructure is often complementary to 'green infrastructure' and includes sustainable drainage systems, swales (shallow, broad and vegetated channels designed to store and/or convey runoff and remove pollutants[ii]), wetlands, rivers, canals (and their banks) and other watercourses[iii]
Candidate Potentially Vulnerable Area (PVAc)	Candidate PVAs are those areas identified after the National Flood Risk Assessment (2011), as a result of new information, where the impact of flooding is potentially sufficient to justify further assessment and appraisal. They will be considered for inclusion as new PVAs in the next flood risk management planning cycle.
Catchment	All the land drained by a river and its tributaries.

Term	Definition
Category 1 and 2 Responders (Cat 1 / 2)	Category 1 and 2 Responders are defined as part of the Civil Contingencies Act 2004 which seeks to minimise disruption in the event of an emergency. Category 1 Responders are 'core' responders: local authorities, police, fire and rescue services, ambulance service, NHS health boards, SEPA and the Maritime and Coastguard Agency. Category 2 Responders are key co-operating responders in support of Category 1 Responders. These include gas and electricity companies, rail and air transport operators, harbour authorities, telecommunications providers, Scottish Water, the Health and Safety Executive and NHS National Services Scotland[iv].
Channel improvement	Where work has been carried out on a river channel allowing an increase in the volume of water it can carry.
Characterisation	Provides a description of the natural characteristics of catchments, coastlines and urban areas in terms of hydrology, geomorphology, topography and land use. It also includes the characterisation of existing levels of flood risk and existing flood risk management activity.
Coastal flooding	Flooding that results from high sea levels or a combination of high sea levels and stormy conditions. The term coastal flooding is used under the Flood Risk Management (Scotland) Act 2009, but in some areas it is also referred to as tidal flooding and covers areas such as estuaries and river channels that are influenced by tidal flows.
Combined sewer	Combined sewers transport sewage from homes and industry as well as carrying surface water runoff from gutters, drains and some highways. Heavy or prolonged rainfall can rapidly increase the flow in a combined sewer until the amount of water exceeds sewer capacity.
Combined sewer (overflow) (CSO)	Combined sewer overflows are purposely designed structures to ensure any excess water from sewerage systems is discharged in a controlled way and at a specific managed location.
Community facility	Within the FRM Strategies this term includes: Emergency Services (Police, Fire, Ambulance, Coastguard, Mountain Rescue) Educational Buildings (crèche, nursery, primary, secondary, further, higher and special education premises) Healthcare facilities: hospitals, health centres and residential care homes
Community flood action groups	Community flood action groups are community based resilience groups which, on behalf of local residents and business, help to prepare for and minimise the effects of flooding. They reflect the interests of their local communities and may differ in composition and remit. There are over 60 groups already established in Scotland. The Scottish Flood Forum provides support for both new and existing groups.
Confluence	Where two or more rivers meet.
Conveyance	Conveyance is a measure of the carrying capacity of a watercourse. Increasing conveyance enables flow to pass more rapidly and reducing conveyance slows flow down. Both actions can be effective in managing flood risk depending on local conditions.
Cultural heritage site	Historic Environment Scotland maintains lists of buildings of special architectural or historic interest; these buildings are referred to as 'listed buildings'. The highest level of designation is a World Heritage Site. Other designations included in this assessment are scheduled monuments, gardens and designed landscapes, and battlefields.
Culvert	A pipe, channel or tunnel used for the conveyance of a watercourse or surface drainage water under a road, railway, canal or other obstacle.
Damages	Flood damages are categorised as direct or indirect i.e. as a result of the flood water itself, or subsequent knock on effects. Damage to buildings and contents caused by flood water are an example of direct damages, whilst loss of industrial production, travel disruption or stress and anxiety are indirect. Some damages can be quantified in monetary terms, and others can only be described.

