



**Flood Risk Management Strategy**  
**Clyde and Loch Lomond**



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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 21,000 residential and 8,600 non-residential properties are at risk of flooding in the Clyde and Loch Lomond Local Plan District. Glasgow City, Paisley, Johnstone and Dumbarton 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 £67 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 Glasgow City 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 Glasgow City Council, Renfrewshire Council, East Renfrewshire Council, Inverclyde Council, West Dunbartonshire Council, East Dunbartonshire Council, North Lanarkshire Council, South Lanarkshire Council, Scottish Water 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



# Flood Risk Management Strategy

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# Flood Risk Management Strategy

## Clyde and Loch Lomond Local Plan District

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# Clyde and Loch Lomond 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](http://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:

- Argyll and Bute Council, East Dunbartonshire Council, East Renfrewshire Council, Glasgow City Council (lead local authority), Inverclyde Council, North Lanarkshire Council, Renfrewshire Council, South Lanarkshire Council, Stirling Council and West Dunbartonshire Council;
- Forestry Commission Scotland
- Loch Lomond and the Trossachs National Park;
- 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, Scottish Water and the Loch Lomond and the Trossachs National Park 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 Clyde and Loch Lomond and Ayrshire 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](http://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.

## 1.5 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.

## 1.6 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.

## 1.7 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

## Clyde and Loch Lomond 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

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• Helensburgh to Loch Long (11/02) .....	40
• Strathblane (11/03) .....	53
• Kilsyth to Bearsden - north of Glasgow City (11/04) .....	62
• Yoker catchment - Clyde (Clydebank to Partick) (11/05) .....	89
• Isle of Bute (11/06).....	105
• Dunoon (11/07) .....	116
• Greenock to Gourock (11/08).....	128
• Clyde south - Port Glasgow to Inchinnan (11/09) .....	141
• Bishopton (11/10).....	151
• Gryfe catchment - Bridge of Weir to Houston (11/11) .....	161
• Black Cart Water catchment - Lochwinnoch to Johnstone (11/12)....	173
• White Cart Water catchment (11/13) .....	191
• Rutherglen(11/14) .....	220
• Glasgow City north (11/15).....	237
• Glasgow City centre (11/16).....	248
• East of Glasgow (11/17/1).....	260
• Clyde catchment – Motherwell to Lesmahagow (11/17/2) .....	280
• Coatbridge and Airdrie (11/17/3) .....	294
• Coatbridge/Viewpark (11/18).....	303
• North of Wishaw (11/19).....	312
• Shotts (11/20) .....	322
• Kilmacolm (11/21c) .....	331

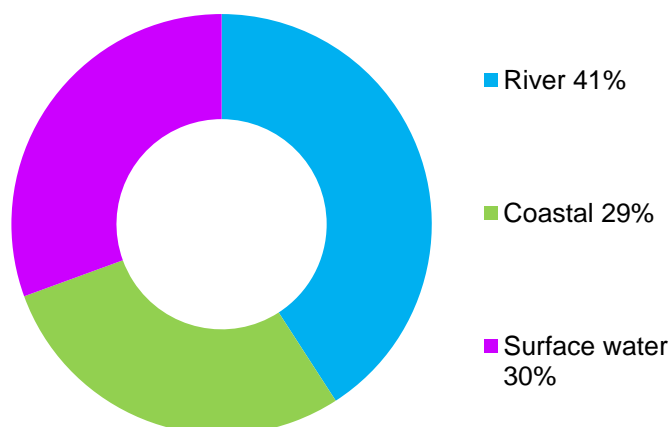
## 2.1 Summary of flooding in the Clyde and Loch Lomond Local Plan District

The Clyde and Loch Lomond Local Plan District extends from Loch Lomond in the north to Leadhills in the south, and includes part of the Loch Lomond and The Trossachs National Park (see Figure 2). This district has a total area of approximately 4,800km<sup>2</sup>. The area contains 16 local authorities and it has 22 Potentially Vulnerable Areas, and one candidate Potentially Vulnerable Area.

### Flood risk in Clyde and Loch Lomond

There are approximately 21,000 residential properties and 8,600 non-residential properties at risk of flooding within the Local Plan District. This equates to 27% of all properties at risk of flooding nationally. Within the Local Plan District, approximately 3% of the residential properties and 8% of non-residential properties are at risk and it is estimated that 97% of these properties are located within Potentially Vulnerable Areas. The Annual Average Damages from flooding (see glossary) are approximately £67 million.

River flooding is the main source of flooding in the Local Plan District, closely followed by surface water flooding (Figure 1). The Annual Average Damages caused by river flooding are £27 million, those caused by coastal flooding are £19 million and those caused by surface water flooding are £20 million.



**Figure 1:** Annual Average Damages by flood source

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

	Residential and non-residential properties at risk of flooding	Annual Average Damages
Glasgow City	13,000	£10,000,000
Paisley and Johnstone	2,900	£3,400,000
Dumbarton	2,000	£12,000,000
Gourock/Greenock/Port Glasgow	1,300	£2,100,000
Kirkintilloch	690	£1,100,000
Alexandria and Balloch	680	£4,100,000
Rutherglen	680	£1,900,000
Renfrew	630	£1,000,000
Coatbridge/Airdrie	550	£730,000
Clydebank	520	£2,400,000

**Table 1:** Main areas at risk of flooding

### Background information on the Clyde and Loch Lomond Local Plan District

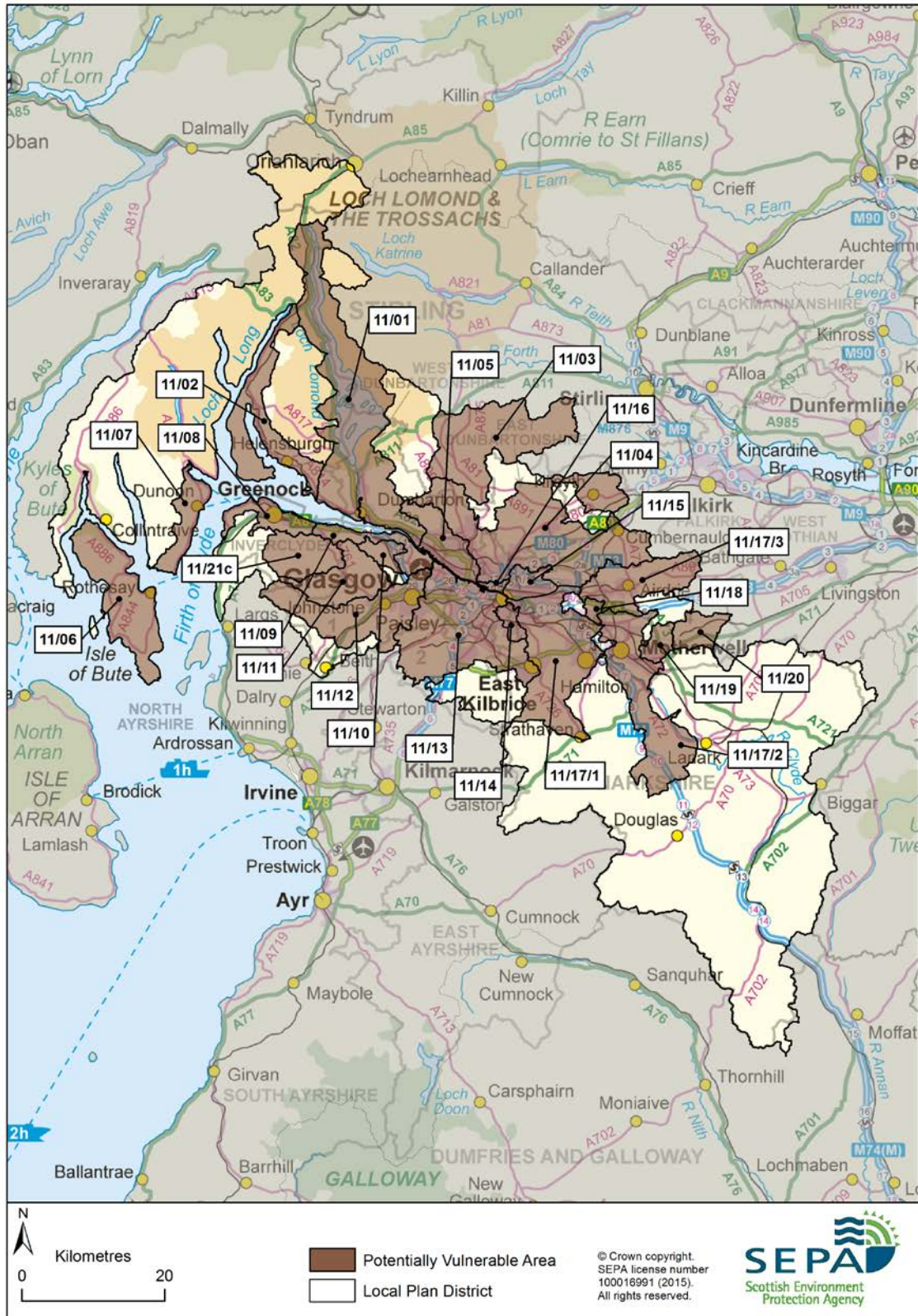
The extent of the Clyde and Loch Lomond Local Plan District and the location of the Potentially Vulnerable Areas are shown in Figure 2. There are many urban areas within the district including; Airdrie / Coatbridge, Cambuslang, Milngavie, Cumbernauld, Dumbarton, East Kilbride, Greenock, Motherwell / Wishaw, Hamilton, Paisley, Rutherglen and Glasgow City. The area has a population of over 1.9 million people.

The main river catchment within the area is the River Clyde, with other watercourses in the area mostly tributaries of the River Clyde including the River Kelvin, White Cart Water and Black Cart Water. The largest Loch in the area is Loch Lomond in the River Leven catchment.

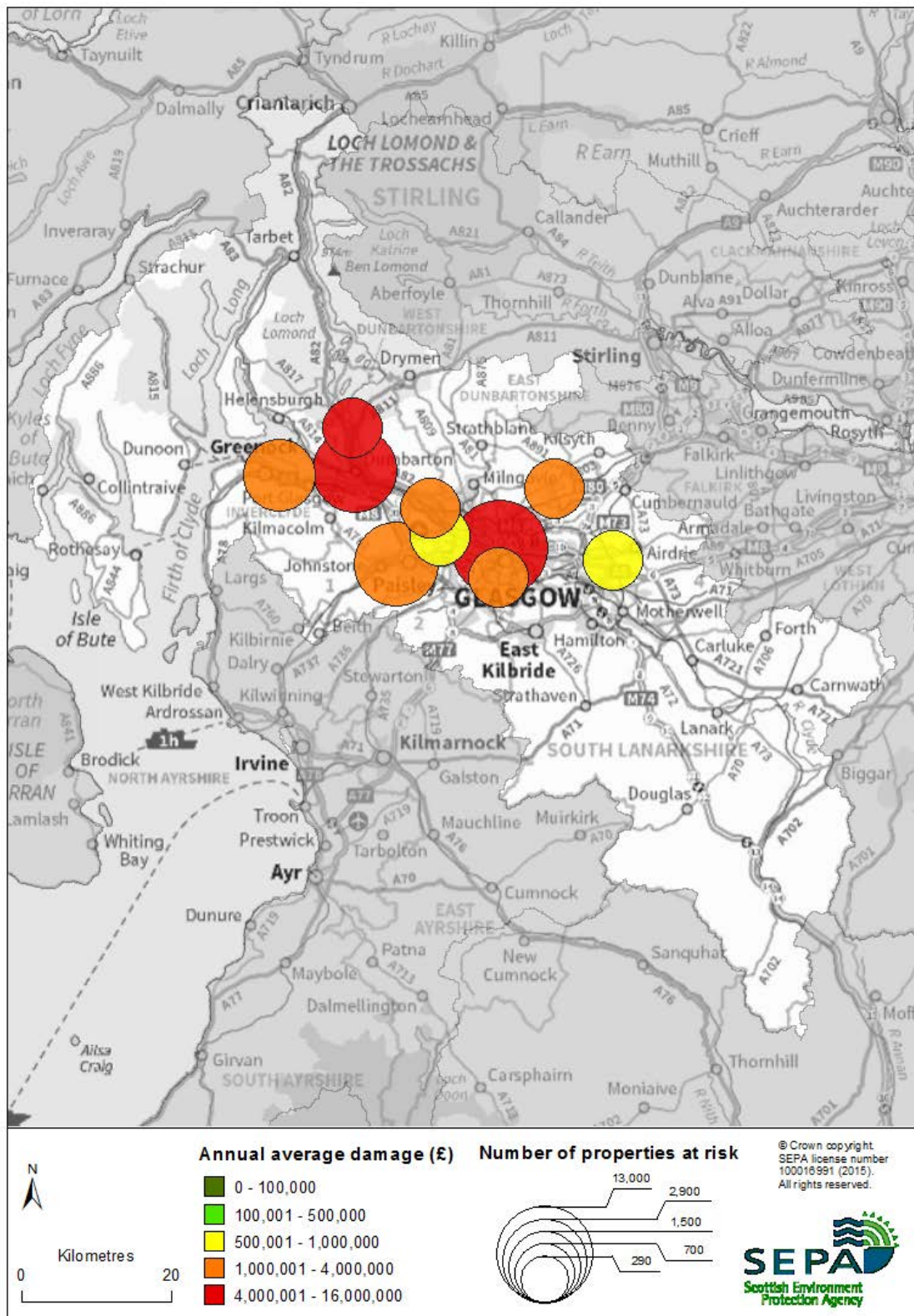
There are highly urbanised areas within this Local Plan District; however, the principal land use within the area is agricultural grazing. Coniferous and broadleaved woodland make up the second largest land cover within the district, and then urban and suburban areas.

The coastal area of the Clyde and Loch Lomond Local Plan District covers approximately 500km of coastline of the Firth of Clyde

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



**Figure 2: South West Local Plan District with Potentially Vulnerable Areas identified**



**Figure 3:** Clyde and Loch Lomond Local Plan District showing areas with most properties at risk of flooding and associated damages

## Objectives and actions in the Clyde and Loch Lomond 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 Clyde and Loch Lomond Local Plan District	Avoid an overall increase in flood risk	11127	<ul style="list-style-type: none"> <li>• 21,000 residential properties</li> <li>• 8,600 non-residential properties</li> <li>• 46,200 people</li> </ul>
Applies across Clyde and Loch Lomond Local Plan District	Reduce overall flood risk	11132	<ul style="list-style-type: none"> <li>• 21,000 residential properties</li> <li>• 8,600 non-residential properties</li> <li>• 46,200 people</li> </ul>

<b>Action (ID):</b>	<b>FLOOD FORECASTING (111320009)</b>		
<b>Objective (ID):</b>	<b>Reduce overall flood risk. (11132)</b>		
<b>Delivery lead:</b>	SEPA		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>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.</p> <p>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.</p>		



<b>Action (ID):</b>	<b>SELF HELP (111320011)</b>		
<b>Objective (ID):</b>	<b>Reduce overall flood risk. (11132)</b>		
<b>Delivery lead:</b>	–		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>AWARENESS RAISING (111320013)</b>		
<b>Objective (ID):</b>	<b>Reduce overall flood risk. (11132)</b>		
<b>Delivery lead:</b>	Responsible authorities		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>MAINTENANCE (111320007)</b>		
<b>Objective (ID):</b>	<b>Reduce overall flood risk. (11132)</b>		
<b>Delivery lead:</b>	Local authority, asset / land managers		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>EMERGENCY PLANS / RESPONSE (111320014)</b>		
<b>Objective (ID):</b>	<b>Reduce overall flood risk. (11132)</b>		
<b>Delivery lead:</b>	Category 1 and 2 Responders		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>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.</p>		

<b>Action (ID):</b>	<b>PLANNING POLICIES (111270001)</b>		
<b>Objective (ID):</b>	<b>Avoid an overall increase in flood risk. (11127)</b> <b>Reduce overall flood risk. (11132)</b>		
<b>Delivery lead:</b>	Planning authority		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>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.</p>		

## 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.

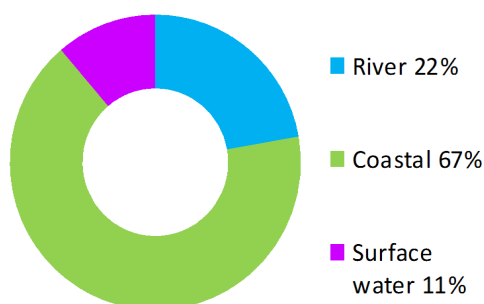
PVA	Flood protection scheme/ works	Natural flood management works	New flood warning	Flood protection study	Natural flood management study	Surface water plan/study	Strategic mapping and modelling	Maintain flood protection scheme*	Maintain flood warning*	Flood forecasting	Property level protection scheme	Community flood action groups	Self help	Awareness raising	Maintenance	Site protection plans	Emergency plans/ response	Planning policies
11/01	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓		✓	✓
11/02	✓			✓		✓	✓	N/A	✓	✓			✓	✓	✓		✓	✓
11/03							✓	N/A	N/A	✓			✓	✓	✓		✓	✓
11/04	✓		✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓
11/05				✓	✓	✓	✓	✓	✓	✓			✓	✓	✓		✓	✓
11/06				✓			✓	✓	✓	✓			✓	✓	✓		✓	✓
11/07				✓		✓	✓	✓	✓	✓			✓	✓	✓		✓	✓
11/08	✓					✓	✓	✓	✓	✓	✓		✓	✓	✓		✓	✓
11/09	✓					✓	✓	N/A	N/A	✓			✓	✓	✓		✓	✓
11/10						✓	✓	N/A	N/A	✓			✓	✓	✓		✓	✓
11/11	✓		✓			✓	✓	N/A	N/A	✓			✓	✓	✓		✓	✓
11/12	✓			✓	✓	✓	✓	✓	N/A	✓			✓	✓	✓		✓	✓
11/13	✓			✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓
11/14				✓		✓	✓	✓	N/A	✓		✓	✓	✓	✓		✓	✓
11/15						✓	✓	N/A	N/A	✓			✓	✓	✓		✓	✓
11/16	✓					✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓
11/17/1	✓			✓		✓	✓	✓	✓	✓		✓	✓	✓	✓		✓	✓
11/17/2	✓			✓		✓	✓	N/A	N/A	✓			✓	✓	✓	✓	✓	✓
11/17/3						✓	✓	N/A	N/A	✓			✓	✓	✓		✓	✓
11/18							✓	N/A	N/A	✓			✓	✓	✓		✓	✓
11/19						✓	✓	N/A	N/A	✓			✓	✓	✓		✓	✓
11/20							✓	N/A	N/A	✓			✓	✓	✓		✓	✓
11/21c	✓		✓		✓		✓	N/A	N/A	✓			✓	✓	✓		✓	✓

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

# Loch Lomond and Vale of Leven (Potentially Vulnerable Area 11/01)

Local Plan District	Local authority	Main catchment
Clyde and Loch Lomond	Argyll and Bute Council, Stirling Council, West Dunbartonshire Council	Loch Lomond

## Summary of flooding impacts



### At risk of flooding

- 3,300 residential properties
- 790 non-residential properties
- £17 million Annual Average Damages

(damages by flood source shown left)

Summary of flooding impacts

## 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.

Objectives

## 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

Actions

## Loch Lomond and Vale of Leven (Potentially Vulnerable Area 11/01)

Local Plan District	Local authority	Main catchment
Clyde and Loch Lomond	Argyll and Bute Council, Stirling Council, West Dunbartonshire Council	Loch Lomond

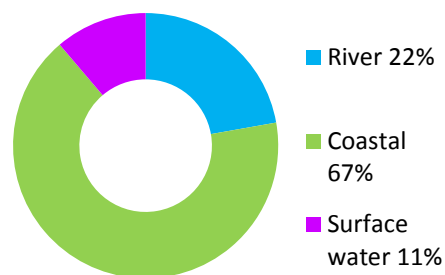
### Background

This Potentially Vulnerable Area is in the north of the Clyde and Loch Lomond Local Plan District (shown below). The area includes Loch Lomond and intersects the Loch Lomond and Trossachs National Park. It is approximately 300km<sup>2</sup>.



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

There are approximately 3,300 residential properties and 790 non-residential properties at risk of flooding. The Annual Average Damages are approximately £17 million.



**Figure 1: Annual Average Damages by flood source**

### Summary of flooding impacts

Coastal flooding from the Firth of Clyde and the River Leven present the greatest risk of flooding in this area. Coastal flooding is predicted to residential and non-residential properties within Dumbarton, Brucehill, Silverton and Dennyston.

River flooding is primarily from the River Leven and its tributaries, which include the Carrochan Burn, Knowle Burn, Gruggies Burn and the Murroch Burn along with two unnamed tributaries. The River Leven flows from Loch Lomond through Alexandria and Dumbarton before discharging to the Firth of Clyde. Flooding is predicted to a large number of residential and non-residential properties along the length of the Leven and the tributaries. This is shown to impact properties along the Vale of Leven and in the Bonhill area of Dumbarton. There are also transport links at risk of flooding (notably the A82 and A811).

A barrage across the River Leven in Alexandria maintains levels within Loch Lomond between a minimum of 23 feet (7m) above Ordnance Datum (AOD) and a maximum of 26 feet (7.6m) AOD. Levels exceeding 26 feet AOD will flow over the barrage gates. The barrage is operated by Scottish Water and is not formally used as a flood prevention structure, although it does help to reduce some flows.