Term	Definition
	The potential damages avoided by implementation of a flood risk management action are commonly referred to as the benefits of that action. When comparing the effectiveness of different actions, it is useful to consider estimated damages and damages avoided across the lifespan of the action. Within the FRM Strategies, a 100 year appraisal period has been used as standard. This allows costs, damages and benefits across this time frame to be compared in present value terms. See also 'Annual Average Damages'
Demountable defences	A temporary flood barrier is one that is only installed when the need arises, that is, when flooding is forecast. A demountable flood defence is a particular type of temporary defence that requires built-in parts and therefore can only be deployed in one specific location.[v]
Deposition	A natural process leading to an accumulation of sediment on a river bed, floodplain or coastline.
Economic impact	An assessment of the economic value of the positive and negative effects of flooding and / or the actions taken to manage floods.
Embankment	Flood embankments are engineered earthfill structures designed to contain high river levels or protect against coastal flooding. They are commonly grass-covered, but may need additional protection against erosion by swiftly flowing water, waves or overtopping.
Emergency plans / response	Emergency response plans are applicable for all types of flooding. They set out the steps to be taken during flooding in order to maximise safety and minimise impacts where possible. Under the Civil Contingencies Act, Category 1 Responders have a duty to maintain emergency plans. Emergency plans may also be prepared by individuals, businesses, organisations or communities.
Environmental impact	A change in the environment as a result of an action or activity. Impacts can be positive or negative and may vary in significance, scale and duration.
Environmental Impact Assessment (EIA)	Environmental Impact Assessment (EIA) is a process which identifies the potential environmental impacts, both negative and positive, of a proposal.
Environmental sites / environmental designated areas/ environmentally designated sites	Areas formally designated for environmental importance, such as Sites of Special Scientific Interest (SSSI), Special Protection Area (SPA) or Special Areas of Conservation (SAC).
Episodic erosion	Erosion induced by a single event, such as a storm.
Erosion	A natural process leading to the removal of sediment from a river bed, bank or floodplain or coastline.
Estuarine surge attenuation	A reduction in the wave energy caused by storm surge. Breakwaters (barriers built out into the sea to protect a coast or harbour from the force of waves) or habitats such as saltmarsh can slow down and reduce the inland impact of storm surges (the rising of the sea due to wind and atmospheric pressure changes associated with storms), thereby reducing coastal flood risk.
Estuary	A coastal body of water usually found where a river meets the sea; the part of the river that is affected by tides.
Fault (fault line)	A break or fracture in the earth's crust as a result of the displacement of one side with respect to the other. In Scotland the Great Glen Fault is a major geological fault line cutting diagonally across the Highlands from Fort William to Inverness.
Flash flood	A flood that occurs a short period of time after high intensity rainfall or a sudden snow melt. A sudden increase in the level and velocity of the water body is often characteristic of these events, leaving a short time for warning or actions.
Flashy watercourse	A 'flashy' river or watercourse has a short lag time (the delay between peak rainfall intensity and peak river discharge), high peak discharge, and quickly returns to average flow. Rivers with these characteristics

Term	Definition
	can be prone to flooding and leave a short time for warning or actions.
Flood	In the terms of the FRM Act, 'flood' means a temporary covering by water, from any source, of land not normally covered by water. This does not include a flood solely from a sewerage system, as a result of normal weather or infrastructure drainage. A flood can cause significant adverse impacts on people, property and the environment. drainage.
Flood bund	A constructed retaining wall, embankment or dyke designed to protect against flooding to a specified standard of protection.
Flood defence	Infrastructure, such as flood walls, embankments or flood storage intended to protect an area against flooding to a specified standard of protection.
Flood extent	The area that has been affected by flooding, or is at risk of flooding fror one or more sources for a particular likelihood.
Flood forecasting	SEPA operates a network of over 250 rainfall, river and coastal monitoring stations throughout Scotland that generate data 24 hours a day. This hydrological information is combined with meteorological information from the Met Office. A team of experts then predict the likelihood and timing of river, coastal and surface water flooding. This joint initiative between SEPA and the Met Office forms the Scottish Flood Forecasting Service.
Flood frequency	The probability that a particular size/severity of flood will occur in a given year (see likelihood).
Flood gate	An adjustable, sometimes temporary, barrier used as a flood defence to control the flow of water within a water system or during a flood. Flood gates can also be part of operational flood defences or protect individual buildings or sites.
Flood guard	Flood guards cover a variety of types of door and window barriers that can be fitted to individual properties and operated by the owners / occupiers prior to a flood event. They act as a physical barrier to water entering the property and can provide protection against frequent and relatively shallow flooding.
Flood hazard	In terms of the FRM Act, hazard refers to the characteristics (extent, depth, velocity) of a flood.
Flood hazard map	Flood hazard maps are required by the FRM Act to show information that describes the nature of a flood in terms of the source, extent, water level or depth and, where appropriate, velocity of water. Flood hazard and risk maps are referred to collectively as flood maps and are available on the SEPA website.
Flood Prevention Scheme / Flood Protection Scheme (FPS)	A flood protection scheme, as defined by the FRM Act, is a scheme by a local authority for the management of flood risk within the authority area. This includes defence measures (flood prevention schemes) formerly promoted under the Flood Prevention (Scotland) Act 1961.
Flood protection study	Flood protection studies aim to refine understanding of the hazard and risk associated with flooding in a particular area, catchment or coastline. They will involve detailed assessment of flood hazard and / or risk and may develop options for managing flood risk.
Flood protection works	Flood protection works can include the same flood defence measures that would make up a formal Flood Protection Scheme but without the legal process, protections and requirements that would come by delivering the works as a scheme.
Flood risk	A measure of the combination of the likelihood of flooding occurring and the associated impacts on people, the economy and the environment.
Flood Risk Assessment (FRA)	Flood Risk Assessments are detailed studies of an area where flood risk may be present. These are often used to inform planning decisions, may help to develop flood schemes and have also contributed to the National Flood Risk Assessment.

Term	Definition
Flood Risk Management (Scotland) Act 2009 (FRM Act)	The flood risk management legislation for Scotland. It transposes the EC Floods Directive into Scots Law and aims to reduce the adverse consequences of flooding on communities, the environment, cultural heritage and economic activity.
Flood risk management cycle	Under the FRM Act flood risk management planning is undertaken in six year cycles. The first planning cycle is 2015 – 2021. The first delivery cycle is lagged by approximately 6 months and is from 2016 - 2022.
Flood Prevention (Scotland) Act 1961	The Flood Prevention (Scotland) Act 1961 gave local authorities discretionary powers to make and build flood prevention schemes. It was superseded by the Flood Risk Management (Scotland) Act 2009.
Flood Risk Management Local Advisory Groups	FRM Local Advisory Groups are stakeholder groups convened to advise SEPA and lead local authorities in the preparation of Flood Risk Management Plans. SEPA and lead local authorities must have regard to the advice they provide.
Flood Risk Management Plans (FRM Plans)	A term used in the FRM Act. FRM Plans set out the actions that will be taken to reduce flood risk in a Local Plan District. They comprise Flood Risk Management Strategies, developed by SEPA, and Local Flood Risk Management Plans produced by lead local authorities.
Flood Risk Management Strategy (FRM Strategy)	Sets out a long-term vision for the overall reduction of flood risk. They contain a summary of flood risk in each Local Plan District, together with information on catchment characteristics and a summary of objectives and actions for Potentially Vulnerable Areas.
Flood risk map	Complements the flood hazard maps published on the SEPA website providing detail on the impacts of flooding on people, the economy and the environment. Flood hazard and risk maps are referred to collectively as flood maps and are available on the SEPA website.
Flood wall	A flood defence feature used to defend an area from flood water to a specified standard of protection.
Flood Warning area (FWA)	A Flood Warning area is where SEPA operates a formal Flood Monitoring Scheme to issue targeted Flood Warning messages for properties located in the area.[vi]
Flood warning scheme	A flood warning scheme is the network of monitoring on a coastal stretch or river, which provides SEPA with the ability to issue Flood Warnings.
Floods Directive	European Directive 2007/60/EC on the Assessment and Management of Flood Risks builds on and is closely related to the Water Framework Directive (see river basin management planning). It was transposed into Scots Law by the Flood Risk Management (Scotland) Act 2009. The Directive requires Member States to assess if all watercourses and coastlines are at risk from flooding, to map the flood extent, assets and humans at risk in these areas and to take adequate and coordinated measures to reduce this flood risk[vii].
Floodplain	Area of land that borders a watercourse, an estuary or the sea, over which water flows in time of flood, or would naturally flow but for the presence of flood defences and other structures where they exist.
Floodplain storage	Floodplains naturally store water during high flows. Storage can be increased through natural or man-made features to increase flood depth or slow flows in order to reduce flooding elsewhere.
Gabion	A metal cage filled with rocks often used in river bank protection.
Green infrastructure	The European Commission defines green infrastructure as “the use of ecosystems, green spaces and water in strategic land use planning to deliver environmental and quality of life benefits. It includes parks, open spaces, playing fields, woodlands, wetlands, road verges, allotments and private gardens. Green infrastructure can contribute to climate change mitigation and adaptation, natural disaster risk mitigation, protection against flooding and erosion as well as biodiversity conservation.” See also ‘blue infrastructure’[viii]