There are a number of small areas around the shores of Loch Lomond which have non-residential properties and piers at risk of flooding.

There are approximately 400 residential properties at risk of surface water flooding. This risk is predominantly in the south, particularly affecting northern Dumbarton, including Silverton and Balloch. The areas at highest risk from surface water flooding will require the preparation of surface water management plans.

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 non-residential properties followed by damages to residential properties.

Within this Potentially Vulnerable Area it is estimated that climate change will increase the number of residential properties at risk of flooding from approximately 3,300 to 4,700 and the number of non-residential properties from approximately 790 to 1,100.

The location of the impacts of flooding is shown in Figure 3. Most of the impacts lie to the east of the A82 at Alexandria and south of the A82 at Dumbarton. This includes people, non-residential properties, community facilities, utilities and railways. The A82 itself floods at Alexandria, Renton and Dumbarton.

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 is one asset identified as being at risk of flooding.

	1 in 10 High likelihood	1 in 200 Medium likelihood	1 in 1000 Low likelihood
Residential properties (total 28,000)	1,700	3,300	4,500
Non-residential properties (total 2,200)	210	790	990
People	3,800	7,300	9,900
Community facilities	10 Includes: educational buildings, emergency services and healthcare facilities	10 Includes: educational buildings, emergency services and healthcare facilities	20 Includes: educational buildings, emergency services and healthcare facilities
Utilities assets	20	50	80
Transport links - roads (km)	8.8 (of which 3.7 is A road)	19.3 (of which 7.4 is A road)	23.8 (of which 8.7 is A road)
Transport links - rail (km)	6.9	12.6	16.5
Environmental designated areas (km <sup>2</sup> )	10.7	11.7	12.3
Designated cultural heritage sites	27	35	36
Agricultural land (km <sup>2</sup> )	1.4	1.9	2.2

Table 1: Summary of flooding impacts<sup>1</sup>

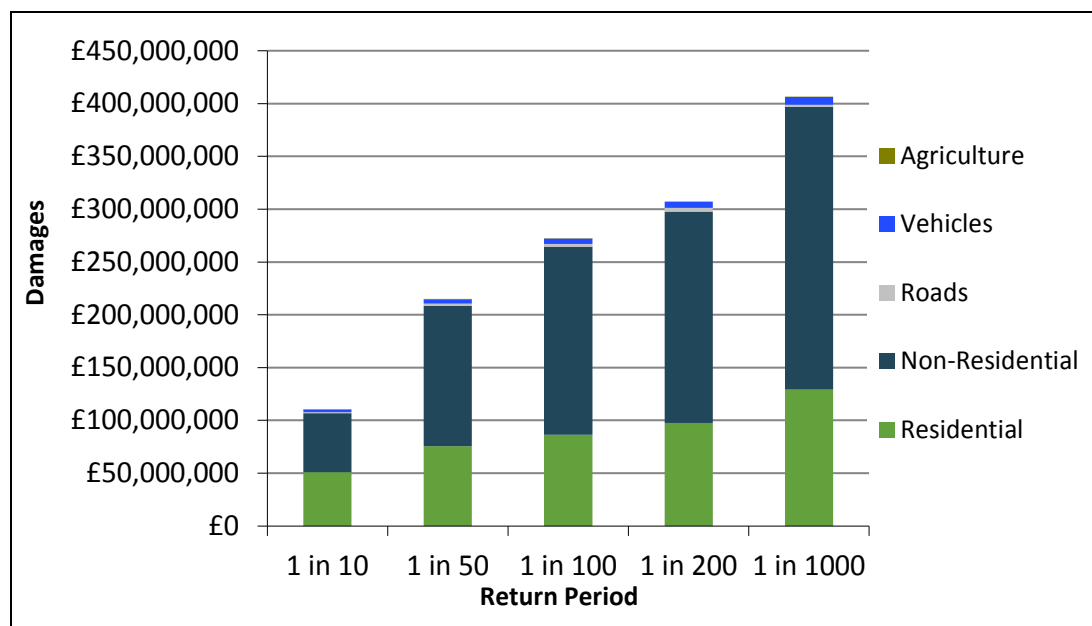


Figure 2: Damages by flood likelihood

<sup>1</sup> Some receptors are counted more than once if flooded from multiple sources

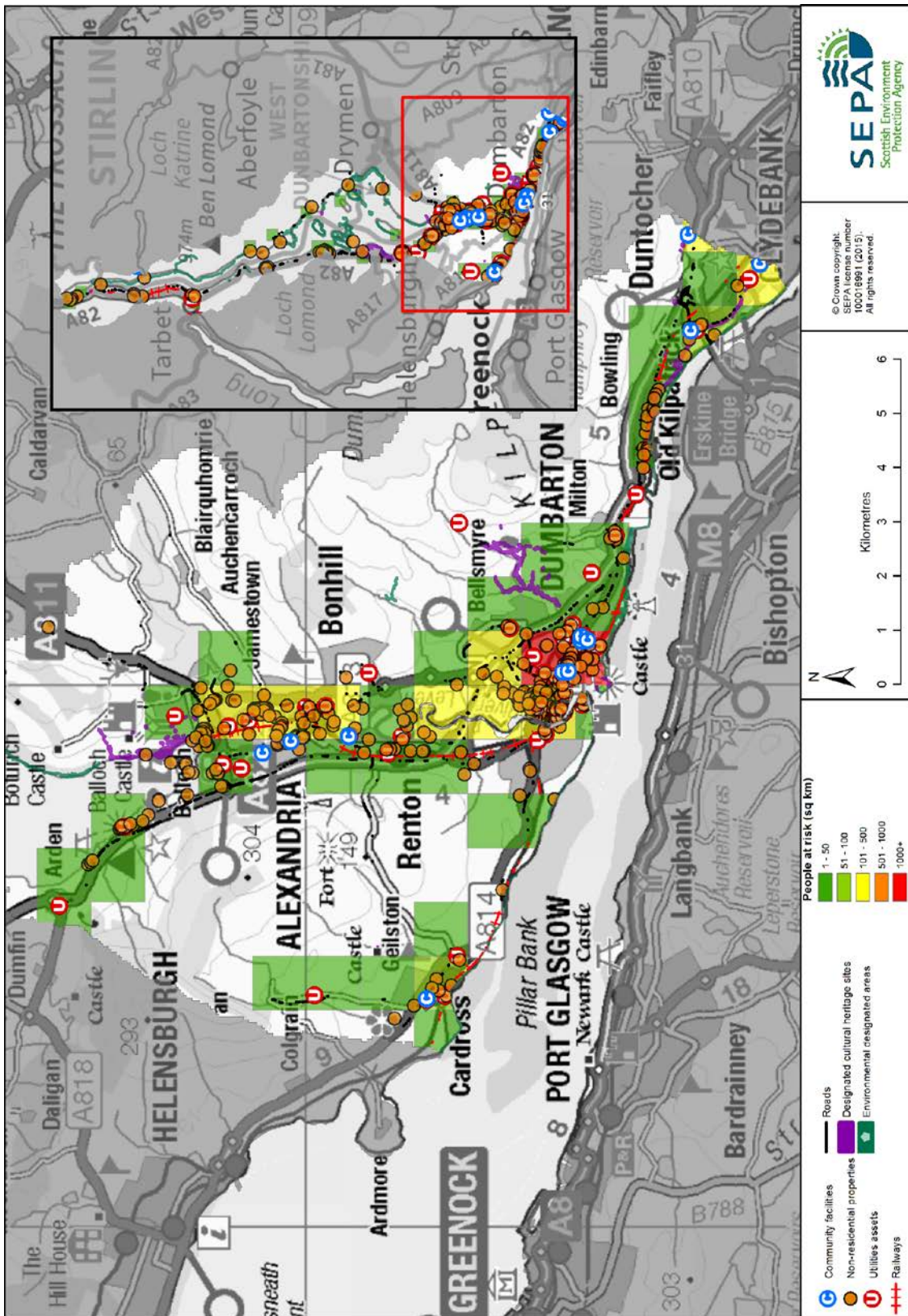


Figure 3: Impacts of flooding



## History of flooding

There have been frequent reports of flooding in area, with flooding from coastal, river and surface water impacting people and properties. Coastal floods were reported in February 1856 and December 1900, inundating High Street in Dumbarton and destroying Dumbarton Pier. A tidal event in January 1991 affected Dumbarton when an extreme high tide (the most intense depression recorded in the North Atlantic until that time) coincided with a moderately high river flow and resulted in over £500,000 of damages.

River floods have mainly been recorded in Dumbarton with flooding also reported in Alexandria. Within Dumbarton there are numerous recent recorded floods on the Gruggies Burn and Knowles Burn, with records in 2002, 2004 and 2005. On the 29 November 2011 the Gruggies Burn flooded and affected a number of properties near the east bank of the River Leven in Dumbarton. There are a number of river flooding reports near Silverton, which has also been subject to coastal and surface water flooding. These floods have impacted residential properties, hotels, trunk roads and agricultural land.

One river flood in particular occurred in Dumbarton in January 1909, destroying a bridge and impacting nearby roads and residential properties. Main roads have been impacted by flooding on a number of occasions with the A82 flooding in July 2004, and in October 2005 a culvert blockage caused a surcharge onto the A813 south of the access to the Vale of Leven Industrial Estate.

Several properties and roads around Loch Lomond have also been significantly impacted by river floods, such as Duck Bay, which flooded in December 2006. During this flood the River Leven flows were the highest on record, with an estimated return period of 110-120 years.

Surface water flooding has occurred further north of the Silverton area in Bellsmyre and Jamestown, affecting gardens and low lying farmland. In February 2011 floods caused extensive damage to the recreational reserve at Cardross, destroying the oval, clubrooms, playground and netball courts.

## Objectives to manage flooding in Potentially Vulnerable Area 11/01

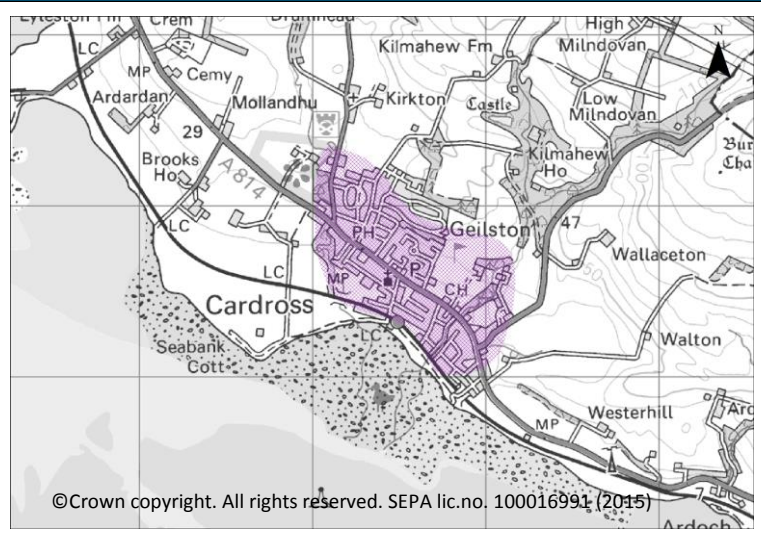
Objectives provide a common goal and shared ambition for managing floods. These objectives have been set by SEPA and agreed with flood risk management authorities following consultation. They were identified through an assessment of the underlying evidence of the causes and impacts of flooding. Target 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 Loch Lomond and Vale of Leven Potentially Vulnerable Area.

### Reduce the risk of river and surface water flooding to residential properties and community facilities in Cardross

Indicators:

- 40 residential properties
- £92,000 Annual Average Damages
- 1 educational building

Target area:



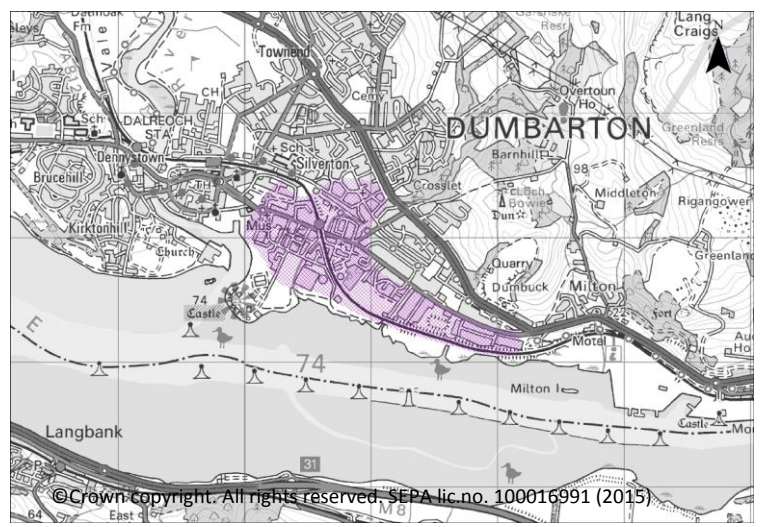
Objective ID: 11001

### Reduce the risk of flooding to residential properties, non-residential properties and transport routes in Dumbarton from the Gruggies Burn and coast

Indicators:

- 1,300 residential properties
- 110 non-residential properties
- £5.9 million Annual Average Damages
- 1.1km of road

Target area:



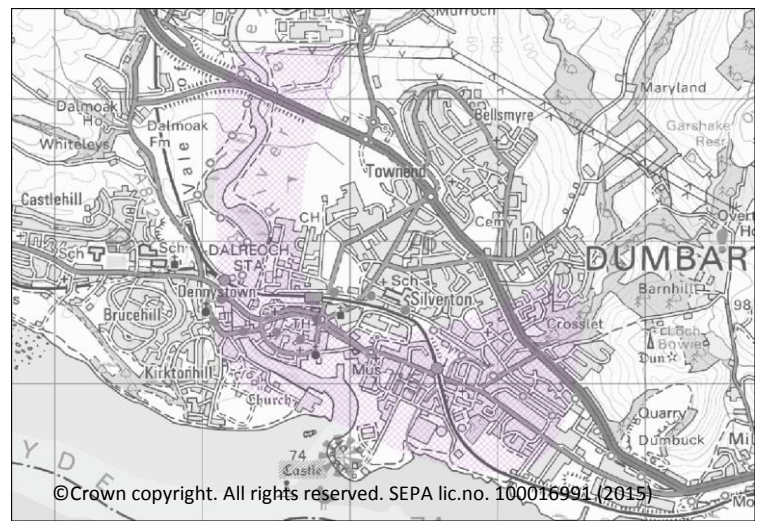
Objective ID: 11072

**Accept that current significant flood risks along the Knowle Burn are being managed appropriately**

Indicators:

Target area:

- Protection provided to:
- 69 residential properties
  - 1 Educational building



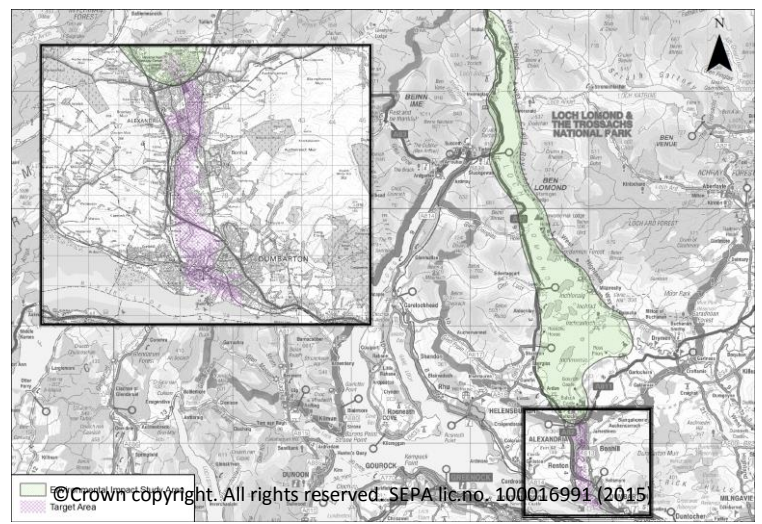
Objective ID: 11074

**Reduce the risk of flooding from the River Leven and Firth of Clyde to residential properties, non-residential properties and community facilities in Vale of Leven and Dumbarton**

Indicators:

Target area:

- 2,600 residential properties
- 520 non-residential properties
- £15 million Annual Average Damages
- 5 educational buildings



Objective ID: 11075

Target area	Objective	ID	Indicators within PVA
Loch Lomond and Vale of Leven	Reduce the risk of disruption along the A82 due to flooding	11300	<ul style="list-style-type: none"> <li>• 1.2km of the A82 at 58 locations</li> </ul>
Alexandria	Reduce the economic damages and risk to people from surface water flooding in Alexandria	11124	* See note below
Dumbarton	Reduce the economic damages and risk to people from surface water flooding in Dumbarton	11125	* See note below
Applies across Clyde and Loch Lomond Local Plan District	Avoid an overall increase in flood risk	11127	<ul style="list-style-type: none"> <li>• 3,300 residential properties</li> <li>• £17 million Annual Average Damages</li> </ul>
Applies across Clyde and Loch Lomond Local Plan District	Reduce overall flood risk	11132	<ul style="list-style-type: none"> <li>• 3,300 residential properties</li> <li>• £17 million Annual Average Damages</li> </ul>
Applies across Clyde and Loch Lomond 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 11/01 there are 870 residential properties at risk and Annual Average Damages of £2.0 million.

## Actions to manage flooding in Potentially Vulnerable Area 11/01

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 Loch Lomond and Vale of Leven 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

<b>Action (ID):</b>	<b>FLOOD PROTECTION SCHEME/WORKS (110720006)</b>				
<b>Objective (ID):</b>	Reduce the risk of flooding from the River Leven and Firth of Clyde to residential properties, non-residential properties and community facilities in Vale of Leven and Dumbarton (11075) Reduce the risk of flooding to residential properties, non-residential properties and transport routes in Dumbarton from the Gruggies Burn and coast (11072)				
<b>Delivery lead:</b>	West Dunbartonshire Council				
<b>Priority:</b>	National:		Within local authority:		
	<b>29 of 42</b>		<b>1 of 1</b>		
<b>Status:</b>	<b>Under development</b>	Indicative delivery:	<b>2016-2021</b>		
<b>Description:</b>	It is recommended that the council progress preparation work on the proposed flood protection scheme for Gruggies Burn. Further design work is required to refine the preferred option for the scheme, which at present is to maximise upstream flood storage and construct defences from Hunter's Burn to Castle Street, and downstream of Castlegreen Street, to address coastal flooding. In addition to these actions the use of property level protection within the scheme should be investigated. The natural flood management work (action 110720004) will also help to reduce the impact of flooding in this area. SEPA will review the study outputs for possible inclusion to the Flood Maps.				
<b>Potential impacts</b>					
<b>Economic:</b>	The proposed scheme may benefit 350 residential properties and 20 non-residential properties at risk of flooding in this location, damages avoided are estimated to be £20 million. The flood protection scheme has an estimated benefit cost ratio of 1.3.				

<b>Social:</b>	A reduction in flood risk would have a positive benefit to the health and wellbeing of the community.
<b>Environmental:</b>	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 should seek to ensure that the scheme will not have an adverse effect on the integrity of the Inner Clyde Special Protection Area. There is the potential for the action to have an impact on the Inner Clyde Site of Special Scientific Interest. The proposed Flood protection works may cover part of the Clyde Estuary water body ID 200320. The physical condition of this estuary is identified by river basin management planning 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.

<b>Action (ID):</b>	<b>FLOOD PROTECTION SCHEME/WORKS (11300021)</b>		
<b>Objective (ID):</b>	Reduce the risk of disruption along the A82 due to flooding (11300)		
<b>Delivery lead:</b>	Transport Scotland		
<b>Status:</b>	<b>Under development</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	Transport Scotland will carry out civil engineering work which will reduce flood risk to identified sections of the trunk road.		

<b>Action (ID):</b>	<b>NATURAL FLOOD MANAGEMENT WORKS (110720004)</b>		
<b>Objective (ID):</b>	Reduce the risk of flooding to residential properties, non-residential properties and transport routes in Dumbarton from the Gruggies Burn and coast (11072)		
<b>Delivery lead:</b>	West Dunbartonshire Council		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	Native woodland planting in the upper catchment has been investigated by the council. The woodland will help to slow and reduce runoff into the river which could reduce the impact from high likelihood flooding. It is recommended that the council start woodland planting and investigate other locations with the potential for runoff control which have also been identified in the strategic assessment of this area.		
<b>Potential impacts</b>			
<b>Economic:</b>	The economic impact of natural flood management actions is difficult to define. However, these actions can reduce risk from high likelihood floods. In this location, it has been estimated that 220 residential and non-residential properties could potentially benefit from natural flood management actions.		

<b>Social:</b>	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 educational building and one utility which have been identified as potentially benefitting from this action. Natural flood management actions can restore and enhance natural environments and create opportunities for recreation and tourism.
<b>Environmental:</b>	Natural flood management actions can have a positive impact on the ecological quality of the environment by restoring and enhancing natural habitats. There are unlikely to be significant negative impacts on protected environmental sites from this action, provided that any runoff control does not impact the three nearby Sites of Special Scientific Interest. There is the potential for the existing ecosystems in the area to be impacted through a potential change to woodland. There are likely to be improvements in water quality through reduced agricultural chemical and sediment runoff, which will have positive impacts on the terrestrial and freshwater habitats and species in the area. There is also the potential for increased carbon storage with this action.