Term	Definition
Groundwater flooding	This type of flooding is caused by water rising up from underlying rocks or flowing from springs. In Scotland groundwater is generally a contributing factor to flooding rather than the primary source.
Integrated catchment study (ICS)	In urban areas, the causes of flooding are complex because of the interactions between rivers, surface water drainage and combined sewer systems and tidal waters. Scottish Water works with SEPA and local authorities to assess these interactions through detailed studies.
Land use planning (LUP)	The process undertaken by public authorities to identify, evaluate and decide on different options for the use of land, including consideration of long term economic, social and environmental objectives and the implications for different communities and interest groups.
Lead local authority	A local authority responsible for leading the production, consultation, publication and review of a Local Flood Risk Management Plan.
Likelihood of flooding	The chance of flooding occurring. **High likelihood**: A flood 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 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 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.
Local Flood Risk Management Plans (Local FRM Plan)	Local Flood Risk Management Plans, produced by lead local authorities, will take forward the objectives and actions set out in Flood Risk Management Strategies. They will provide detail on the funding, timeline of delivery, arrangements and co-ordination of actions at the local level during each six year FRM planning cycle.
Local Nature Reserve (LNR)	A Local Nature Reserve is a protected area of land designated by a local authority because of its local special natural interest and / or educational value. Local authorities select and designate local nature reserves using their powers under the National Parks and Access to the Countryside Act 1949[ix].
Local Plan District	Geographical areas for the purposes of flood risk management planning. There are 14 Local Plan Districts in Scotland.
Local Plan District Partnerships	Each LPD has established a local partnership comprised of local authorities, SEPA, Scottish Water and others as appropriate. These partnerships are distinct from the FRM Local Advisory Groups and they retain clear responsibility for delivery of the FRM actions set out in the Local Flood Risk Management Plans. It is the local partnership that makes decisions and supports the delivery of these plans.
Maintenance	Sections 18 and 59 of the Flood Risk Management (Scotland) Act 2009 put duties of watercourse inspection, clearance and repair on local authorities. In addition, local authorities may also be responsible for maintenance of existing flood protection schemes or defences.
Montane habitat	This habitat encompasses a range of natural or near-natural vegetation occurring in the montane zone, lying above or beyond the natural tree-line.
National Flood Management Advisory Group (NFMAG)	The National Flood Management Advisory Group provides advice and support to SEPA and, where required, Scottish Water, local authorities and other responsible authorities on the production of FRM Strategies and Local FRM Plans.
National Flood Risk Assessment (NFRA)	A national analysis of flood risk from all sources of flooding which also considers climate change impacts. Completed in December 2011 this provides the information required to undertake a strategic approach to flood management that identifies areas at flood risk that require further appraisal. The NFRA will be reviewed and updated for the second cycle of FRM Planning by December 2018.

Term	Definition
Natural flood management (NFM)	A set of flood management techniques that aim to work with natural processes (or nature) to manage flood risk.
Non-residential properties	Properties that are not used for people to live in, such as shops or other public, commercial or industrial buildings.
Objectives	Objectives provide a common goal and shared ambition for managing floods. These objectives have been set by SEPA and agreed with flood risk management authorities following consultation. They were identified through an assessment of the underlying evidence of the causes and impacts of flooding.
One in 200 year flood	See 'likelihood of flooding' and 'return period'.
Planning policies	Current national planning policies, Scottish Planning Policy and accompanying Planning Advice notes restrict development within the floodplain and limit exposure of new receptors to flood risk. In addition to national policies, local planning policies may place further requirements within their area of operation to restrict inappropriate development and prevent unacceptable risk.
Potentially Vulnerable Areas (PVA)	Catchments identified as being at risk of flooding and where the impact of flooding is sufficient to justify further assessment and appraisal. There were 243 PVAs identified by SEPA in the National Flood Risk Assessment and these are the focus of the first FRM planning cycle.
Property level protection	Property level protection includes flood gates, sandbags and other temporary barriers that can be used to prevent water from entering individual properties during a flood.
Property level protection scheme	Some responsible authorities may have a formal scheme to provide, install and maintain property level protection for properties.
Ramsar sites	Ramsar sites are wetlands of international importance designated under the Ramsar Convention.
Receptor	Refers to the entity that may be impacted by flooding (a person, property, infrastructure or habitat). The vulnerability of a receptor can be reduced by increasing its resilience to flooding.
Residual risk	The risk that remains after risk management and mitigation. This may include risk due to very severe (above design standard) storms or risks from unforeseen hazards.
Resilience	The ability of an individual, community or system to recover from flooding.
Responsible authority	Designated under the FRM (Scotland) Act 2009 and associated legislation as local authorities, Scottish Water and, from 21 December 2013, the National Park Authorities and Forestry Commission Scotland. Responsible authorities, along with SEPA and Scottish Ministers, have specific duties in relation to their flood risk related functions.
Return period	A measure of the rarity of a flood event. It is the statistical average length of time separating flood events of a similar size. (see likelihood)
Revetment	Sloping structures placed on banks or at the foot of cliffs in such a way as to deflect the energy of incoming water.
Riparian	The riparian area is the interface between land and a river or stream. For the purposes of FRM this commonly refers to the riparian owner, which denotes ownership of the land area beside a river or stream.
River basin management planning (RBMP)	The Water Environment and Water Services (Scotland) Act 2003 transposed the European Water Framework Directive into Scots law. The Act created the River Basin Management Planning process to achieve environmental improvements to protect and improve our water environment. It also provided the framework for regulations to control the negative impacts of all activities likely to have an impact on the water environment.
Runoff reduction	Actions within a catchment or sub-catchment to reduce the amount of runoff during rainfall events. This can include intercepting rainfall,

Term	Definition
	storing water, diverting flows or encouraging infiltration.
Scottish Advisory and Implementation Forum for Flooding (SAIFF)	The stakeholder forum on flooding set up by the Scottish Government to ensure legislative and policy aims are met and to provide a platform for sharing expertise and developing common aspirations and approaches to reducing the impact of flooding on Scotland's communities, environment, cultural heritage and economy.
Sediment balance	Within a river where erosion and deposition processes are equal over the medium to long-term resulting in channel dimensions (width, depth, slope) that are relatively stable.
Sediment management	Sediment management covers a wide range of activities that includes anything from the small scale removal of dry gravels to the dredging of whole river channels and the reintroduction of removed sediment into the water environment. Historically, sediment management has been carried out for several reasons, including reducing flood risk, reducing bank erosion, for use as aggregate and to improve land drainage.
Self help	Self help actions can be undertaken by any individuals, businesses, organisations or communities at risk of flooding. They are applicable to all sources, frequency and scales of flooding. They focus on awareness raising and understanding of flood risk.
Sewer flooding (and other artificial drainage system flooding)	Flooding as a result of the sewer or other artificial drainage system (e.g. road drainage) capacity being exceeded by rainfall runoff or when the drainage system cannot discharge water at the outfall due to high water levels (river and sea levels) in receiving waters.
Site protection plans	Site protection plans are developed to identify whether normal operation of a facility can be maintained during a flood. This may be due to existing protection or resilience of the facility or the network.
Shoreline Management Plan (SMP)	A Shoreline Management Plan is a large scale assessment of the coastal flood and erosion risks to people and the developed, historic and natural environment. It sets out a long-term framework for the management of these risks in a sustainable manner.
Site of Special Scientific Interest (SSSI)	Sites of Special Scientific Interest are protected by law under the Nature Conservation (Scotland) Act 2004 to conserve their plants, animals and habitats, rocks and landforms[x].
Source of flooding	The type of flooding. This can be coastal, river, surface water or groundwater.
Special Area of Conservation (SAC)	Special Areas of Conservation are strictly protected sites designated under the European Habitats Directive. The Directive requires the establishment of a European network of protected areas which are internationally important for threatened habitats and species[xi].
Special Protection Areas (SPA)	Special Protection Areas are strictly protected sites classified in accordance with the European Birds Directive. They are classified for rare and vulnerable birds (as listed in the Directive), and for regularly occurring migratory species[xii].
Standard of protection (SoP)	All flood protection structures are designed to be effective up to a specified flood likelihood (Standard of Protection). For events beyond this standard, flooding will occur. The chosen Standard of Protection will determine the required defence height and / or capacity.
Storage area	A feature that can be used to store floodwater, this can be natural in the form of low lying land or manmade such as a reservoir or modified landform.
Strategic Environmental Assessment (SEA)	A process for the early identification and assessment of the likely significant environmental effects, positive and negative, of activities. Often considered before actions are approved or adopted.
Strategic Flood Risk Assessment (SFRA)	A Strategic Flood Risk Assessment is designed for the purposes of specifically informing the Development Plan Process. A SFRA involves the collection, analysis and presentation of all existing and readily available flood risk information (from any source) for the area of interest. It constitutes a strategic overview of flood risk.