<b>Action (ID):</b>	<b>NEW FLOOD WARNING (111320010)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	SEPA		
<b>Status:</b>	<b>Ongoing</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	Continue with the development of the River Leven and Loch Lomond flood warning scheme. This will provide warnings to properties at risk between Loch Lomond and Dumbarton Common with the main centres of risk found at Balloch and Alexandria.		

<b>Action (ID):</b>	<b>FLOOD PROTECTION STUDY (110750005)</b>		
<b>Objective (ID):</b>	Reduce the risk of flooding from the River Leven and Firth of Clyde to residential properties, non-residential properties and community facilities in Vale of Leven and Dumbarton (11075)		
<b>Delivery lead:</b>	West Dunbartonshire Council		
<b>Priority:</b>	National:	Within local authority:	
	<b>1 of 168</b>	<b>1 of 2</b>	
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	A study is recommended to further investigate the feasibility of a flood protection scheme to reduce river and coastal risk along the River Leven. This should build on previous studies to examine the potential benefits of a new canal, sediment management including the erosion of banks, the potential to set back existing embankments and new direct defences along the River Leven. In addition to this the potential to increase flood storage within Loch Lomond, while remaining within the current operating limits of the barrage, should be investigated. The study should initially look to establish a technical grounding to any potential benefit of additional storage within Loch Lomond. If there is an identified benefit from this action, a second		

	<p>stage of work should be undertaken. The second stage of work should focus on engaging with interested stakeholders to establish the feasibility and restrictions to taking forward this action.</p> <p>Due to the importance of the area, the study, while led by West Dunbartonshire Council, should be carried out in partnership with Loch Lomond and The Trossachs National Park, Scottish Water and SEPA.</p> <p>SEPA will review the study outputs for possible inclusion to the Flood Maps.</p>
<b>Potential impacts</b>	
<b>Economic:</b>	The flood protection study should consider how to reduce flood risk to 610 residential properties and 70 non-residential properties in this location, with potential damages avoided of up to £32 million.
<b>Social:</b>	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, there are one educational building and three utilities which have been identified as potentially benefitting from this action.
<b>Environmental:</b>	Flood protection studies should consider the positive and negative impacts of proposed actions on the ecological quality of the environment. This study is proposed for the Outer Clyde Estuary (water body ID 200320). The physical condition of this estuary is identified by river basin management planning 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 should seek to ensure that the actions will not have an adverse effect on the integrity of the Inner Clyde Special Protection Area, Loch Lomond Water Special Area of Conservation, Endrick Water Special Area of Conservation, and Loch Lomond Special Protection Area. The international, national and local level environmental designations in the area are unlikely to be impacted by this action provided any temporary changes in hydrology from barrage operation are within the current operating regime. Any drawdown in loch levels prior to a flood should only provide slight temporary impacts, which should be within the normal barrage operating regime. Increased use of the Leven Barrage to take account of potential floods would be likely to cause increases in greenhouse gas emissions.

<b>Action (ID):</b>	<b>FLOOD PROTECTION STUDY (110010005)</b>		
<b>Objective (ID):</b>	Reduce the risk of river and surface water flooding to residential properties and community facilities in Cardross (11001)		
<b>Delivery lead:</b>	Argyll and Bute Council		
<b>Priority:</b>	National:	Within local authority:	
	<b>156 of 168</b>	<b>9 of 9</b>	
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2022-2027</b>



<b>Description:</b>	A study is recommended to further investigate the feasibility of a flood protection scheme in Cardross, focusing on the potential for storage areas upstream of Moore's Bridge and consideration of property level protection. The study should also consider the combined risk from the current drainage system and rivers to investigate the feasibility of mitigation actions including sustainable drainage systems. Other actions may also be considered to select the most sustainable combination of actions.
<b>Potential impacts</b>	
<b>Economic:</b>	The flood protection study should consider how to reduce flooding to 10 residential properties and one non-residential property identified at risk of flooding in this location. The potential damages avoided are estimated to be up to £600,000.
<b>Social:</b>	A reduction in flood risk would have a positive benefit to the health and wellbeing of the community. There may be negative impacts through disturbance to the local community during the construction phase.
<b>Environmental:</b>	Flood protection studies should consider the positive and negative impacts of proposed actions on the ecological quality of the environment. Opportunities to mitigate any environmental impacts may include design and timing of works.

<b>Action (ID):</b>	<b>NATURAL FLOOD MANAGEMENT STUDY (110750003)</b>		
<b>Objective (ID):</b>	Reduce the risk of flooding from the River Leven and Firth of Clyde to residential properties, non-residential properties and community facilities in Vale of Leven and Dumbarton (11075)		
<b>Delivery lead:</b>	Loch Lomond and The Trossachs National Park Authority		
<b>Status:</b>	<b>Not started</b>	<b>Indicative delivery:</b>	<b>2016-2021</b>
<b>Description:</b>	It is recommended that a natural flood management study should be undertaken by Loch Lomond and The Trossachs National Park in partnership with West Dunbartonshire Council, Argyll and Bute Council and Stirling Council to further investigate in detail the potential benefit for runoff control in areas surrounding Loch Lomond. This study will focus on reducing runoff to the small burns that feed into Loch Lomond, which can impact some communities and transport routes.		
<b>Potential impacts</b>			
<b>Economic:</b>	The economic impact of natural flood management actions is difficult to define. However, these actions can reduce flood risk for high likelihood events. In this location, it has been estimated that 250 residential and non-residential properties could potentially benefit from natural flood management actions.		
<b>Social:</b>	A reduction in flood risk would have a positive benefit to the health and wellbeing of the community. In addition there are one educational building and one utility which have been identified as potentially benefitting from this action. Natural flood management actions can restore and enhance natural environments and create opportunities for recreation and tourism.		
<b>Environmental:</b>	Natural flood management actions can have a positive impact on the ecological quality of the environment by restoring and enhancing		

**Environmental:** natural habitats. To be in accord with the Flood Risk Management 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 Loch Lomond Woods Special Area of Conservation, Endrick Water Special Area of Conservation, Glen Etive and Glen Fyne Special Protection Area, and Loch Lomond Special Protection Area. There is potential for impacts on 12 Sites of Special Scientific Interest in the area. Depending on the runoff control measures implemented and given the natural state of this area, impacts to Loch Lomond could be positive or negative. Positive impacts will occur through more natural drainage, reduced agricultural and sediment runoff and therefore improved water quality. Negative impacts will occur through potential change of land use and ecology if woodland planting is undertaken where not appropriate. There is high potential for priority bogs in upland areas including Auchinden Hill, Strathblane Hills and Gargunnock Hills. Runoff control using more sensitive land management may be more appropriate throughout these areas than woodland planting, which may only be appropriate in less natural areas on the periphery of Renton, Alexandria and Dumbarton. There is the potential for catchment runoff control at the northern end of Loch Lomond to impact upon the Ben Lui National Nature Reserve. Locally there is the potential for improved water quality, reduced sediment and reduced scour from this action. There is also the potential for increased carbon storage with this action. However, given the natural state of much of Loch Lomond, most benefits would be in the Renton, Alexandria, Bonhill and Dumbarton areas from local runoff control measures. There may be short term negative impacts on water quality during sediment management works. There may be localised loss of habitat and displacement of species during sediment management works; however, these may re-establish and return to the area following sediment management activities. There is the potential for this action to impact on the Rossdhu protected garden and designed landscape, the Luss and Fintry heritage conservation areas and 17 scheduled sites and monuments. Although the highlighted areas for potential runoff control intersect over 100 listed building, it is unlikely that this action would significantly impact upon them or their setting.

<b>Action (ID):</b>	<b>SURFACE WATER PLAN/STUDY (111240018)</b>		
<b>Objective (ID):</b>	Reduce the economic damages and risk to people from surface water flooding in Alexandria (11124)		
<b>Delivery lead:</b>	West Dunbartonshire Council		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2022-2027</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>SURFACE WATER PLAN/STUDY (111250018)</b>		
<b>Objective (ID):</b>	Reduce the economic damages and risk to people from surface water flooding in Dumbarton (11125)		
<b>Delivery lead:</b>	West Dunbartonshire Council		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>STRATEGIC MAPPING AND MODELLING (111320019)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Scottish Water		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>MAINTAIN FLOOD PROTECTION SCHEME (110740017)</b>		
<b>Objective (ID):</b>	Accept that current significant flood risks along the Knowle Burn are being managed appropriately (11074)		
<b>Delivery lead:</b>	West Dunbartonshire Council		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	Continue to maintain the existing flood defences along the Knowle Burn.		

<b>Action (ID):</b>	<b>MAINTAIN FLOOD WARNING (111320030)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	SEPA		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	Continue to maintain the Dumbarton Central, Dumbarton Common and Dumbarton East End flood warning areas which are part of the Firth of Clyde coastal flood warning scheme.		

<b>Action (ID):</b>	<b>FLOOD FORECASTING (111320009)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	SEPA		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>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.</p>		

<b>Action (ID):</b>	<b>SELF HELP (111320011)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	—		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>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.</p> <p>West Dunbartonshire Council have in place a flood resilience subsidy scheme which permits any residential or business property at risk of flooding to apply. The scheme enables applicants to purchase selected property level protection products at cost price less a maximum subsidy.</p>		

<b>Action (ID):</b>	<b>AWARENESS RAISING (111320013)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Responsible authorities		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>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.</p> <p>From 2016 SEPA will engage with the community and promote Floodline. This will be achieved through SEPA-led education events. Local authorities will be undertaking additional awareness raising activities. Further details will be set out in the Local FRM Plan.</p>		

<b>Action (ID):</b>	<b>MAINTENANCE (111320007)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Local authorities, asset / land managers		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>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.</p>		

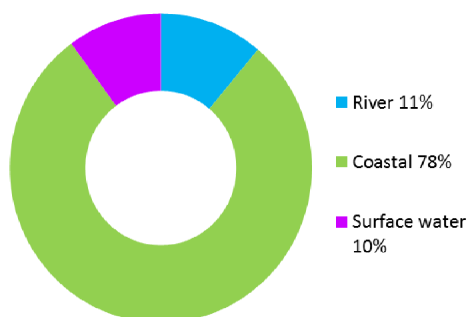
<b>Action (ID):</b>	<b>EMERGENCY PLANS/RESPONSE (111320014)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Category 1 and 2 Responders		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>Providing an emergency response to 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.</p>		

<b>Action (ID):</b>	<b>PLANNING POLICIES (111270001)</b>		
<b>Objective (ID):</b>	Avoid an overall increase in flood risk (11127) Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Planning authority		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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.		

# Helensburgh to Loch Long (Potentially Vulnerable Area 11/02)

Local Plan District	Local authority	Main catchment
Clyde and Loch Lomond	Argyll and Bute Council	Loch Long and Gare Loch

## Summary of flooding impacts



### At risk of flooding

- 70 residential properties
- 90 non-residential properties
- £390,000 Annual Average Damages

(damages by flood source shown left)

Summary of flooding impacts

## 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.

Objectives

## Summary of actions to manage flooding

The actions below have been selected to manage flood risk.

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

Actions

# Helensburgh to Loch Long (Potentially Vulnerable Area 11/02)

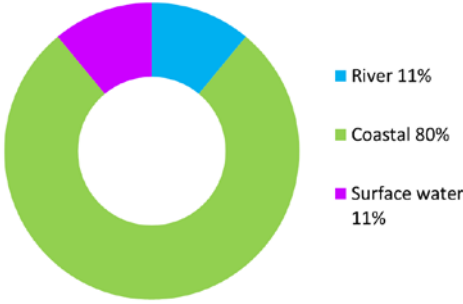
Local Plan District	Local authority	Main catchment
Clyde and Loch Lomond	Argyll and Bute Council	Loch Long and Gare Loch

## Background

This Potentially Vulnerable Area is located to the north of the Firth of Clyde. It incorporates Helensburgh and Garelochhead and is approximately 100km<sup>2</sup> (shown below). It includes part of the Loch Lomond and Trossachs National Park.

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

There are approximately 70 residential properties and 90 non-residential properties at risk of flooding. The Annual Average Damages are approximately £390,000.



**Figure 1: Annual Average Damages by flood source**

## Summary of flooding impacts

Coastal flooding affects the shoreline within Loch Long and Gare Loch. The coastal modelling does not take into account the impact of wave overtopping and as a result coastal flood risk may be underestimated.

Areas where residential properties are at risk include Coulport, Kilcreggan, Rosneath, Clynder, Garelochhead, Shandon and Helensburgh. It is also recognised that passenger ferry piers at Helensburgh and Kilcreggan lie within an area of coastal flood risk. A number of other transport routes are also at risk (notably the A83 and A814).

River flooding within the area is primarily attributed to the Mcaulay Burn, which flows into the northern end of Gare Loch at Garelochhead where residential properties are at risk. To the south there is a risk of flooding to residential properties from the Red Burn in Craigendoran, in the vicinity of the A814.



Surface water flooding is identified as a risk near Garelochhead and Craigendoran, with impacts to utilities and transport routes. The methodology for the national surface water flood maps is known to underestimate the risk in Kilcreggan and Helensburgh. The areas at highest risk from surface water flooding will require the preparation of surface water management plans.

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. Residential and non-residential properties affected by coastal flooding experience the highest economic impact, contributing to approximately 50% of the overall damages.

Within this Potentially Vulnerable Area it is estimated that climate change will increase the number of residential properties at risk of flooding from approximately 70 to 230 and the number of non-residential properties from approximately 90 to 200.

The location of the impacts is shown in Figure 3. Most of impacts are along the A814 at Helensburgh and the B872 at Garelochhead. This includes flooding to people, properties, utilities and the A814 itself which floods at Helensburgh.

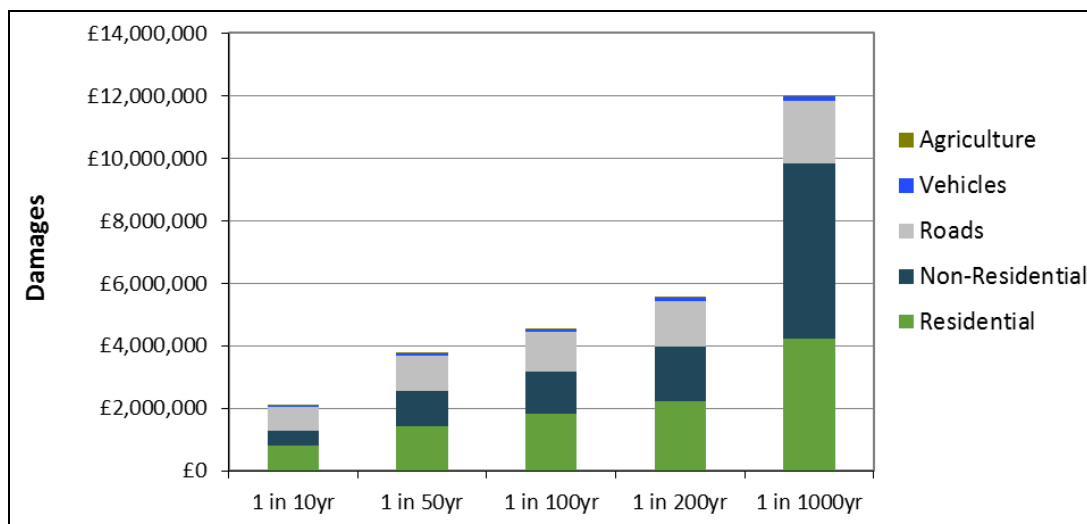
The risk of flooding to utilities in Table 1 does not include Scottish Water data. Scottish Water undertook a national assessment of above ground assets at medium likelihood of flooding (including water treatment works, wastewater treatment works, and pumping stations). Within this Potentially Vulnerable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

## **History of flooding**

The seafront at Helensburgh along East/West Clyde Street is susceptible to coastal flooding, with records dating back to 1922. A report compiled by Halcrow in 2001 stated that the highest sea level recorded at Helensburgh was experienced on the 5 January 1991. On the 8 December 2011 storms on the west coast of Scotland caused damages in Helensburgh. On the 18 November 2010, storms and high tides submerged the car park at Helensburgh pier and stranded vehicles. Historical flood records show that coastal flooding has taken place in this Potentially Vulnerable Area in 1922, 1961, 2002 and 2004.

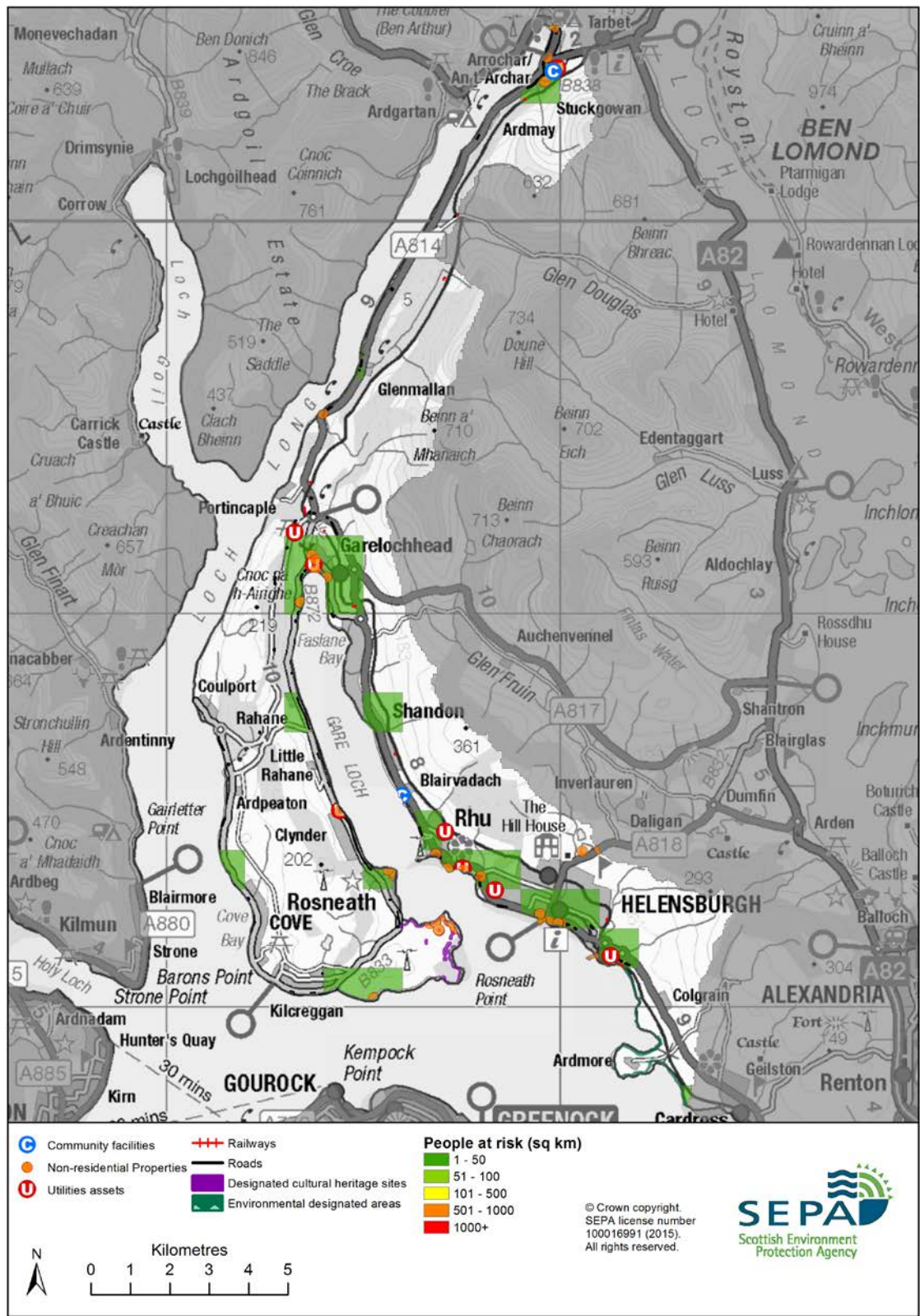
	1 in 10	1 in 200	1 in 1000
	High likelihood	Medium likelihood	Low likelihood
Residential properties (total 10,000)	30	70	140
Non-residential properties (total 2,300)	50	90	150
People	60	150	310
Community facilities	<10 Emergency services	<10 Includes: emergency services and healthcare facilities	<10 Includes: emergency services, educational buildings and healthcare facilities
Utilities assets	<10	<10	10
Transport links - roads (km)	4.4 (of which 0.1 is A road)	7.1 (of which 0.2 is A road)	8.9 (of which 0.2 is A road)
Transport links - rail (km)	0.5	0.6	0.5
Environmental designated areas (km <sup>2</sup> )	0.3	0.3	0.3
Designated cultural heritage sites	5	6	6
Agricultural land (km <sup>2</sup> )	0.2	0.3	0.4

**Table 1:** Summary of flooding impacts<sup>1</sup>



**Figure 2:** Damages by flood likelihood

<sup>1</sup> Some receptors are counted more than once if flooded from multiple sources



**Figure 3: Impacts of flooding**

## Objectives to manage flooding in Potentially Vulnerable Area 11/02

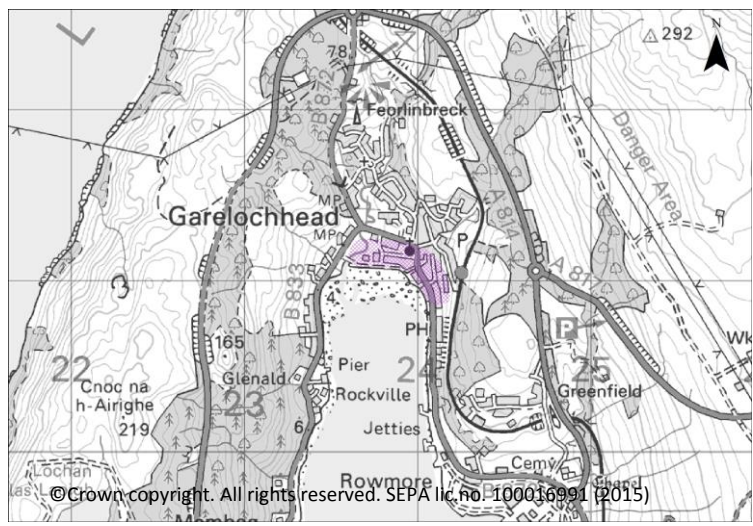
Objectives provide a common goal and shared ambition for managing floods. These objectives have been set by SEPA and agreed with flood risk management authorities following consultation. They were identified through an assessment of the underlying evidence of the causes and impacts of flooding. Target 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 Helensburgh to Loch Long Potentially Vulnerable Area.

### Reduce the risk of coastal flooding to residential properties and non-residential properties in Garelochhead

Indicators:

- 10 residential properties
- <10 non-residential properties
- £47,000 Annual Average Damages

Target area:



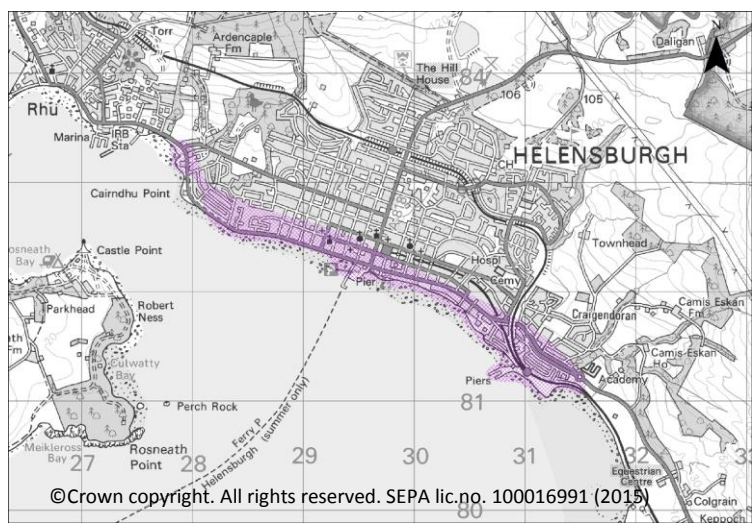
Objective ID: 11002

### Reduce the risk of coastal flooding to residential properties and non-residential properties in Helensburgh

Indicators:

- 30 residential properties
- 10 non-residential properties
- £48,000 Annual Average Damages

Target area:



Objective ID: 11003

Target area	Objective	ID	Indicators within PVA
Craigendoran	Reduce the physical or disruption risk related to the transport network for rail.	11301	<ul style="list-style-type: none"> <li>• 0.3km of rail track at 1 location</li> </ul>
Kilcreggan	Reduce the economic damages and risk to people from surface water flooding in Kilcreggan	11084	* See note below
Applies across Clyde and Loch Lomond Local Plan District	Avoid an overall increase in flood risk	11127	<ul style="list-style-type: none"> <li>• 70 residential properties</li> <li>• £390,000 Annual Average Damages</li> </ul>
Applies across Clyde and Loch Lomond Local Plan District	Reduce overall flood risk	11132	<ul style="list-style-type: none"> <li>• 70 residential properties</li> <li>• £390,000 Annual Average Damages</li> </ul>
Applies across Clyde and Loch Lomond 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 11/02 there are 10 residential properties at risk and Annual Average Damages of £43,000.

## Actions to manage flooding in Potentially Vulnerable Area 11/02

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 Helensburgh to Loch Long Potentially Vulnerable Area.

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

<b>Action (ID):</b>	<b>FLOOD PROTECTION SCHEME/WORKS (110840005)</b>		
<b>Objective (ID):</b>	Reduce the economic damages and risk to people from surface water flooding in Kilcreggan (11084)		
<b>Delivery lead:</b>	Argyll and Bute Council		
<b>Status:</b>	<b>Under development</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	<p>Argyll and Bute Council have completed a study of surface water flooding in Kilcreggan, which identified frequent surface water flooding due to runoff from the surrounding area. It is recommended that mitigation options are further refined to produce an economic appraisal of benefits from flood protection works. The preparation work should also examine the use of property level protection as a single action and in combination with other actions and the potential benefits of natural flood management for runoff control. This work is linked to the surface water management plan.</p> <p>The work has not been prioritised as further investigation is required to develop the work that will be carried out and to establish the benefits of the work.</p>		
<b>Potential impacts</b>			
<b>Economic:</b>	The economic impacts will be established during the study, however frequent flooding to roads has been experienced.		
<b>Social:</b>	A reduction in flood risk would have a positive benefit to the health and wellbeing of the community.		
<b>Environmental:</b>	Flood protection studies should consider the positive and negative impacts of proposed actions on the ecological quality of the environment.		

<b>Action (ID):</b>	<b>FLOOD PROTECTION SCHEME/WORKS (113010021)</b>		
<b>Objective (ID):</b>	Reduce the physical or disruption risk related to the transport network for rail. (11301)		
<b>Delivery lead:</b>	Network Rail		
<b>Status:</b>	<b>Under development</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	Network Rail will carry out civil engineering work which will reduce flood risk to identified sections of the rail network within this Potentially Vulnerable Area.		

<b>Action (ID):</b>	<b>FLOOD PROTECTION STUDY (110030005)</b>		
<b>Objective (ID):</b>	Reduce the risk of coastal flooding to residential properties and non-residential properties in Helensburgh (11003)		
<b>Delivery lead:</b>	Argyll and Bute Council		
<b>Priority:</b>	National:	Within local authority:	
	<b>127 of 168</b>	<b>4 of 9</b>	
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	A study is recommended to further investigate the feasibility of new and or enhanced sections of defences along the seafront of Helensburgh. This study should look to complement and enhance the proposed development along the seafront including a new swimming pool and raised car park in Helensburgh. The study should also consider the potential for natural flood management actions to help reduce coastal flooding and the maintenance of defences. Other actions may also be considered to select the most sustainable combination of actions.		

<b>Potential impacts</b>			
<b>Economic:</b>	The flood protection study should consider how to reduce flooding to 26 residential properties and 13 non-residential properties. The potential damages avoided are estimated to be up to £1.2 million. A reduction of flooding in the area could have a positive economic benefit to the local economy.		
<b>Social:</b>	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. There may be changes in visual amenity and land use as a result of this action.		
<b>Environmental:</b>	Flood protection studies should consider the positive and negative impacts of proposed actions on the ecological quality of the environment. Within the study area the Outer Clyde Estuary (water body ID 200320) is identified by river basin management planning to be at less than good status for its physical condition. 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. The study should seek to ensure that actions will not have an adverse effect on the integrity of the Inner Clyde Special Protection		

**Environmental:** Area and Ramsar sites in the area.

<b>Action (ID):</b>	<b>FLOOD PROTECTION STUDY (110020005)</b>		
<b>Objective (ID):</b>	Reduce the risk of coastal flooding to residential properties and non-residential properties in Garelochhead (11002)		
<b>Delivery lead:</b>	Argyll and Bute Council		
<b>Priority:</b>	National:	Within local authority:	
	<b>132 of 168</b>	<b>5 of 9</b>	
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2022-2027</b>
<b>Description:</b>	A study is recommended to further investigate the feasibility of an increased level of protection against coastal flooding in Garelochhead, focusing on the tidal sections of the McAuley Burn and the potential to enhance the existing retaining wall. The study should also investigate the benefits of a property level protection scheme. Other actions may also be considered to select the most sustainable combination of actions.		
<b>Potential impacts</b>			
<b>Economic:</b>	The flood protection study should consider how to reduce flooding to 12 residential properties and five non-residential properties. The potential damages avoided are estimated to be up to £1.3 million.		
<b>Social:</b>	A reduction in flood risk would have a positive benefit to the health and wellbeing of the community. There may be changes in visual amenity and land use as a result of this action.		
<b>Environmental:</b>	Flood protection studies should consider the positive and negative impacts of proposed actions on the ecological quality of the environment. There are no international or national level environmental designations that are likely to be impacted by this action. Depending on the potential to enhance the current wall, there may be a direct loss of natural and semi-natural habitat, including intertidal areas, in the direct footprint and vicinity of the defences. There is the potential for direct defences to have direct negative impacts on the setting of listed buildings on Shore Walk.		

<b>Action (ID):</b>	<b>SURFACE WATER PLAN/STUDY (110840018)</b>		
<b>Objective (ID):</b>	Reduce the economic damages and risk to people from surface water flooding in Kilcreggan (11084)		
<b>Delivery lead:</b>	Argyll and Bute Council		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	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.		



<b>Action (ID):</b>	<b>STRATEGIC MAPPING AND MODELLING (111320016)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	SEPA		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	SEPA will seek to incorporate additional surface water data into the flood maps to improve understanding of flood risk. Approximately 2,200km <sup>2</sup> 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.		

<b>Action (ID):</b>	<b>STRATEGIC MAPPING AND MODELLING (111320019)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Scottish Water		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>MAINTAIN FLOOD WARNING (111320030)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	SEPA		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	Continue to maintain the Helensburgh A814 flood warning area which is part of the Firth of Clyde coastal flood warning scheme.		

<b>Action (ID):</b>	<b>FLOOD FORECASTING (111320009)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	SEPA		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>SELF HELP (111320011)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	—		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>AWARENESS RAISING (111320013)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Responsible authorities		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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 and promote Floodline. This will be achieved through SEPA-led education events. Local authorities will be undertaking additional awareness raising activities. Further details will be set out in the Local FRM Plan.		

<b>Action (ID):</b>	<b>MAINTENANCE (111320007)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Argyll & Bute Council, asset / land managers		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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.		

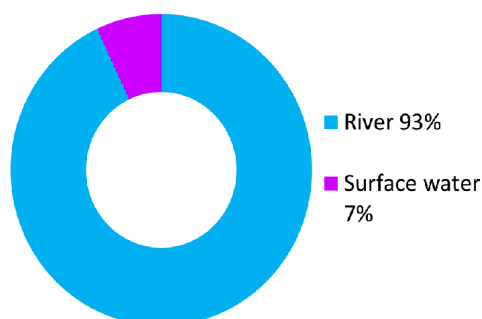
<b>Action (ID):</b>	<b>EMERGENCY PLANS/RESPONSE (111320014)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Category 1 and 2 Responders		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	Providing an emergency response to flooding 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.		

<b>Action (ID):</b>	<b>PLANNING POLICIES (111270001)</b>		
<b>Objective (ID):</b>	Avoid an overall increase in flood risk (11127) Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Planning authority		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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.		

## Strathblane (Potentially Vulnerable Area 11/03)

Local Plan District	Local authority	Main catchment
Clyde and Loch Lomond	East Dunbartonshire, Stirling Council	River Endrick (Loch Lomond)

### Summary of flooding impacts



#### At risk of flooding

- 40 residential properties
- <10 non-residential properties
- £140,000 Annual Average Damages

(damages by flood source shown left)

Summary of flooding impacts

### 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.

Objectives

### Summary of actions to manage flooding

The actions below have been selected to manage flood risk.

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

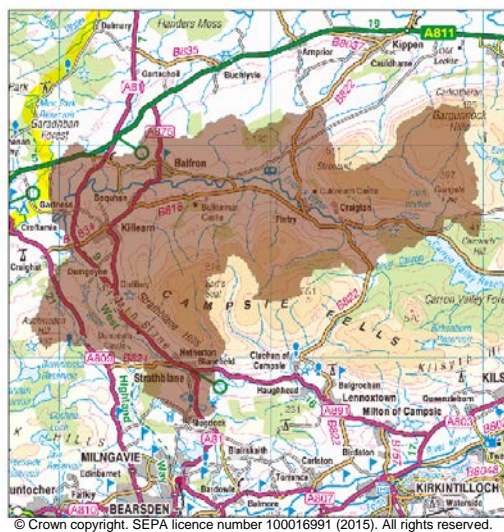
Actions

# Strathblane (Potentially Vulnerable Area 11/03)

Local Plan District	Local authority	Main catchment
Clyde and Loch Lomond	East Dunbartonshire Council, Stirling Council	River Endrick (Loch Lomond)

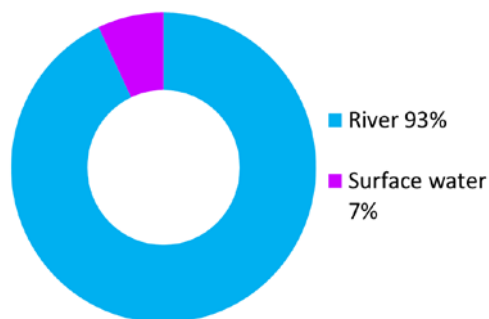
## Background

This Potentially Vulnerable Area is located to the north of Campsie Fells, between Killearn and Strathblane in the west and the Gargunnoch Hills in the east (shown below). It contains Balfron, Fintry and Craigton and is approximately 160km<sup>2</sup>.



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

There are approximately 40 residential properties at risk of flooding. The Annual Average Damages are approximately £140,000.



**Figure 1: Annual Average Damages by flood source**

## Summary of flooding impacts

River flooding within the area is mainly attributed to the Endrick Water and the Blane Water. There are a relatively small number of residential and non-residential properties at risk. These properties are mainly in the towns of Fintry, Balfron, Killearn and Strathblane. There are also small sections of transport routes at risk of flooding (notably the A81 and A875). The River Endrick Flood Mapping Study assessed the risk of flooding from the existing watercourses, looking in particular at Fintry. The study concluded that 12 properties are at risk of flooding in Fintry.

There are isolated patches of surface water flooding in Fintry, Killearn, Balfron and Strathblane with some residential properties at risk.

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. Surface water damages may be under-represented in Figure 2 due to limitations in the available modelling output. Residential properties affected by river flooding experience the highest economic impact at approximately 70% of the damages.

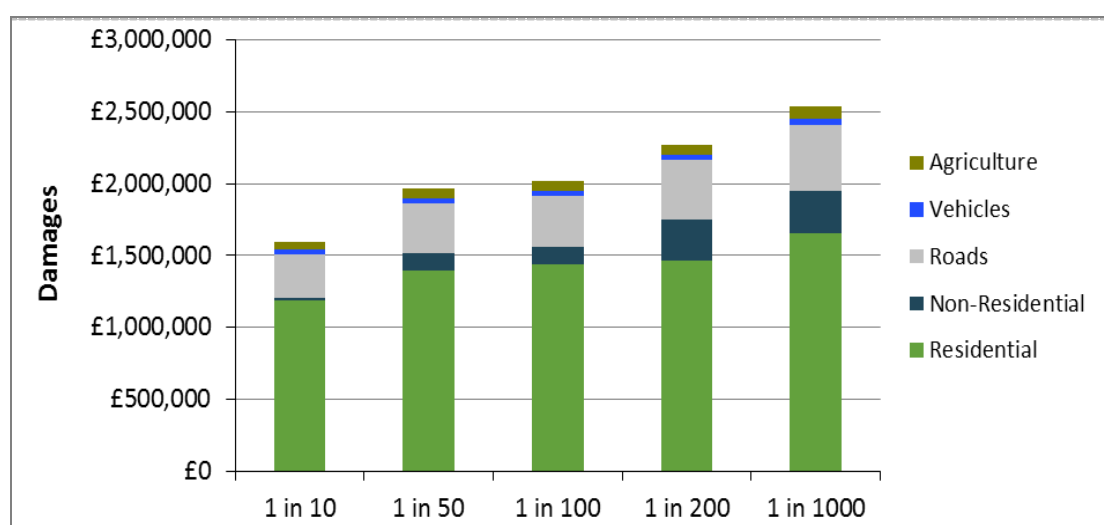
Within this Potentially Vulnerable Area it is estimated that climate change will increase the number of residential properties at risk of flooding from approximately 40 to 50.

The location of the impacts of flooding is shown in Figure 3. Most of the impacts are in the towns of Balfron, Strathblane, Fintry and the west of Killearn with flooding to people and properties.

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 is one asset identified as being at risk of flooding.

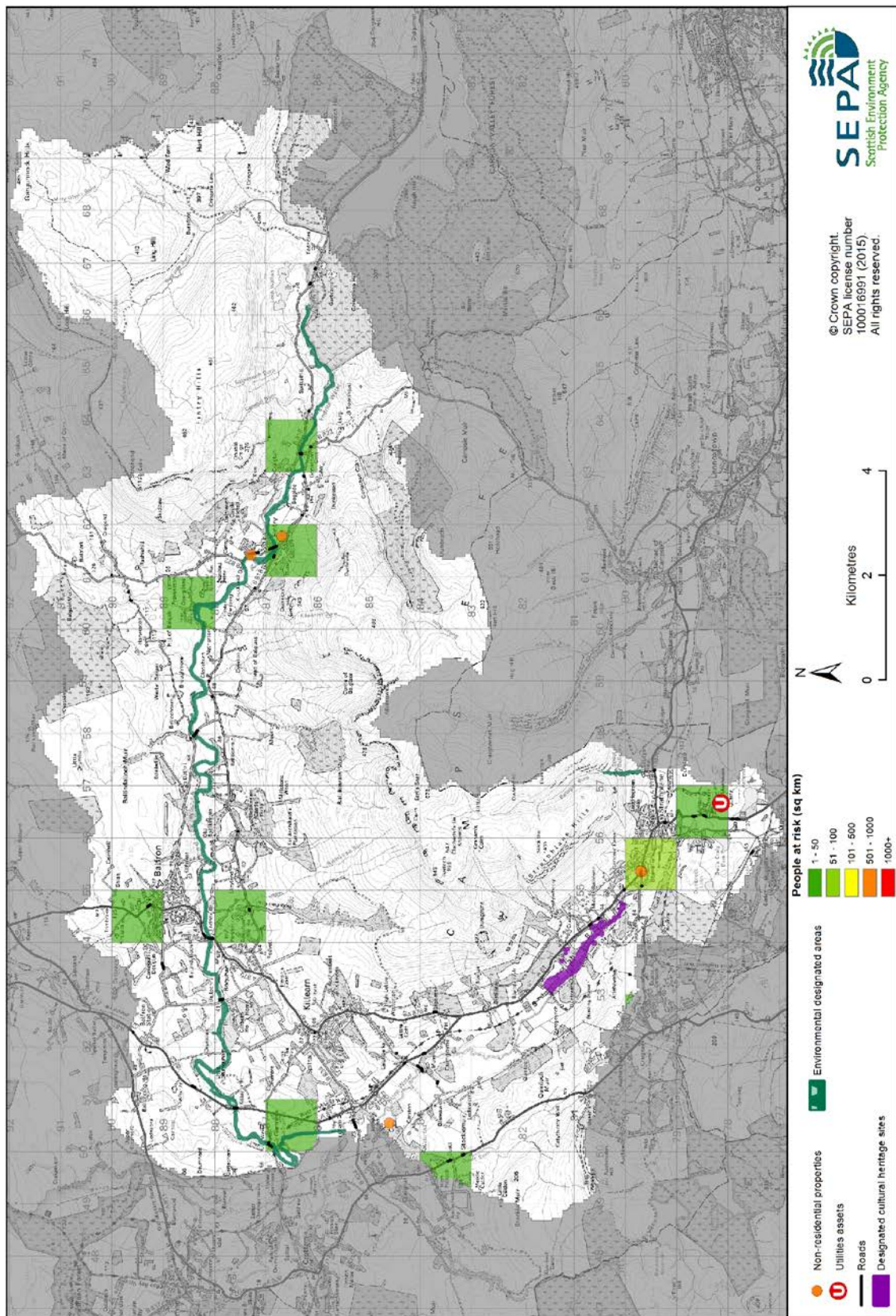
	1 in 10	1 in 200	1 in 1000
	High likelihood	Medium likelihood	Low likelihood
Residential properties (total 3,000)	30	40	40
Non-residential properties (total 320)	<10	<10	<10
People	80	80	100
Community facilities	0	0	0
Utilities assets	<10	<10	<10
Transport links - roads (km)	1.2	1.6	1.9
Environmental designated areas (km <sup>2</sup> )	1.4	1.6	1.5
Designated cultural heritage sites	3	3	3
Agricultural land (km <sup>2</sup> )	2.6	3.7	3.9

**Table 1:** Summary of flooding impacts<sup>1</sup>



**Figure 2:** Damages by flood likelihood

<sup>1</sup> Some receptors are counted more than once if flooded from multiple sources



**Figure 3: Impacts of flooding**

## History of flooding

The River Endrick in Fintry is known to flood Kippen Road and nearby sports fields regularly. The worst reported floods occurred in January 1993 and January 2008, where gardens and boundaries of properties were impacted. However, there are no reports of flood levels exceeding floor levels. In Killearn regular surface water flooding affects gardens and garages, although no reports mention flood levels exceeding floor levels.

In Strathblane the most significant source of flooding is from small watercourses (Craigenlay Burn, South Burn and Jenny's Burn), and the surcharging of the drainage network in Southburn Road area. However, a low number of properties have been affected by such flooding.



## Objectives to manage flooding in Potentially Vulnerable Area 11/03

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 Strathblane Potentially Vulnerable Area.