Term	Definition
Strategic mapping and modelling	Strategic mapping and modelling actions have been identified in locations where SEPA is planning to undertake additional modelling or analysis of catchments and coastlines, working collaboratively with local authorities where appropriate, to improve the national understanding of flood risk.
Surcharge	Watercourses and culverts can carry a limited amount of water. When they can no longer cope, they overflow, or 'surcharge'.
Surface water flooding	Flooding that occurs when rainwater does not drain away through the normal drainage systems or soak into the ground, but lies on or flows over the ground instead[xiii]
Surface water management plan (SWMP)	A plan that takes an integrated approach to drainage accounting for all aspects of urban drainage systems and produces long term and sustainable actions. The aim is to ensure that during a flood the flows created can be managed in a way that will cause minimum harm to people, buildings, the environment and business.
Surface water plan/study	The management of flooding from surface water sewers, drains, small watercourses and ditches that occurs, primarily in urban areas, during heavy rainfall. FRM Strategy actions in this category include: Surface Water Management Plans, Integrated Catchment Studies and assessment of flood risk from sewerage systems (FRM Act Section 16) by Scottish Water. These have been selected as appropriate for each Potentially Vulnerable Area.
Sustainable flood risk management	The sustainable flood risk management approach aims to meet human needs, whilst 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 reconcile three pillars of sustainability – environmental, social and economic.
Sustainable drainage systems (SuDS)	A set of techniques designed to slow the flow of water. They 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. SuDS encourage us to take account of quality, quantity and amenity / biodiversity.
UK Climate Change Projections (UKCP09)	The leading source of climate change information for the UK. It can help users to assess their climate risks and plan how to adapt to a changing climate. The high emissions scenario refers to the SRES A1F1 emission scenario. See Annex 1 of the UKCP09 Climate change projections report for details.[xiv]
Utility assets	Within the FRM Strategies this refers to electricity sub stations, mineral and fuel extraction sites, telephone assets, television and radio assets.
Voe	A dialect term, common in place names and used to refer to a small bay or creek in Orkney or Shetland.
Vulnerability	A measure of how likely someone or something is to suffer long-term damage as a result of flooding. It is a combination of the likelihood of suffering harm or damage during a flood (susceptibility) and the ability to recover following a flood (resilience).
Wave energy dissipation	Process by which a wave loses its energy.
Wave overtopping	Wave overtopping occurs when water passes over a flood wall or other structure as a result of wave action. Wave overtopping may lead to flooding particularly in exposed coastal locations.