Target area	Objective	ID	Indicators within PVA
Applies across Clyde and Loch Lomond Local Plan District	Avoid an overall increase in flood risk	11127	<ul style="list-style-type: none"> <li>• 40 residential properties</li> <li>• £140,000 Annual Average Damages</li> </ul>
Applies across Clyde and Loch Lomond Local Plan District	Reduce overall flood risk	11132	<ul style="list-style-type: none"> <li>• 40 residential properties</li> <li>• £140,000 Annual Average Damages</li> </ul>
Applies across Clyde and Loch Lomond 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 11/03

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 Strathblane Potentially Vulnerable Area.

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

<b>Action (ID):</b>	<b>STRATEGIC MAPPING AND MODELLING (111320016)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	SEPA		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	SEPA will seek to incorporate additional surface water data into the flood maps to improve understanding of flood risk. Approximately 2,200km <sup>2</sup> 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.		

<b>Action (ID):</b>	<b>STRATEGIC MAPPING AND MODELLING (111320019)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Scottish Water		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>FLOOD FORECASTING (111320009)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	SEPA		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>SELF HELP (111320011)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	—		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>AWARENESS RAISING (111320013)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Responsible authorities		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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 and promote Floodline. This will be achieved through SEPA-led education events. Local authorities will be undertaking additional awareness raising activities. Further details will be set out in the Local FRM Plan.		

<b>Action (ID):</b>	<b>MAINTENANCE (111320007)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Stirling Council, asset / land managers		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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.		

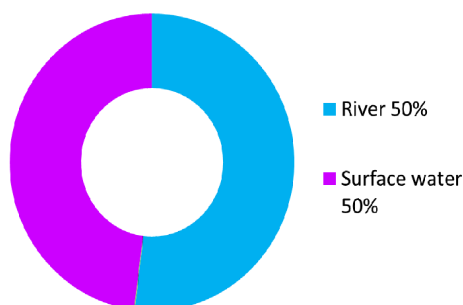
<b>Action (ID):</b>	<b>EMERGENCY PLANS/RESPONSE (111320014)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Category 1 and 2 Responders		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	Providing an emergency response to flooding 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.		

<b>Action (ID):</b>	<b>PLANNING POLICIES (111270001)</b>		
<b>Objective (ID):</b>	Avoid an overall increase in flood risk (11127) Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Planning authority		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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.		

## Kilsyth to Bearsden - north of Glasgow City (Potentially Vulnerable Area 11/04)

Local Plan District	Local authority	Main catchment
Clyde and Loch Lomond	East Dunbartonshire Council, Falkirk Council, Glasgow City Council, North Lanarkshire Council, Stirling Council, West Dunbartonshire Council	River Kelvin

### Summary of flooding impacts



#### At risk of flooding

- 2,300 residential properties
- 1,100 non-residential properties
- £4.6 million Annual Average Damages

(damages by flood source shown left)

Summary of Flooding impacts

### 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.

Objectives

### Summary of actions to manage flooding

The actions below have been selected to manage flood risk.

Flood protection scheme/works	<i>Natural flood management works</i>	New flood warning	Community flood action groups	<i>Property level protection scheme</i>	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

Actions

## Kilsyth to Bearsden – north of Glasgow City (Potentially Vulnerable Area 11/04)

Local Plan District	Local authority	Main catchment
Clyde and Loch Lomond	East Dunbartonshire Council, Falkirk Council, Glasgow City Council, North Lanarkshire Council, Stirling Council, West Dunbartonshire Council	River Kelvin

### Background

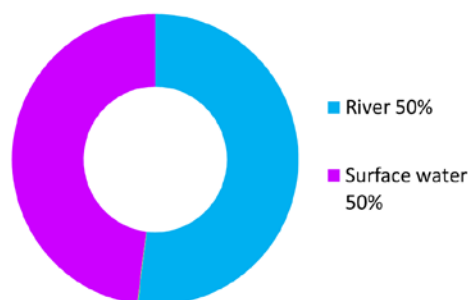
This Potentially Vulnerable Area incorporates the northern urban extent of the City of Glasgow, between Clydebank and Cumbernauld and is approximately 290km<sup>2</sup> (shown below).



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The area has a risk of river and surface water flooding. The damages are evenly split.

There are approximately 2,300 residential properties and 1,100 non-residential properties at risk of flooding. The Annual Average Damages are approximately £4.6 million.



**Figure 1:** Annual Average Damages by flood source

### Summary of flooding impacts

The main river catchment in this area is the River Kelvin which, along with its tributaries, is responsible for the majority of the river flood risk. This includes parts of Kilsyth, Kirkintilloch, Bishopbriggs, Bearsden and Milngavie where a large number of residential and non-residential properties are shown to be impacted. In the south river flooding presents a risk to a number of properties within the Gartcosh and Gartloch area, in the vicinity of the Seven Lochs Wetland Park. The water levels in the lochs are controlled and their operation is vital for managing flood risk.

Agricultural land is also predicted to flood from river sources in the vicinity of Torrance and Balmore and to the north of Kirkintilloch. As the area is heavily urbanised in the south, flooding from minor culverted or heavily modified watercourses is a problem, with complex interaction between flooding sources. The

Forth and Clyde Canal also runs through this area, parallel to the River Kelvin, before diverging to the north of Bishopbriggs and then crossing to the south of Cowal Road in the city. The canal provides drainage relief in a number of locations where overflows have been connected to it.

This area contains a large number of river structures and culverts which complicate our understanding of flood risk. Local authorities are aiming to improve modelling in the area by carrying out more detailed investigations.

Widespread surface water flooding is expected across the area with almost all of the main urban areas being affected. This is shown to impact residential properties, non-residential properties and main transport routes including sections of railway lines and roads (notably the M73, M8, M80 and A80). Kirkintilloch and Kilsyth are susceptible to runoff from the surrounding hills, whereas the surface water flooding in the south of the area is more likely to be caused from drainage capacity issues, historical culverting or diversion of watercourses. The areas at highest risk from surface water flooding will require the preparation of surface water management plans.

Scottish Water and local authorities have completed a number of studies in the area. These have included strategic and detailed assessments of surface water risk and its interaction with river flooding as well as considering mitigating actions. Many of these studies have been helped by the partnership working developed within the Metropolitan Glasgow Strategic Drainage Partnership. This has led to the implementation of schemes and works to protect properties from river and surface water flooding.

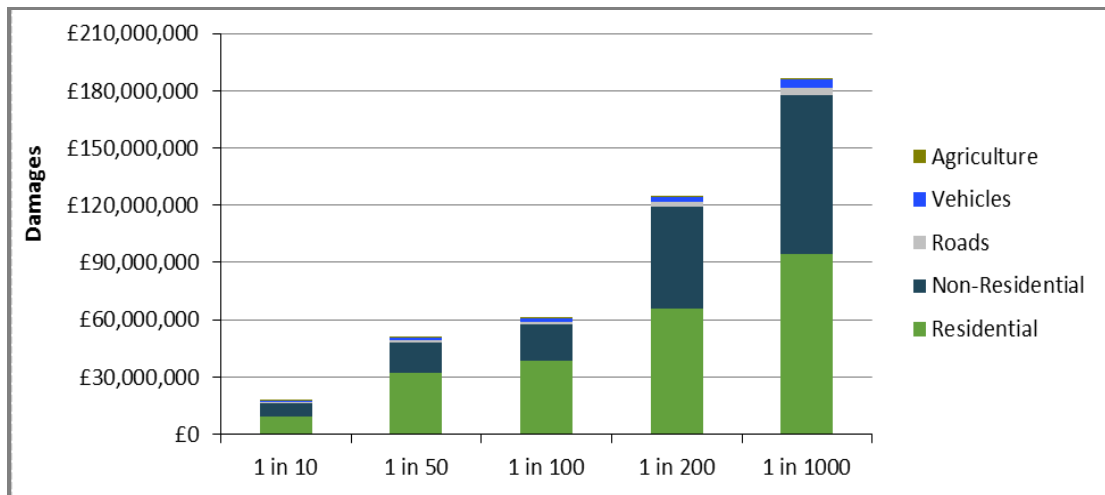
The risk of flooding to people and property, as well as to community facilities, utilities, the transport network, designated sites and agricultural land is summarised in Table 1. The damages associated with floods of different likelihood are shown in Figure 2. Residential properties affected by river flooding experience the highest economic impact at approximately 35% of the damages.

Within this Potentially Vulnerable Area it is estimated that climate change will increase the number of residential properties at risk of flooding from approximately 2,300 to 3,300 and the number of non-residential properties from approximately 1,100 to 1,500.

The locations of flooding impacts in the west are shown in Figure 3a with impacts in the east shown in Figure 3b. They show there are flooding impacts throughout the area, with the greatest concentration of receptors at risk in Milngavie, Kirkintilloch and Bearsden.

	1 in 10 High likelihood	1 in 200 Medium likelihood	1 in 1000 Low likelihood
Residential properties (total 120,000)	360	2,300	3,100
Non-residential properties (total 9,000)	300	1,100	1,500
People	800	5,000	6,800
Community facilities	<10 Includes: educational buildings and healthcare facilities	<10 Includes: educational buildings, emergency services and healthcare facilities	10 Includes: educational buildings, emergency services and healthcare facilities
Utilities assets	30	90	110
Transport links - roads (km)	13.3 (of which 0.5 is motorway and 0.2 is A road)	32.5 (of which 1.8 is motorway and 0.7 is A road)	40.3 (of which 2.8 is motorway and 1.0 is A road)
Transport links - rail (km)	6.4	16.4	18.6
Environmental designated areas (km <sup>2</sup> )	0.8	0.9	0.9
Designated cultural heritage sites	43	59	81
Agricultural land (km <sup>2</sup> )	12.2	12.6	13.3

**Table 1:** Summary of flooding impacts<sup>1</sup>



**Figure 2:** Damages by flood likelihood

<sup>1</sup> Some receptors are counted more than once if flooded from multiple sources



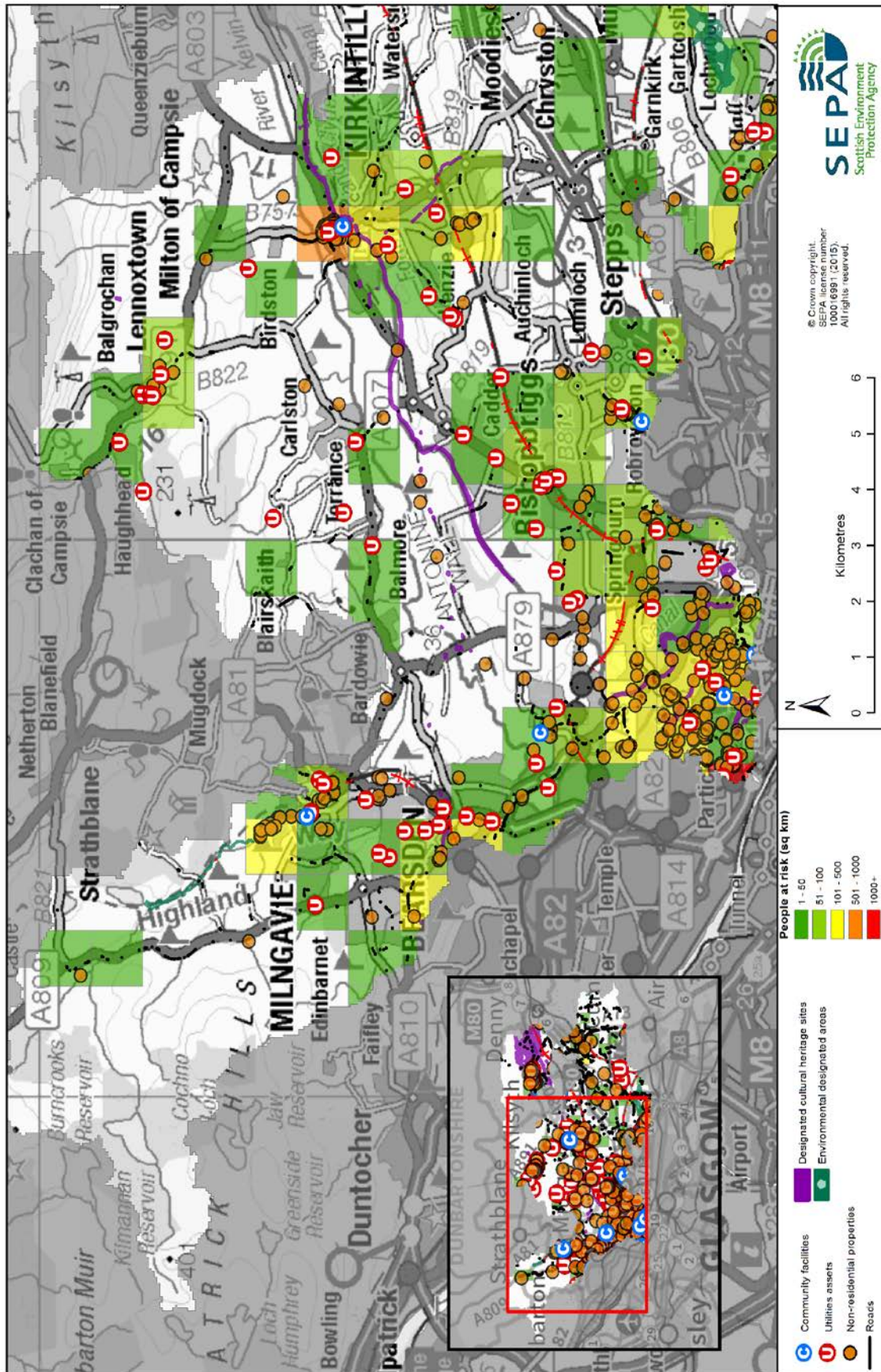


Figure 3a: Impacts of flooding

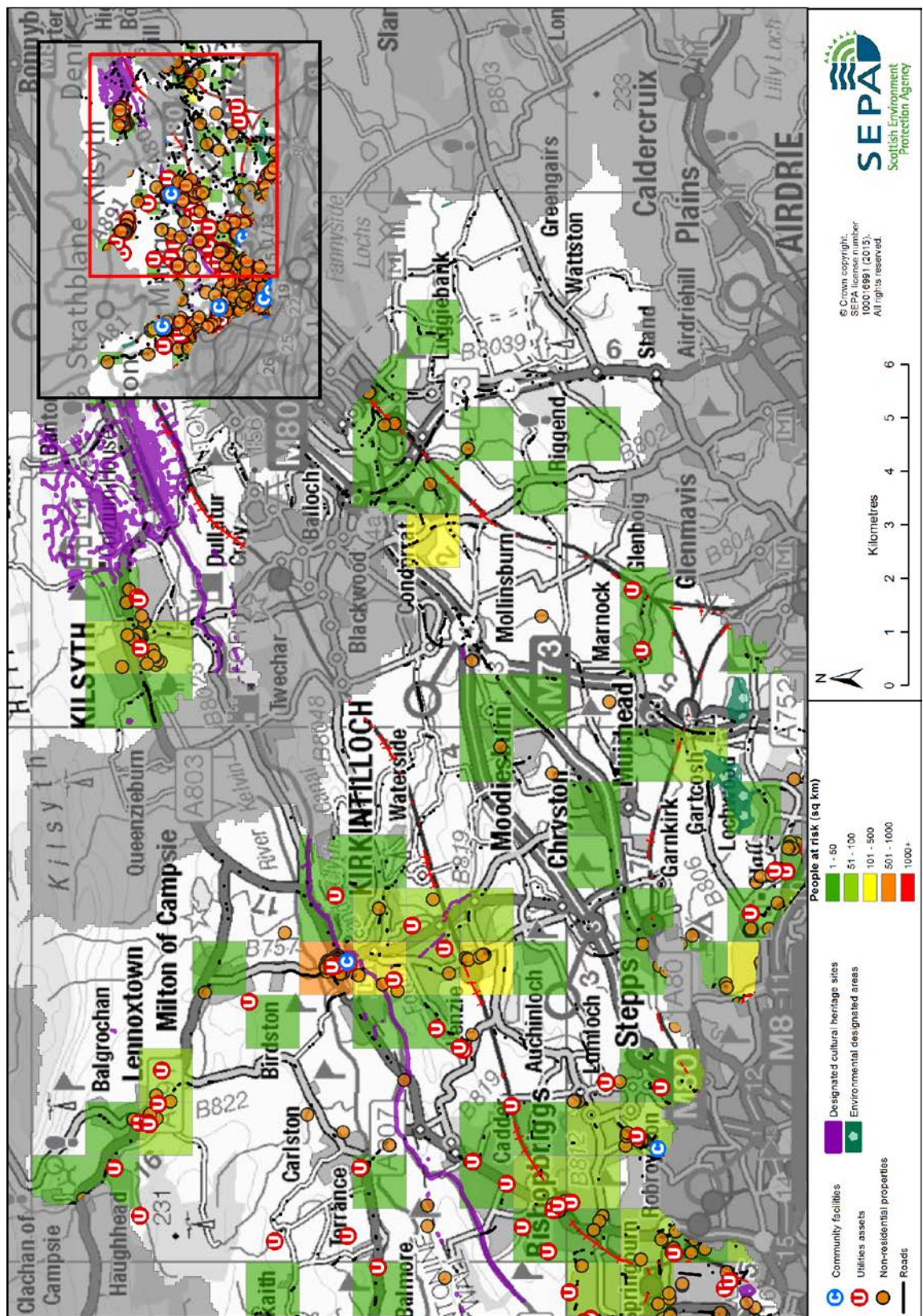


Figure 3b: Impacts of flooding

## History of flooding

Records of river flooding are spread throughout the area. The locations with the highest concentrations of river flooding include Bearsden, Kirkintilloch and Glasgow City. The Manse Burn flooded in 2007 in Bearsden, affecting roads, properties and gardens. River floods have recently affected residents and properties in Lennoxton after the Rannie Burn flooded in January 2011 and December 2006.

Between 10-12 December 1994 major flooding occurred in rivers and urban watercourses across Glasgow and surrounding areas. A slow-moving weather system delivered persistent rain over a 48 hour period, across a wide geographical area. Previously recorded peak river flows were exceeded in all major catchments in the region. The River Clyde, to the south of the Potentially Vulnerable Area, is thought to have reached its highest level in 150 years, and the total cost of the damage across the whole region reached approximately £100 million. This flood caused significant damages in the Kirkintilloch and Glasgow City areas. Flood water from the River Kelvin caused power failures and flooded 60 properties in the Summerfield Gate area as well as various areas bounding the Kelvin, including in particular; Cleveden Gardens, the District Subway at Kelvinbridge and part of the North Glasgow Electric Railway System. A further 80 properties in Glasgow were also flooded which alone caused an estimated £11 million in damages.

Maree Drive and the ring road underpass in Condorrat were affected by surface water floods on the 4 July 2012. The area of Bearsden in East Dunbartonshire is particularly affected by surface water flooding. SEPA have records of reported floods dating back to 1882; however, the majority of surface water floods were recorded between 2004 and 2009.

## Objectives to manage flooding in Potentially Vulnerable Area 11/04

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 Kilsyth to Bearsden - north of Glasgow City Potentially Vulnerable Area.

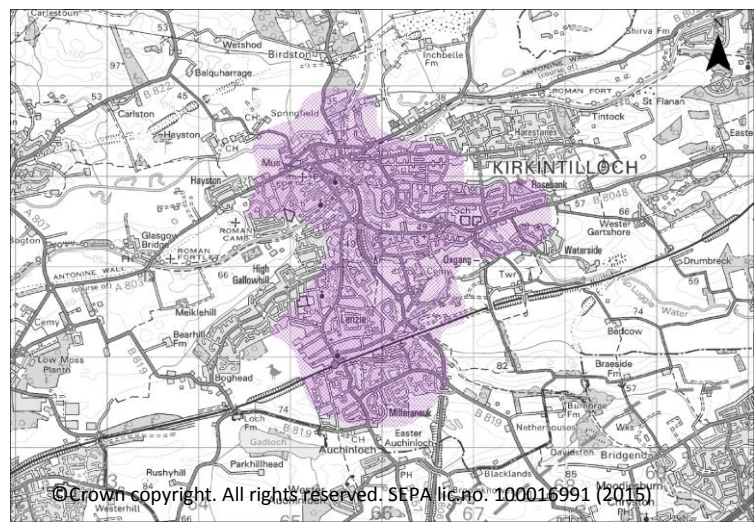
### Reduce the risk of river and surface water flooding to residential properties, non-residential properties, community facilities and transport routes in Kirkintilloch

Indicators:

- 510 residential properties
- 130 non-residential properties
- £690,000 Annual Average Damages
- 1 healthcare facility
- 2.8km of road

Objective ID: 11008

Target area:



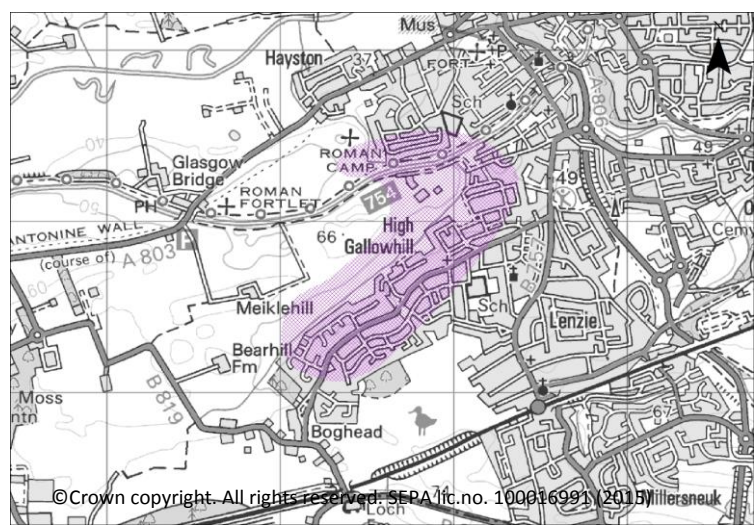
### Reduce the risk of flooding from the Park Burn and surface water to residential properties in Kirkintilloch

Indicators:

- 50 residential properties
- £86,000 Annual Average Damages

Objective ID: 11009

Target area:

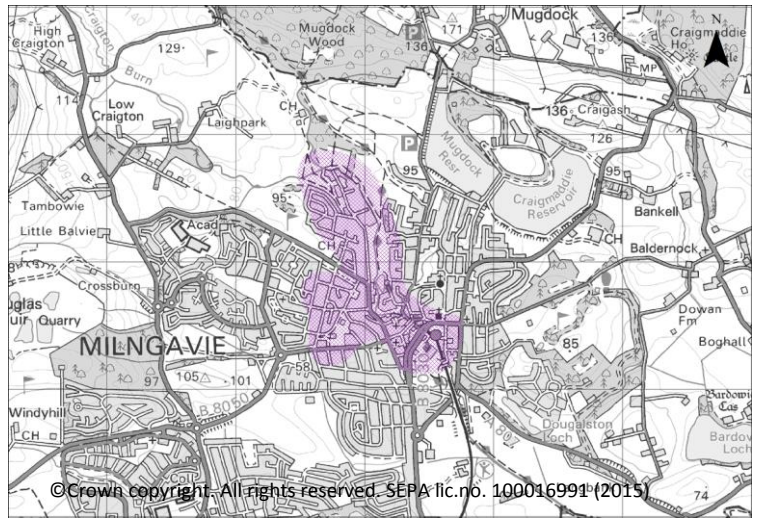


**Reduce the risk of flooding from the Allander Water and surface water to residential properties and non-residential properties in Milngavie**

Indicators:

Target area:

- 190 residential properties
- 90 non-residential properties
- £690,000 Annual Average Damages



Objective ID: 11011

**Reduce the risk of flooding from the River Kelvin and surface water to residential properties, non-residential properties and community facilities in west and north west Glasgow**

Indicators:

Target area:

- 660 residential properties
- 600 non-residential properties
- £950,000 Annual Average Damages
- 1 educational building



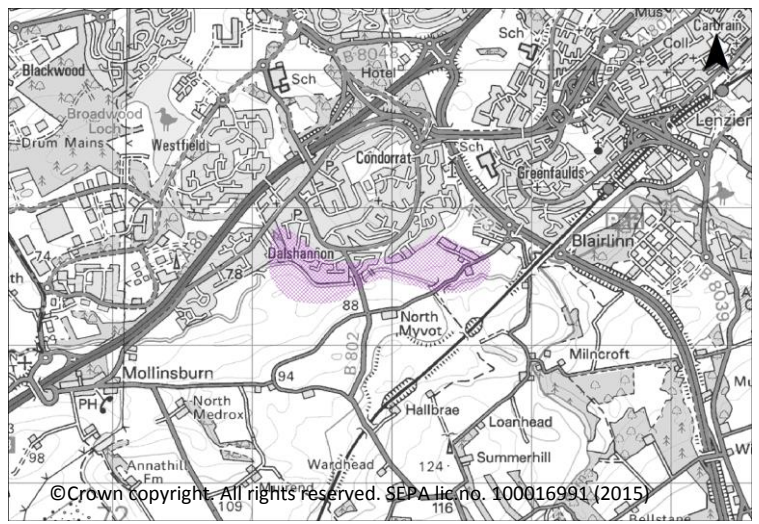
Objective ID: 11014

**Reduce the risk of flooding from the Luggie Water to residential properties in Cumbernauld**

Indicators:

Target area:

- 70 residential properties
- <10 non-residential properties
- £160,000 Annual Average Damages



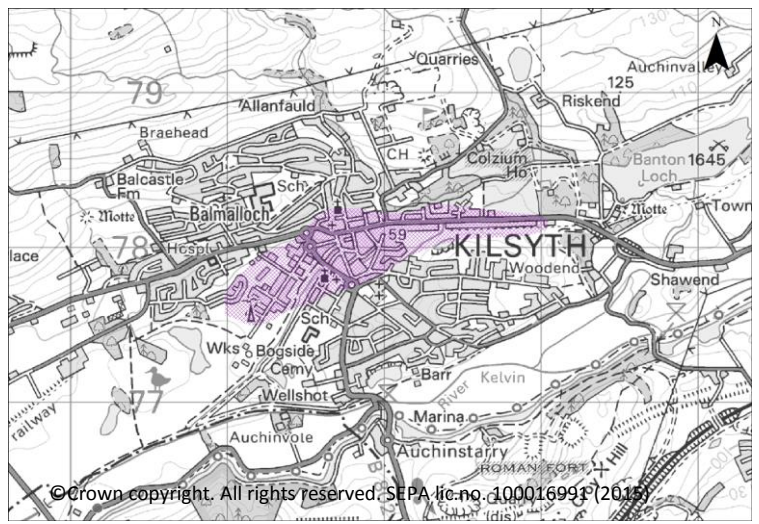
Objective ID: 11035

**Reduce the risk of river flooding to residential properties and non-residential properties in Kilsyth**

Indicators:

Target area:

- 90 residential properties
- 60 non-residential properties
- £140,000 Annual Average Damages



Objective ID: 11036

Target area	Objective	ID	Indicators within PVA
Glasgow	Reduce the economic damages and number of people at risk of surface water flooding in Glasgow City	11007	* See note below
Bishopbriggs	Reduce the economic damages and risk to people from surface water flooding in Bishopbriggs	11085	* See note below
Milngavie	Reduce the economic damages and risk to people from surface water flooding in Milngavie	11086	* See note below
Bearsden	Reduce the economic damages and risk to people from surface water flooding in Bearsden	11087	* See note below
Milton, Glasgow	Reduce the economic damages and risk to people from surface water flooding in Milton	11099	* See note below
Stand Burn catchment, Ferness, Glasgow	Reduce the economic damages and risk to people from surface water flooding in the Stand Burn catchment, Ferness	11103	* See note below
Cumbernauld (west)	Reduce the economic damages and risk to people from surface water flooding in Cumbernauld	11111	* See note below
Kilsyth	Reduce the economic damages and risk to people from surface water flooding in Kilsyth	11112	* See note below
Possilpark	Reduce the economic damages and risk to people from surface water flooding in Possilpark	11128	* See note below
Kirkintilloch	Reduce the economic damages and risk to people from surface water flooding in Kirkintilloch	11204	* See note below
Applies across Clyde and Loch Lomond Local Plan District	Avoid an overall increase in flood risk	11127	<ul style="list-style-type: none"> <li>• 2,300 residential properties</li> <li>• £4.6 million Annual Average Damages</li> </ul>
Applies across Clyde and Loch Lomond Local Plan District	Reduce overall flood risk	11132	<ul style="list-style-type: none"> <li>• 2,300 residential properties</li> <li>• £4.6 million Annual Average Damages</li> </ul>
Applies across Clyde and Loch Lomond 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 11/04 there are 1,400 residential properties at risk and Annual Average Damages of £2.4 million.

## Actions to manage flooding in Potentially Vulnerable Area 11/04

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 Kilsyth to Bearsden - north of Glasgow City Potentially Vulnerable Area.

Selected actions					
Flood protection scheme/works	<i>Natural flood management works</i>	New flood warning	Community flood action groups	<i>Property level protection scheme</i>	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

<b>Action (ID):</b>	<b>FLOOD PROTECTION SCHEME/WORKS (110090006)</b>		
<b>Objective (ID):</b>	Reduce the risk of flooding from the Park Burn and surface water to residential properties in Kirkintilloch (11009)		
<b>Delivery lead:</b>	East Dunbartonshire Council		
<b>Priority:</b>	National:	Within local authority:	
	<b>13 of 42</b>	<b>1 of 1</b>	
<b>Status:</b>	<b>Under development</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	<p>It is recommended that the council look to progress flood protection works along the Park Burn. Before the final design of the works the flood modelling in the area should be updated to improve the representation of the River Kelvin. This will help to more accurately represent the risk of flooding downstream. If there is found to be an interaction between the Park Burn and River Kelvin, joint probability analysis should also be carried out. The potential for natural flood management actions to help reduce runoff should also be investigated.</p> <p>The works will include the profiling of the channel and provide scope to improve the ecology and morphology of the river in addition to the flooding benefits. The proposed works could offer protection up to a 1 in 75 year flood; however, it is recommended that additional property level protection options be investigated to improve the overall protection of the scheme.</p> <p>The flood mapping for the Park Burn should be revised to identify the areas protected by the works and any remaining residual risk now and in the future.</p> <p>SEPA will review the study outputs for possible inclusion in the Flood Maps.</p>		



Potential impacts	
<b>Economic:</b>	The proposed flood protection scheme may benefit 70 residential properties at this location, damages avoided are estimated to be £1.5 million. The economic impact of natural flood management actions is difficult to define. However, these actions can reduce flood risk for high likelihood events. The flood protection scheme has an estimated benefit cost ratio of 4.
<b>Social:</b>	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. There may be negative impacts through disturbance to the local community during the construction phase.
<b>Environmental:</b>	Flood protection works can have both positive and negative impacts on the ecological quality of the environment depending on how they are designed. The flood protection works are proposed for the Park Burn (water body ID 10731). The physical condition of this river is identified by river basin management planning to be at less than good status. Future works could improve the condition of the river or degrade it. Opportunities to improve the condition of the river should be considered by coordinating with river basin management planning. There are no international, national or local level environmental designations that are likely to be impacted by this action. There would be the temporary loss of aquatic habitat and displacement of aquatic species from the re-grading footprint; however, these may re-establish and return to the channel in the future. There are likely to be short term negative impacts on water quality during works from increased sediment. Re-grading activities would have temporary negative impacts on the visual setting of the nearby Antonine Wall World Heritage Site and Scheduled Monument, along with the Forth and Clyde Canal Scheduled Monument.

<b>Action (ID):</b>	<b>NEW FLOOD WARNING (111320010)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	SEPA		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>post 2021</b>
<b>Description:</b>	<p>The area under consideration includes properties in Lennoxton affected by flooding from the Glazert Water. To deliver a warning in this location an extension to the Kelvin flood forecasting system will be required. Further assessment will help to determine appropriate timescales for delivery.</p> <p>A second area under consideration includes properties in Milngavie affected by flooding from the Allander Water. Further studies being undertaken will give more detail on whether flood warning is required in this location and subsequent to that appropriate timescales for delivery.</p>		

<b>Action (ID):</b>	<b>FLOOD PROTECTION STUDY (110080005)</b>		
<b>Objective (ID):</b>	Reduce the risk of river and surface water flooding to residential properties, non-residential properties, community facilities and transport routes in Kirkintilloch (11008)		
<b>Delivery lead:</b>	East Dunbartonshire Council		
<b>Priority:</b>	National:	Within local authority:	
	<b>14 of 168</b>	<b>1 of 2</b>	
<b>Status:</b>	<b>Ongoing</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	<p>A study of the River Kelvin catchment is being undertaken and will assess the current level of flood risk. The study is being undertaken by East Dunbartonshire Council in conjunction with Glasgow City Council and SEPA. The study will provide revised data on flood risk in the area and assess the benefit offered by the existing flood protection scheme in Kirkintilloch.</p> <p>It is recommended that the outcomes of the River Kelvin study are reviewed to determine the current risk in the town and the potential future risk with climate change. This will determine if / when further work is required to investigate how to reduce the flood risk from the River Kelvin to Kirkintilloch.</p> <p>SEPA will review the study outputs for possible inclusion in the Flood Maps.</p>		
<b>Potential impacts</b>			
<b>Economic:</b>	The flood protection study should consider how to reduce flooding to 510 residential properties and 130 non-residential properties. The potential damages avoided are estimated to be up to £84 million. The economic impact of natural flood management actions is difficult to define. However, these actions can reduce flood risk for high likelihood events.		
<b>Social:</b>	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.		
<b>Environmental:</b>	Flood protection studies should consider the positive and negative impacts of proposed actions on the ecological quality of the environment. This study is proposed for the River Kelvin (Glazert Water to Tidal Limit) (water body ID 10130). The physical condition of this river is identified by river basin management planning to be at less than good status. Future works could improve the condition of the river or degrade it. Opportunities to improve the condition of the river should be considered by coordinating with river basin management planning.		

<b>Action (ID):</b>	<b>FLOOD PROTECTION STUDY (110140005)</b>		
<b>Objective (ID):</b>	Reduce the risk of flooding from the River Kelvin and surface water to residential properties, non-residential properties and community facilities in west and north west Glasgow (11014)		

<b>Delivery lead:</b>	Glasgow City Council and East Dunbartonshire Council		
<b>Priority:</b>	National:	Within local authority:	
	<b>43 of 168</b>	<b>7 of 8</b>	
<b>Status:</b>	<b>Ongoing</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	<p>A study of the River Kelvin catchment is being undertaken and will assess the current level of flood risk. The study is being undertaken by East Dunbartonshire Council in conjunction with Glasgow City Council and SEPA. The study will provide a revised assessment of risk within the area.</p> <p>It is recommended that the outcomes of the River Kelvin study are reviewed to determine the current risk in the town and the potential future risk with climate change. This will determine if / when further work is required to investigate how to reduce the flood risk from the River Kelvin.</p> <p>The additional benefits from natural flood management are being considered within a separate catchment study, and both studies should be considered to select the most sustainable combination of actions.</p> <p>SEPA will review the study outputs for possible inclusion in the Flood Maps.</p>		
<b>Potential impacts</b>			
<b>Economic:</b>	The flood protection study should consider how to reduce flooding to 140 residential properties and 30 non-residential properties in this location. The potential damages avoided are estimated to be up to £10 million.		
<b>Social:</b>	A reduction in flood risk would have a positive benefit to the health and wellbeing of the community. In addition there is one utility 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.		
<b>Environmental:</b>	<p>Flood protection studies should consider the positive and negative impacts of proposed actions on the ecological quality of the environment. This study is proposed for part of the River Kelvin (water body ID 10130). The physical condition of this river is identified by river basin management planning to be at less than good status. Future works could improve the condition of this river or degrade it. Opportunities to improve the condition of the river should be considered by coordinating with river basin management planning.</p> <p>There is the potential for negative impacts from the storage action on the Dawsholm Park Local Nature Reserve, which is mostly woodland. Downstream of this action there may be negative impacts on water quality through increased erosion and sedimentation. Implementation of this storage action will have permanent negative impacts on the water body morphology. There may be a loss of agricultural land and semi-natural habitats in the footprint of the storage areas, and a loss of semi-natural habitat in the footprint and vicinity of the enhanced defences. There is the potential for slight positive impacts on water quality from the implementation of sustainable drainage systems in the area. There is potential for storage in this area to have negative impacts on the setting of the nearby Antonine Wall World Heritage Site and Scheduled Monument and the Forth and Clyde Canal Scheduled Monument. There is also potential for negative impacts on the Kelvin Walkway. Changes to the conveyance would have</p>		

<b>Environmental:</b>	temporary negative impacts on the visual setting of the Forth and Clyde Canal, and North Woodside Flint Mill scheduled monuments and the setting of the Glasgow Botanical Gardens and Kelvingrove Park. Many of the bridges in the area are listed structures, changes in the conveyance could cause erosion which could have a permanent negative impact. The creation of direct defences could have potentially negative impacts on the visual setting of the Glasgow City Heritage conservation areas and Kelvingrove Park.
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<b>Action (ID):</b>	<b>FLOOD PROTECTION STUDY (110110005)</b>		
<b>Objective (ID):</b>	Reduce the risk of flooding from the Allander Water and surface water to residential properties and non-residential properties in Milngavie (11011)		
<b>Delivery lead:</b>	East Dunbartonshire Council		
<b>Priority:</b>	National:	Within local authority:	
	<b>49 of 168</b>	<b>2 of 2</b>	
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	<p>A study is recommended to further investigate the feasibility of a flood protection scheme on the Allander Water in Milngavie, focusing on the construction of direct defences along with the benefits of property level protection and other actions which may enhance the level of protection offered.</p> <p>The additional benefits from natural flood management are being considered within a separate catchment study, and both studies should be considered to select the most sustainable combination of actions.</p>		
<b>Potential impacts</b>			
<b>Economic:</b>	The flood protection study should consider how to reduce flood risk to 60 residential properties and 20 non-residential properties in this location, with potential damages avoided of up to £11 million.		
<b>Social:</b>	A reduction in flood risk would have a positive benefit to the health and wellbeing of the community. There may be changes in visual amenity and land use as a result of this action.		
<b>Environmental:</b>	<p>Flood protection studies should consider the positive and negative impacts of proposed actions on the ecological quality of the environment. This study is proposed for the Allander Water (water body ID 10132). The physical condition of this river is identified by river basin management planning to be at less than good status. Future works could improve the condition of the river or degrade it. Opportunities to improve the condition of the river should be considered by coordinating with river basin management planning.</p> <p>This action has the potential to impact upon the ancient woodland of Mugdock Wood Site of Special Scientific Interest. There is likely to be a loss of semi-natural habitat in the footprint and vicinity of the defences. There is the potential for local negative impacts on morphology and sediment dynamics which in turn may impact fish through increased sediment load.</p>		

<b>Action (ID):</b>	<b>FLOOD PROTECTION STUDY (110350005)</b>		
<b>Objective (ID):</b>	Reduce the risk of flooding from the Luggie Water to residential properties in Cumbernauld (11035)		
<b>Delivery lead:</b>	North Lanarkshire Council		
<b>Priority:</b>	National:	Within local authority:	
	<b>100 of 168</b>	<b>1 of 4</b>	
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	<p>A study is recommended to further investigate the flood risk along the Luggie Water. As part of this study the feasibility of flood protection work in Cumbernauld should be examined, focusing on the potential to redesign the Badenheath Bridge to increase conveyance of the Luggie Water, and the benefit of direct defences along the Luggie Water. This study should consider property level protection and other complementary actions to determine the most sustainable combination of actions.</p> <p>North Lanarkshire Council and East Dunbartonshire Council may undertake this as a joint study to identify any further potential flood risk areas along the river.</p>		
<b>Potential impacts</b>			
<b>Economic:</b>	The flood protection study should consider how to reduce flood risk to 60 residential properties in this location, with potential damages avoided of up to £4.4 million.		
<b>Social:</b>	A reduction in flood risk would have a positive benefit to the health and wellbeing of the community. There may be changes in visual amenity and land use as a result of this action.		
<b>Environmental:</b>	<p>Flood protection studies should consider the positive and negative impacts of proposed actions on the ecological quality of the environment. There are no international or national level environmental designations that are likely to be impacted by this action. There is likely to be a loss of semi-natural habitat in the footprint and vicinity of the defences. There is likely to be a loss of habitat and displacement of species in the vicinity of the conveyance works; however, these may re-establish and return to the area.</p> <p>Downstream of engineering works there may be negative impacts on water quality through localised increased erosion and sedimentation on the Luggie Water.</p>		

<b>Action (ID):</b>	<b>FLOOD PROTECTION STUDY (110360005)</b>		
<b>Objective (ID):</b>	Reduce the risk of river flooding to residential properties and non-residential properties in Kilsyth (11036)		
<b>Delivery lead:</b>	North Lanarkshire Council		
<b>Priority:</b>	National:	Within local authority:	
	<b>132 of 168</b>	<b>3 of 4</b>	
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>

<b>Description:</b>	A study is recommended to further investigate the feasibility of flood protection work in Kilsyth, focusing on the use of the Scottish Canals feeder as a bypass channel to divert flow from the Colzium Burn to Banton Loch for storage, and increasing the conveyance of the Ebroch Burn by altering the footbridge at Burngreen Park. This study should also investigate the use of property level protection to reduce residual risk. Other actions may also be considered to select the most sustainable combination of actions.
<b>Potential impacts</b>	
<b>Economic:</b>	The flood protection study should consider how to reduce flood risk to 30 residential properties and 10 non-residential properties in this location, with potential damages avoided of up to £1.7 million.
<b>Social:</b>	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 there are one community facility, one emergency service and one utility which have been identified as potentially benefitting from this action.
<b>Environmental:</b>	Flood protection studies should consider the positive and negative impacts of proposed actions on the ecological quality of the environment. This study includes the Garrel Burn (water body ID 10148). The physical condition of this river is identified by river basin management planning to be at less than good status. Future works could improve the condition of the river or degrade it. Opportunities to improve the condition of the river should be considered by coordinating with river basin management planning. There are no international or national level environmental designations that are likely to be impacted by this action. There is likely to be a loss of habitat and displacement of species in the vicinity of these works; however, these may re-establish and return to the area. Downstream of engineering works there may be negative impacts on water quality through localised increased erosion and sedimentation on the Ebroch Burn. There are likely to be impacts to the existing flora and fauna in the loch with alterations to water levels and flows. There is the potential for impacts to the Castle Hill Scheduled Monument and the Kilsyth battlefield heritage site from engineering works and water levels and therefore monitoring may be required during engineering works.