[i] http://apps.sepa.org.uk/bathingwaters/ accessed 14/10/2015 last updated 2015
[ii] http://www.susdrain.org/delivering-suds/using-suds/suds-components/swales-and-conveyance-channels/swales.html accessed 12/10/2015 last updated 2012
[iii] http://www.gov.scot/Resource/Doc/362219/0122541.pdf accessed 12/10/2015 last updated 2011
[iv] http://www.legislation.gov.uk/ukpga/2004/36/schedule/1 accessed 12/10/2015 last updated 2004
[v] http://evidence.environment-agency.gov.uk/FCERM/en/FluvialDesignGuide/Chapter9.aspx?pagenum=10 accessed 12/10/2015 last update 07/03/2012
[vii] http://ec.europa.eu/environment/water/flood_risk/ accessed 12/10/2015 last updated 17/09/2015
[viii] http://www.gov.scot/Resource/Doc/362219/0122541.pdf accessed 12/10/2015 last updated 2011

[ix] http://www.snh.gov.uk/protecting-scotlands-nature/protected-areas/local-designations/lnr/ accessed 12/10/2015 last updated 12/07/2015
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Annex 2: Land use planning

Flood risk management actions from national planning policies
AVOID DEVELOPMENT IN MEDIUM TO HIGH RISK AREAS a) **Planning authorities** work in partnership undertaking catchment-wide Strategic Flood Risk Assessments to inform their development plan allocations in line with SEPA's guidance and Land Use Vulnerability. b) **Planning authorities and SEPA** require the submission of flood risk assessments that accord with SEPA's *Technical Flood Risk Guidance for Stakeholders*, to support planning applications where there is a potential flood risk. The flood risk assessment should be used to demonstrate as far as possible that the development will be safe for its lifetime, without increasing flood risk elsewhere and, where possible, takes opportunities to reduce flood risk overall. c) **SEPA** ensures that its flood risk advice to planning authorities is clear and appropriate. SEPA, in consultation with planning authorities, undertakes an annual assessment of planning advice and its contribution to flood risk. d) **SEPA and planning authorities** engage at an early stage of the development plan process to agree appropriate forms of development to help inform the preparation and implementation of Strategic Flood Risk Assessments.
REDUCE IMPACTS TO EXISTING BUILDINGS a) **SEPA, planning authorities and local communities** are required to engage at an early stage of the development plan process to agree the best long term land uses for areas where relocation, abandonment and/or change of use have been identified to deliver sustainable flood risk management. Where possible, new land uses should aim to achieve multiple benefits for local communities such as the creation of blue / green infrastructure and increased resilience to climate change.
PROTECT AND ENHANCE NATURAL FEATURES THAT HAVE A POSITIVE IMPACT ON REDUCING OVERALL FLOOD RISK a) **SEPA and planning authorities** are required to engage early in the development plan process to identify opportunities for the restoration and protection of natural features which help manage flood risk. Opportunities should be maximised to achieve multiple benefits such as the development of green / blue infrastructure and improved place making. Areas of land that may contribute to flood management should be identified and protected.
NEW DEVELOPMENTS ARE DESIGNED TO ENSURE THAT SURFACE WATER DRAINAGE DOES NOT INCREASE FLOOD RISK ON OR OFF SITE a) **SEPA** prepares guidance for planning authorities and developers on the use of surface water hazard maps for land use planning purposes. b) **Planning authorities** support the implementation of Surface Water Management Plans, developed by the local authorities, through development plan allocations and policies. Surface Water Management Plans should take account of development opportunities that could contribute to the reduction of surface water flood risk. c) **SEPA** engages at an early stage of the development plan process to progress exemplar projects that demonstrate the potential for land use planning to mitigate surface water flooding and contribute to wider environmental benefits.
a) **NEW DEVELOPMENT IS RESILIENT TO PREDICTED FUTURE CHANGES IN CLIMATE Planning authorities** ensure that climate change is considered in Strategic Flood Risk Assessments and Flood Risk Assessments, based upon the best scientific evidence and the information requirements of planners to make informed decisions.

Table 1: Objectives and actions that reflect national Land Use Planning policies and guidance

Annex 3: Acknowledgements

SEPA gratefully acknowledges the cooperation and input that various parties have provided, including *inter alia*, the following organisations:

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Local authorities
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Further detail on the datasets that have been used in the development of the Flood Risk Management Strategies can be found in the Strategic Appraisal Methodology, which is available from the SEPA webpage.