<b>Action (ID):</b>	<b>NATURAL FLOOD MANAGEMENT STUDY (110080003)</b>		
<b>Objective (ID):</b>	Reduce the risk of river and surface water flooding to residential properties, non-residential properties, community facilities and transport routes in Kirkintilloch (11008)		
<b>Delivery lead:</b>	SEPA		
<b>Status:</b>	<b>Ongoing</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	SEPA are currently carrying out a pilot study looking at potential options for river restoration and natural flood management in the Glazert catchment. This study should assess in detail runoff control and floodplain restoration. This action may also have a positive flooding impact near Kirkintilloch within the River Kelvin catchment.		

Potential impacts	
<b>Economic:</b>	The economic impacts have not been defined at this stage.
<b>Social:</b>	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.
<b>Environmental:</b>	Natural flood management actions can have a positive impact on the ecological quality of the environment by restoring and enhancing natural habitats. This study is being carried out in coordination with river basin management planning to improve the condition of River Glazert. Further environmental impacts will be assessed during the study.

<b>Action (ID):</b>	<b>NATURAL FLOOD MANAGEMENT STUDY (110110003)</b>		
<b>Objective (ID):</b>	<p>Reduce the economic damages and risk to people from surface water flooding in Bearsden (11087)</p> <p>Reduce the risk of flooding from the River Kelvin and surface water to residential properties, non-residential properties and community facilities in west and north west Glasgow (11014)</p> <p>Reduce the risk of flooding from the Allander Water and surface water to residential properties and non-residential properties in Milngavie (11011)</p> <p>Reduce the risk of flooding from the Park Burn and surface water to residential properties in Kirkintilloch (11009)</p>		
<b>Delivery lead:</b>	Glasgow Clyde Valley Green Network and local authorities		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	<p>The strategic assessment identified that there are widespread areas with the potential for runoff control and floodplain restoration, therefore a catchment wide natural flood management study is recommended for the River Kelvin. The study should focus on the potential benefit natural flood management actions may have on the tributaries of the River Kelvin but also if these actions combined would start to reduce flood risk on the River Kelvin.</p>		
Potential impacts			
<b>Economic:</b>	The economic impact of natural flood management actions is difficult to define. However, these actions can reduce flood risk for high likelihood events.		
<b>Social:</b>	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. There may be changes in visual amenity and land use as a result of this action.		
<b>Environmental:</b>	Natural flood management actions can have a positive impact on the ecological quality of the environment by restoring and enhancing natural habitats. This study is proposed for part of the River Kelvin, Allander Water and Craigmaddie Burn (water body IDs 10130, 10132 and 10133). The physical condition of these rivers is identified by river basin management planning to be at less than good status.		

<b>Environmental:</b>	Natural flood management actions are likely to improve the condition of rivers. Proposed actions should be coordinated with river basin management planning. This action has the potential to impact upon multiple Sites of Special Scientific Interest including the Craigallian Marshes on the Allander Water. There is the potential for the existing ecosystems in the area to be impacted through a potential change of land use if woodland planting is undertaken. There are likely to be improvements in water quality through reduced agricultural chemical and sediment runoff, which will have positive impacts on the terrestrial and freshwater habitats and species in the area. The existing ecosystems in the area for restoration will be impacted through a potential change in local hydrology. There may be improvements in biodiversity and water quality through this action. There is the potential for implementation of the runoff control action to negatively impact upon the Carbeth North and South conservation areas.
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<b>Action (ID):</b>	<b>SURFACE WATER PLAN/STUDY (110070018)</b>		
<b>Objective (ID):</b>	Reduce the economic damages and number of people at risk of surface water flooding in Glasgow City (11007)		
<b>Delivery lead:</b>	Glasgow City Council		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2028-2033</b>
<b>Description:</b>	The area must be covered by a strategy to manage and reduce surface water flood risk and identify the most sustainable actions to achieve the objectives. This strategy has been developed by the Metropolitan Glasgow Strategic Drainage Partnership. The detailed objectives and actions to manage and reduce surface water flood risk will be set out in the area specific surface water management plans described below.		

<b>Action (ID):</b>	<b>SURFACE WATER PLAN/STUDY (110850018)</b>		
<b>Objective (ID):</b>	Reduce the economic damages and risk to people from surface water flooding in Bishopbriggs (11085)		
<b>Delivery lead:</b>	East Dunbartonshire Council		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	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. The Metropolitan Glasgow Strategic Drainage Partnership will support the 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.		



<b>Action (ID):</b>	<b>SURFACE WATER PLAN/STUDY (110860018)</b>		
<b>Objective (ID):</b>	Reduce the economic damages and risk to people from surface water flooding in Milngavie (11086)		
<b>Delivery lead:</b>	East Dunbartonshire Council		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	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. The Metropolitan Glasgow Strategic Drainage Partnership will support the process and improve knowledge and understanding of surface water flood risk and interactions with other sources of flooding e.g. with the sewer network and watercourses.		

<b>Action (ID):</b>	<b>SURFACE WATER PLAN/STUDY (110870018)</b>		
<b>Objective (ID):</b>	Reduce the economic damages and risk to people from surface water flooding in Bearsden (11087)		
<b>Delivery lead:</b>	East Dunbartonshire Council		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	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. The Metropolitan Glasgow Strategic Drainage Partnership will support the 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.		

<b>Action (ID):</b>	<b>SURFACE WATER PLAN/STUDY (110990018)</b>		
<b>Objective (ID):</b>	Reduce the economic damages and risk to people from surface water flooding in Milton (11099)		
<b>Delivery lead:</b>	Glasgow City Council		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2022-2027</b>
<b>Description:</b>	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. The Metropolitan Glasgow Strategic Drainage Partnership will support the 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.		

<b>Action (ID):</b>	<b>SURFACE WATER PLAN/STUDY (111030018)</b>		
<b>Objective (ID):</b>	Reduce the economic damages and risk to people from surface water flooding in the Stand Burn catchment, Ferness (11103)		
<b>Delivery lead:</b>	Glasgow City Council		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2022-2027</b>
<b>Description:</b>	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. The Metropolitan Glasgow Strategic Drainage Partnership will support the 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.		

<b>Action (ID):</b>	<b>SURFACE WATER PLAN/STUDY (111110018)</b>		
<b>Objective (ID):</b>	Reduce the economic damages and risk to people from surface water flooding in Cumbernauld (11111)		
<b>Delivery lead:</b>	North Lanarkshire Council		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	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. The Metropolitan Glasgow Strategic Drainage Partnership will support the process and improve knowledge and understanding of surface water flood risk and interactions with other sources of flooding e.g. with the sewer network and watercourses.		

<b>Action (ID):</b>	<b>SURFACE WATER PLAN/STUDY (111120018)</b>		
<b>Objective (ID):</b>	Reduce the economic damages and risk to people from surface water flooding in Kilsyth (11112)		
<b>Delivery lead:</b>	North Lanarkshire Council		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2022-2027</b>
<b>Description:</b>	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. The Metropolitan Glasgow Strategic Drainage Partnership will support the process and improve knowledge and understanding of surface water flood risk and interactions with other sources of flooding e.g. with the sewer network and watercourses.		

<b>Action (ID):</b>	<b>SURFACE WATER PLAN/STUDY (111280018)</b>		
<b>Objective (ID):</b>	Reduce the economic damages and risk to people from surface water flooding in Possilpark (11128)		
<b>Delivery lead:</b>	Glasgow City Council		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2022-2027</b>
<b>Description:</b>	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. The Metropolitan Glasgow Strategic Drainage Partnership will support the 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.		

<b>Action (ID):</b>	<b>SURFACE WATER PLAN/STUDY (112040018)</b>		
<b>Objective (ID):</b>	Reduce the economic damages and risk to people from surface water flooding in Kirkintilloch (11204)		
<b>Delivery lead:</b>	East Dunbartonshire Council		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2022-2027</b>
<b>Description:</b>	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. The plan will also look to cover areas of Lenzie. The Metropolitan Glasgow Strategic Drainage Partnership will support the process and improve knowledge and understanding of surface water flood risk and interactions with other sources of flooding e.g. with the sewer network and watercourses.		

<b>Action (ID):</b>	<b>STRATEGIC MAPPING AND MODELLING (111320019)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Scottish Water		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>MAINTAIN FLOOD PROTECTION SCHEME (110080017)</b>		
<b>Objective (ID):</b>	Reduce the risk of river and surface water flooding to residential properties, non-residential properties, community facilities and transport routes in Kirkintilloch (11008)		
<b>Delivery lead:</b>	East Dunbartonshire Council		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	The River Kelvin Flood Protection Scheme 1998 consists of embankments, retaining walls, channel improvements, culverts, floodgates and various other works. The scheme was completed in 2004 and provides protection to Kirkintilloch. The level of protection offered by the scheme is being assessed. This scheme will be maintained and will continue to mitigate flooding. The level of flood risk is likely to increase over time as a consequence of climate change.		

<b>Action (ID):</b>	<b>MAINTAIN FLOOD PROTECTION SCHEME (110140017)</b>		
<b>Objective (ID):</b>	Reduce the risk of flooding from the River Kelvin and surface water to residential properties, non-residential properties and community facilities in west and north west Glasgow (11014)		
<b>Delivery lead:</b>	Glasgow City Council		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	There a number of sections of flood defence along the River Clyde which offer protection to properties in the area. These defences will be maintained, and will continue to manage flooding according to the design standard at the time of construction. Levels of flood risk are likely to increase over time as a consequence of climate change.		

<b>Action (ID):</b>	<b>MAINTAIN FLOOD WARNING (111320030)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	SEPA		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	Continue to maintain the Cleveden Park, Goyle Bridge and Kelvinbridge Underground flood warning areas which are part of the Kelvin river flood warning scheme.		

<b>Action (ID):</b>	<b>FLOOD FORECASTING (111320009)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	SEPA		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>COMMUNITY FLOOD ACTION GROUPS (111320012)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Community		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	East Dunbartonshire Council have approached the Scottish Flood Forum for support in creating a community flood action group.		

<b>Action (ID):</b>	<b>SELF HELP (111320011)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	—		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>AWARENESS RAISING (111320013)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Responsible authorities		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>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.</p> <p>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.</p> <p>Local authorities will be undertaking additional awareness raising activities. Further details will be set out in the Local FRM Plan.</p>		

<b>Action (ID):</b>	<b>MAINTENANCE (111320007)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Local authorities, asset / land managers		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>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.</p>		

<b>Action (ID):</b>	<b>SITE PROTECTION PLANS (110140015)</b>		
<b>Objective (ID):</b>	Reduce the risk of flooding from the River Kelvin and surface water to residential properties, non-residential properties and community facilities in west and north west Glasgow (11014)		
<b>Delivery lead:</b>	Glasgow City Council		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	<p>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. A Site Protection Plan should be developed for the Kelvin Bridge Subway.</p>		

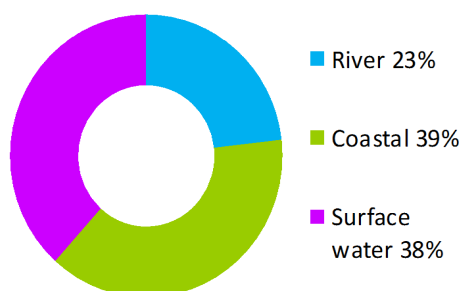
<b>Action (ID):</b>	<b>EMERGENCY PLANS/RESPONSE (111320014)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Category 1 and 2 Responders		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>Providing an emergency response to 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.</p>		

<b>Action (ID):</b>	<b>PLANNING POLICIES (111270001)</b>		
<b>Objective (ID):</b>	Avoid an overall increase in flood risk (11127) Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Planning authority		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>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.</p>		

## Yoker catchment - Clyde (Clydebank to Partick) (Potentially Vulnerable Area 11/05)

Local Plan District	Local authority	Main catchment
Clyde and Loch Lomond	East Dunbartonshire Council, Glasgow City Council, West Dunbartonshire Council	River Clyde

### Summary of flooding impacts



#### At risk of flooding

- 4,900 residential properties
- 700 non-residential properties
- £8.1 million Annual Average Damages

(damages by flood source shown left)

Summary of flooding impacts

### 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.

Objectives

### Summary of actions to manage flooding

The actions below have been selected to manage flood risk.

<i>Flood protection scheme/works</i>	<i>Natural flood management works</i>	<i>New flood warning</i>	<i>Community flood action groups</i>	<i>Property level protection scheme</i>	<i>Site protection plans</i>
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

Actions



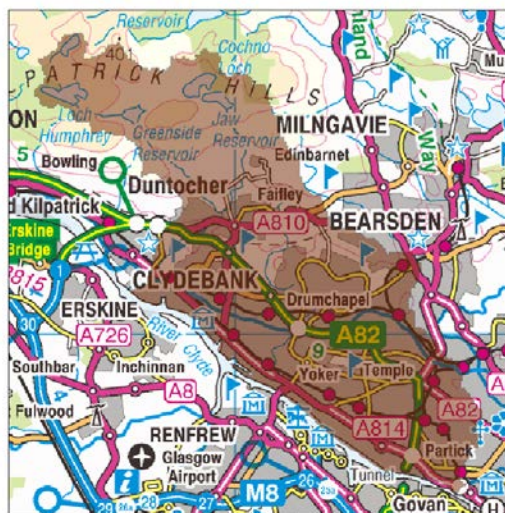
## Yoker catchment – Clyde (Clydebank to Partick) (Potentially Vulnerable Area 11/05)

Local Plan District	Local authority	Main catchment
Clyde and Loch Lomond	East Dunbartonshire Council, Glasgow City Council, West Dunbartonshire Council	River Clyde

### Background

This Potentially Vulnerable Area is located to the south east of Loch Lomond on the northern bank of the River Clyde (shown below).

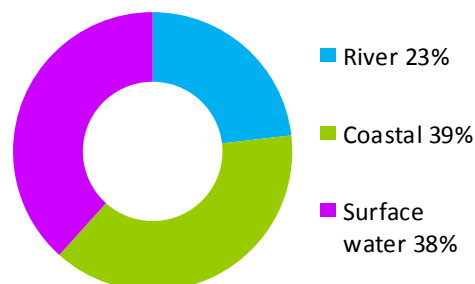
The area stretches from Clydebank in the west and extends east to incorporate parts of Bearsden, Drumchapel and the north west of Glasgow City. It is approximately 80km<sup>2</sup>.



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The area has a risk of river surface water and coastal flooding. Damages are split fairly evenly over all sources of flooding.

There are approximately 4,900 residential properties and 700 non-residential properties at risk of flooding. The Annual Average Damages are £8.1 million.



**Figure 1: Annual Average Damages by flood source**

### Summary of flooding impacts

There are a number of communities at risk of flooding from river, surface water and coastal sources with impacts to properties, infrastructure and community facilities. Due to the heavily urbanised nature in the south of this area, river flooding and surface water flooding may be closely linked with a large potential for interaction.

River flooding to properties is identified within the areas of Clydebank, Drumchapel and Yoker. The Yoker Burn, originating in Bearsden and flowing through Clydebank, has been culverted over much of its length. Glasgow City Council undertook a study of the Yoker Burn and the Yoker mains Burn, looking at the interaction of surface water and river flooding. The study showed a large extent of flooding to properties in the area. The information from these studies has been incorporated into this assessment.

There are a number of smaller watercourses which flow into the Clyde Estuary and present a risk of river flooding. The Loch Humphrey / Duntocher Burn originates from Greenside Reservoir and flows to the west of Clydebank. The burn is intersected by a number of structures as it passes through these urban areas. Within Duntocher there are a large number of residential properties at risk of flooding. Downstream of the Duntocher Burn properties within the Mountblow area are also at risk. The Garscadden Burn and its tributaries are known to cause flooding to the residential area of Bearsden, which borders Drumchapel (Colquhoun Park/Conon Avenue).

There are approximately 2,300 residential properties at risk of surface water flooding. The main transport routes, which run from east to west across the Potentially Vulnerable Area, are at risk including the A82 and A739. The areas at highest risk from surface water flooding will require the preparation of surface water management plans.

Scottish Water and local authorities have completed a number of studies in the area. These have included strategic and detailed assessments of surface water risk and interaction with river flooding, with the potential for mitigation action. Many of these studies have been helped by the partnership working developed within the Metropolitan Glasgow Strategic Drainage Partnership. This has led to the implementation of schemes and works to protect properties from river and surface water flooding.

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 non-residential properties followed by damages to residential properties.

Within this Potentially Vulnerable Area it is estimated that climate change will increase the number of residential properties at risk of flooding from approximately 4,900 to 6,300 and the number of non-residential properties from approximately 700 to 950.

The location of the impacts of flooding is shown in Figure 3. The areas with the highest impacts are Clydebank, Drumchapel and Partick. Various roads including the A82 and railways are also at risk of flooding.

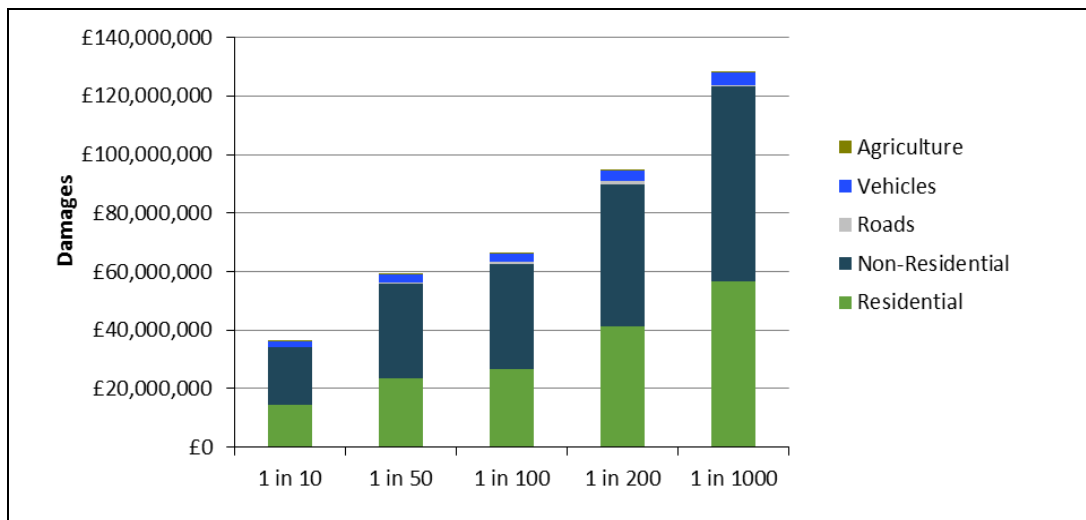
## **History of flooding**

Flood records in the area predominantly relate to surface water flooding at Bearsden in East Dunbartonshire. These events have impacted roads, properties and businesses. Notable flooding occurred in Bearsden in 2005, 2006, 2007 and 2008 which resulted in disruptions to railway services and flooding of houses. Flooding also occurred in this part of Glasgow City in January 1934, which affected the railway services and suspended traffic.

The Garscadden Burn and its tributaries have also caused flooding to the residential area of Bearsden, which borders Drumchapel (Colquhoun Park/Conon Ave Bearsden). Significant flooding was recorded in a narrow corridor in Glasgow City on 21 October 2013, which affected various parts of north and north west Glasgow.

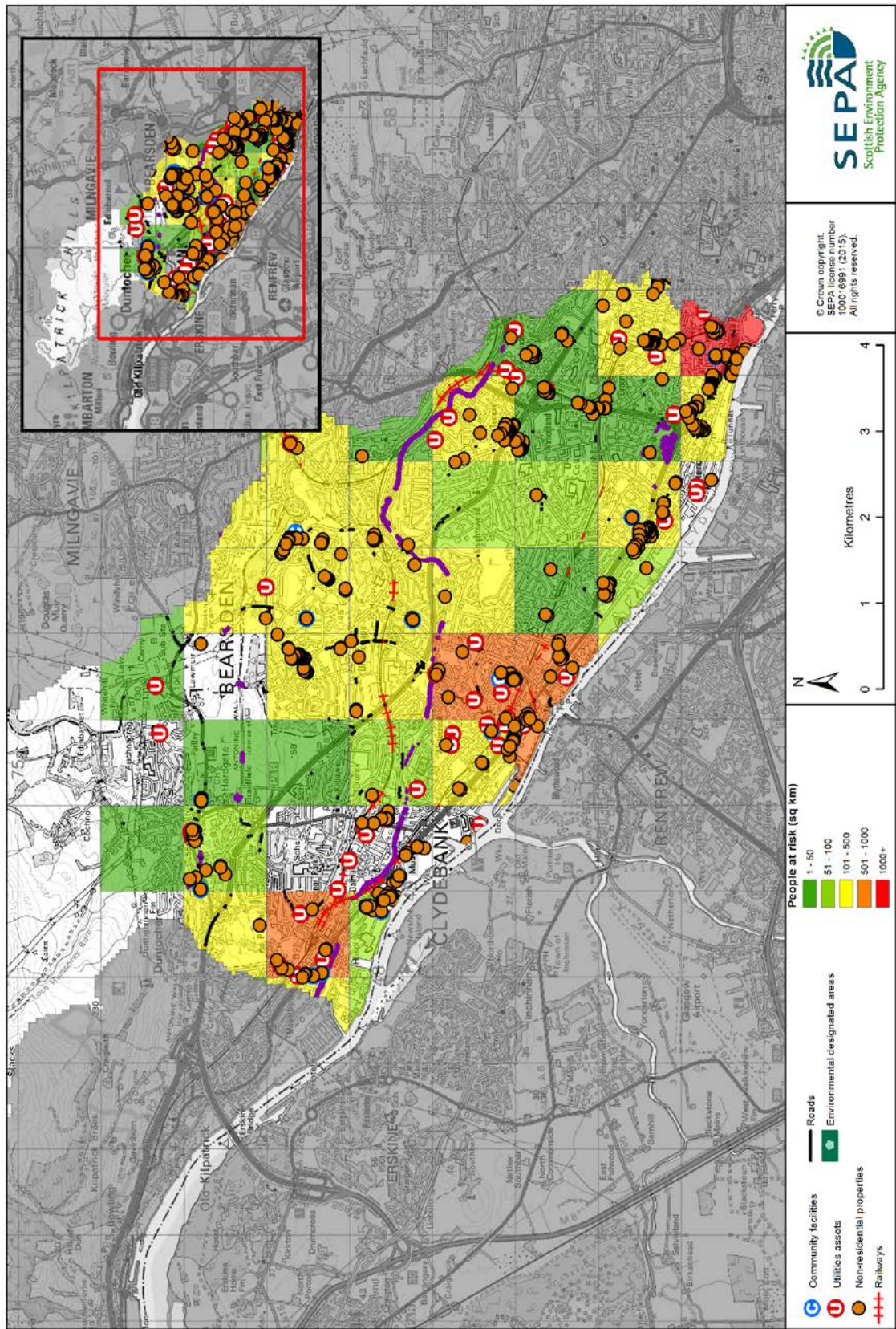
	1 in 10 High likelihood	1 in 200 Medium likelihood	1 in 1000 Low likelihood
Residential properties (total 69,000)	1,900	4,900	6,100
Non-residential properties (total 9,100)	200	700	950
People	4,100	11,000	13,000
Community facilities	10 Includes: educational buildings and healthcare facilities	20 Includes: educational buildings and healthcare facilities	20 Includes: educational buildings and healthcare facilities
Utilities assets	20	60	70
Transport links-roads (km)	4.3 (of which 1.1 is A road)	14.7 (of which 12.5 is A road)	19.5 (of which 12.9 is A road)
Transport links-rail (km)	1.4	6.0	7.5
Environmental designated areas (km <sup>2</sup> )	0	0	0
Designated cultural heritage sites	11	15	16
Agricultural land (km <sup>2</sup> )	0.3	0.4	0.4

**Table 1:** Summary of flooding impacts<sup>1</sup>



**Figure 2:** Damages by flood likelihood

<sup>1</sup> Some receptors are counted more than once if flooded from multiple sources



**Figure 3: Impacts of flooding**

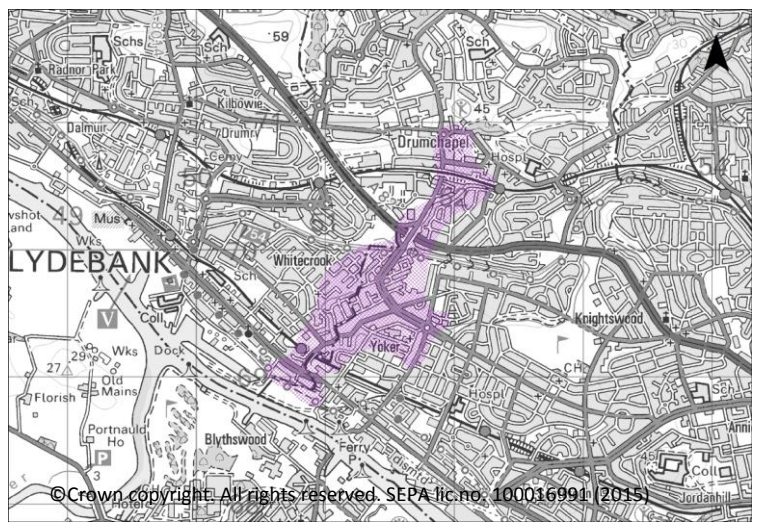
**Objectives to manage flooding in Potentially Vulnerable Area 11/05**

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 Yoker catchment - Clyde (Clydebank to Partick) Potentially Vulnerable Area.

**Reduce the risk of river and surface water flooding to residential properties, non-residential properties and transport routes in Yoker Mains and Yoker Burn catchments**

- Indicators:
- 370 residential properties
  - 50 non-residential properties
  - £1.2 million Annual Average Damages
  - 3.0km of road

Target area:

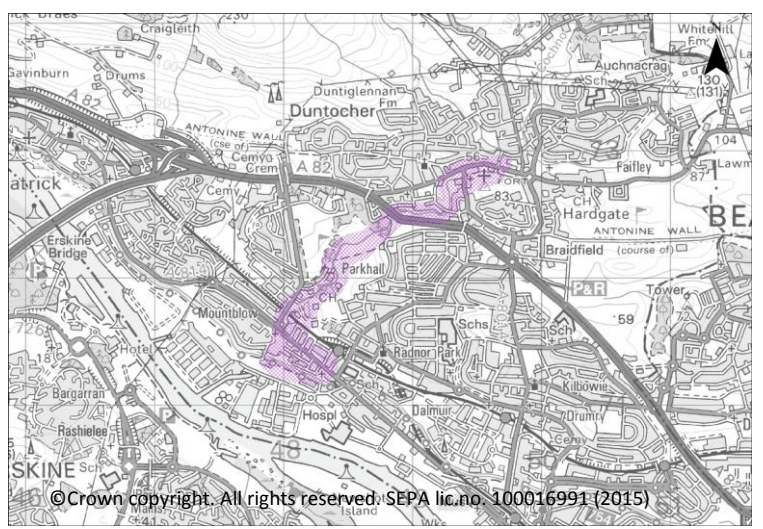


Objective ID: 11016

**Reduce the risk of flooding from the Duntocher Burn combined with surface water to residential properties, non-residential properties and community facilities**

- Indicators:
- 370 residential properties
  - 30 non-residential properties
  - £550,000 Annual Average Damages
  - 2 educational buildings

Target area:



Objective ID: 11079

Target area	Objective	ID	Indicators within PVA
Glasgow	Reduce the economic damages and number of people at risk of surface water flooding in Glasgow City	11007	* See note below
Bearsden	Reduce the economic damages and risk to people from surface water flooding in Bearsden	11087	* See note below
Drumchapel, Glasgow	Reduce the economic damages and risk to people from surface water flooding in Drumchapel	11093	* See note below
High Knightswood and Netherton, Glasgow	Reduce the economic damages and risk to people from surface water flooding in High Knightswood, Netherton	11096	* See note below
Scotstoun, Jordanhill and Whiteinch, Glasgow	Reduce the economic damages and risk to people from surface water flooding in Scotstoun, Jordanhill and Whiteinch	11102	* See note below
Yokermain Burn catchment, Glasgow	Reduce the economic damages and risk to people from surface water flooding in the Yokermain Burn catchment	11105	* See note below
Old Kilpatrick, Mountblow	Reduce the economic damages and risk to people from surface water flooding in Old Kilpatrick, Duntocher and Mountblow	11126	* See note below
Applies across Clyde and Loch Lomond Local Plan District	Avoid an overall increase in flood risk	11127	<ul style="list-style-type: none"> <li>• 4,900 residential properties</li> <li>• £8.1 million Annual Average Damages</li> </ul>
Applies across Clyde and Loch Lomond Local Plan District	Reduce overall flood risk	11132	<ul style="list-style-type: none"> <li>• 4,900 residential properties</li> <li>• £8.1 million Annual Average Damages</li> </ul>
Applies across Clyde and Loch Lomond 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 11/05 there are 2,600 residential properties at risk and Annual Average Damages of £3.1 million.

## Actions to manage flooding in Potentially Vulnerable Area 11/05

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 Yoker catchment - Clyde (Clydebank to Partick) Potentially Vulnerable Area.

Selected actions					
<i>Flood protection scheme/works</i>	<i>Natural flood management works</i>	<i>New flood warning</i>	<i>Community flood action groups</i>	<i>Property level protection scheme</i>	<i>Site protection plans</i>
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

<b>Action (ID):</b>	<b>FLOOD PROTECTION STUDY (110160005)</b>		
<b>Objective (ID):</b>	Reduce the economic damages and risk to people from surface water flooding in the Yokermain Burn catchment (11105) Reduce the risk of river and surface water flooding to residential properties, non-residential properties and transport routes in Yoker Mains and Yoker Burn catchments (11016)		
<b>Delivery lead:</b>	Glasgow City Council		
<b>Priority:</b>	National:	Within local authority:	
	<b>36 of 168</b>	<b>5 of 8</b>	
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	<p>A study is recommended to further investigate the feasibility of a flood protection scheme on the Yoker Burn and Garscadden Burn, focusing on the benefit of direct defences along both banks, the potential benefit for runoff control using natural flood management and the benefits of a property level protection scheme to reduce residual risk. Other actions may also be considered to select the most sustainable combination of actions.</p> <p>A surface water management plan for the Yokermain Burn should be carried out for the area, which will help identify actions to reduce flooding in the area, such as sustainable drainage systems.</p>		
<b>Potential impacts</b>			
<b>Economic:</b>	The flood protection study should consider how to reduce flooding to 130 residential properties and two non-residential properties in this location. The potential damages avoided are estimated to be up to £21 million. The economic impact of natural flood management actions is difficult to define. However, these actions can reduce flood risk for high likelihood events. In this location, it has been estimated that 90 residential and non-residential properties could potentially		

<b>Economic:</b>	benefit from natural flood management actions.
<b>Social:</b>	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. There may be changes in visual amenity and land use as a result of this action.
<b>Environmental:</b>	Flood protection studies should consider the positive and negative impacts of proposed actions on the ecological quality of the environment. Natural flood management actions can have a positive impact by restoring and enhancing natural habitats. There are no international, national or local level environmental designations that are likely to be impacted by this action. There is likely to be a loss of semi-natural habitat in the footprint and vicinity of the defences. There are likely to be short term negative impacts on water quality during construction from increased sediment. There is the potential for slight positive impacts on water quality from the implementation of sustainable drainage systems in the area.

<b>Action (ID):</b>	<b>FLOOD PROTECTION STUDY (110790005)</b>		
<b>Objective (ID):</b>	Reduce the risk of flooding from the Duntocher Burn combined with surface water to residential properties, non-residential properties and community facilities (11079)		
<b>Delivery lead:</b>	West Dunbartonshire Council		
<b>Priority:</b>	National:	Within local authority:	
	<b>90 of 168</b>	<b>2 of 2</b>	
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2022-2027</b>
<b>Description:</b>	A study is recommended to further investigate the feasibility of a flood protection scheme on the Duntocher Burn, focusing on upgrading a restrictive culvert under the canal and sustainable drainage systems to reduce surface water flows into the burn. Other actions may also be considered to select the most sustainable combination of actions.		
<b>Potential impacts</b>			
<b>Economic:</b>	The flood protection study should consider how to reduce flood risk to three residential properties and 10 non-residential properties in this location, with potential damages avoided of up to £3.6 million.		
<b>Social:</b>	A reduction in flood risk would have a positive benefit to the health and wellbeing of the community.		
<b>Environmental:</b>	Flood protection studies should consider the positive and negative impacts of proposed actions on the ecological quality of the environment. There are no international, national or local level environmental designations that are likely to be impacted by this action. There may be a loss of woodland and acid and heather grasslands from increasing water levels at Greenside Reservoir. There is the potential for long term positive impacts from the creation of new wetland habitat with this action. Downstream of this action there may be negative impacts on water quality through increased erosion and sedimentation on the Duntocher Burn.		



<b>Action (ID):</b>	<b>NATURAL FLOOD MANAGEMENT STUDY (110160003)</b>		
<b>Objective (ID):</b>	Reduce the economic damages and risk to people from surface water flooding in Bearsden (11087) Reduce the risk of river and surface water flooding to residential properties, non-residential properties and transport routes in Yoker Mains and Yoker Burn catchments (11016)		
<b>Delivery lead:</b>	Glasgow Clyde Valley Green Network and local authorities		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	A natural flood management study should be undertaken to further investigate the potential benefit from runoff control within the catchment. The strategic screening has identified that there are areas of the upper catchment that could reduce the impact of flooding by altering land management or land cover. If there is an identified benefit of these actions the study should look at engaging with local land owners to establish the potential for future works.		
<b>Potential impacts</b>			
<b>Economic:</b>	The economic impacts have not been defined at this stage.		
<b>Social:</b>	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 natural flood management study area. Natural flood management actions can restore and enhance natural environments and create opportunities for recreation and tourism.		
<b>Environmental:</b>	Natural flood management actions can have a positive impact on the ecological quality of the environment by restoring and enhancing natural habitats. Garscadden Wood Local Nature Reserve has the potential to be impacted by this action; however, these impacts could be positive if improved land management is implemented. There is the potential for the existing ecosystems in the area to be impacted through a change of land use if woodland planting is undertaken. There are likely to be improvements in water quality through reduced agricultural chemical and sediment runoff, which will have positive impacts on the terrestrial and freshwater habitats and species in the area. There is the potential for implementation of the runoff control action in this area to impact upon the setting of the Antonine Wall World Heritage Site and Scheduled Monument. This impact could be positive or negative.		

<b>Action (ID):</b>	<b>SURFACE WATER PLAN/STUDY (110070018)</b>		
<b>Objective (ID):</b>	Reduce the economic damages and number of people at risk of surface water flooding in Glasgow City (11007)		
<b>Delivery lead:</b>	Glasgow City Council		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2028-2033</b>
<b>Description:</b>	The area must be covered by a strategy to manage and reduce surface water flood risk and identify the most sustainable actions to achieve the objectives. This strategy has been developed by the Metropolitan Glasgow Strategic Drainage Partnership. The detailed		

objectives and actions to manage and reduce surface water flood risk will be set out in the area specific surface water management plans described below.

<b>Action (ID):</b>	<b>SURFACE WATER PLAN/STUDY (110871018)</b>		
<b>Objective (ID):</b>	Reduce the economic damages and risk to people from surface water flooding in Bearsden (11087)		
<b>Delivery lead:</b>	East Dunbartonshire Council		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	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. The Metropolitan Glasgow Strategic Drainage Partnership will support the process and improve knowledge and understanding of surface water flood risk and interactions with other sources of flooding e.g. with the sewer network and watercourses.		

<b>Action (ID):</b>	<b>SURFACE WATER PLAN/STUDY (110930018)</b>		
<b>Objective (ID):</b>	Reduce the economic damages and risk to people from surface water flooding in Drumchapel (11093)		
<b>Delivery lead:</b>	Glasgow City Council		
<b>Status:</b>	<b>Ongoing</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	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. The Metropolitan Glasgow Strategic Drainage Partnership will support the 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.		

<b>Action (ID):</b>	<b>SURFACE WATER PLAN/STUDY (110960018)</b>		
<b>Objective (ID):</b>	Reduce the economic damages and risk to people from surface water flooding in High Knightswood, Netherton (11096)		
<b>Delivery lead:</b>	Glasgow City Council		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	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. The Metropolitan Glasgow Strategic Drainage Partnership will support the 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.		

<b>Action (ID):</b>	<b>SURFACE WATER PLAN/STUDY (111020018)</b>		
<b>Objective (ID):</b>	Reduce the economic damages and risk to people from surface water flooding in Scotstoun, Jordanhill and Whiteinch (11102)		
<b>Delivery lead:</b>	Glasgow City Council		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2022-2027</b>
<b>Description:</b>	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. The Metropolitan Glasgow Strategic Drainage Partnership will support the 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.		

<b>Action (ID):</b>	<b>SURFACE WATER PLAN/STUDY (111050018)</b>		
<b>Objective (ID):</b>	Reduce the economic damages and risk to people from surface water flooding in the Yokermain Burn catchment (11105)		
<b>Delivery lead:</b>	Glasgow City Council		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	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. The Metropolitan Glasgow Strategic Drainage Partnership will support the 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.		

<b>Action (ID):</b>	<b>SURFACE WATER PLAN/STUDY (111260018)</b>		
<b>Objective (ID):</b>	Reduce the economic damages and risk to people from surface water flooding in Old Kilpatrick, Duntocher and Mountblow (11126)		
<b>Delivery lead:</b>	West Dunbartonshire Council		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	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. The Metropolitan Glasgow Strategic Drainage Partnership will support the 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.		

<b>Action (ID):</b>	<b>STRATEGIC MAPPING AND MODELLING (111320019)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Scottish Water		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>MAINTAIN FLOOD PROTECTION SCHEME (110160017)</b>		
<b>Objective (ID):</b>	Reduce the risk of river and surface water flooding to residential properties, non-residential properties and transport routes in Yoker Mains and Yoker Burn catchments (11016)		
<b>Delivery lead:</b>	Glasgow City Council		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	There are a number of sections of flood defence along the River Clyde which offer protection to properties in the area. These defences will be maintained, and will continue to manage flooding according to the design standard at the time of construction. Levels of flood risk are likely to increase over time as a consequence of climate change.		

<b>Action (ID):</b>	<b>MAINTAIN FLOOD WARNING (111320030)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	SEPA		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	Continue to maintain the Renfrew flood warning area which is part of the Firth of Clyde coastal flood warning scheme.		

<b>Action (ID):</b>	<b>FLOOD FORECASTING (111320009)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	SEPA		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>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.</p>		

<b>Action (ID):</b>	<b>SELF HELP (111320011)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	—		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>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.</p> <p>West Dunbartonshire Council have in place a flood resilience subsidy scheme which permits any residential or business property at risk of flooding to apply. The scheme enables applicants to purchase selected property level protection products at cost price less a maximum subsidy.</p>		

<b>Action (ID):</b>	<b>AWARENESS RAISING (111320013)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Responsible authorities		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>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.</p> <p>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.</p>		

<b>Action (ID):</b>	<b>MAINTENANCE (111320007)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Local authorities, asset / land managers		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>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.</p>		

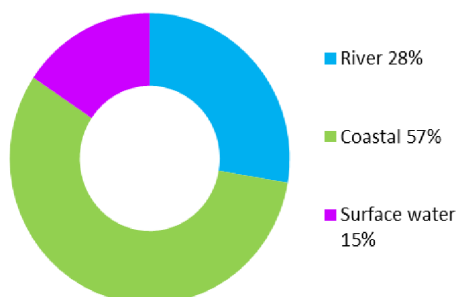
<b>Action (ID):</b>	<b>EMERGENCY PLANS/RESPONSE (111320014)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Category 1 and 2 Responders		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>Providing an emergency response to 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.</p>		

<b>Action (ID):</b>	<b>PLANNING POLICIES (111270001)</b>		
<b>Objective (ID):</b>	Avoid an overall increase in flood risk (11127) Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Planning authority		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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.		

## Isle of Bute (Potentially Vulnerable Area 11/06)

Local Plan District	Local authority	Main catchment
Clyde and Loch Lomond	Argyll and Bute Council	Isle of Bute

### Summary of flooding impacts



### At risk of flooding

- 600 residential properties
- 420 non-residential properties
- £2.3 million Annual Average Damages

(damages by flood source shown left)

Summary of flooding impacts

### 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.

Objectives

### Summary of actions to manage flooding

The actions below have been selected to manage flood risk.

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

Actions

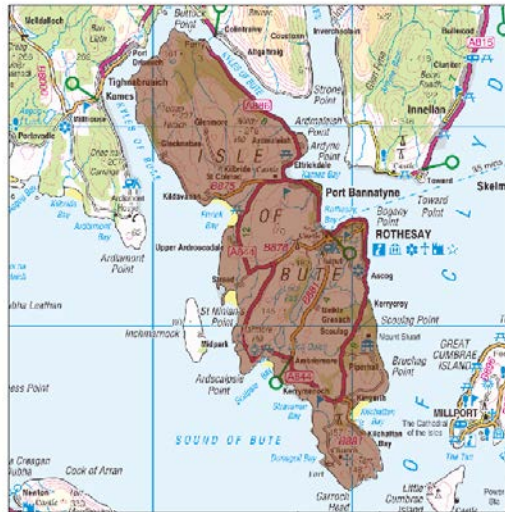


# Isle of Bute (Potentially Vulnerable Area 11/06)

Local Plan District	Local authority	Main catchment
Clyde and Loch Lomond	Argyll and Bute Council	Isle of Bute

## Background

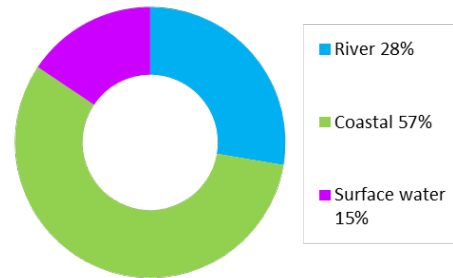
This Potentially Vulnerable Area is located in the west of the Clyde and Loch Lomond Local Plan District, on the Isle of Bute. It is approximately 120km<sup>2</sup> (shown below).



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

There are approximately 600 residential properties and 420 non-residential properties at risk of flooding. The Annual Average Damages are approximately £2.3 million.



**Figure 1:** Annual Average Damages by flood source

## Summary of flooding impacts

Coastal flooding has the greatest impact in Rothesay, although areas of Port Bannatyne, Kingarth, Kilchattan Bay, St Ninian’s point and to the south of Kerrycroy are also predicted to be at risk. In relation to Rothesay the predicted coastal flood risk is likely to be largely mitigated by the existing flood defence scheme, which consists of approximately 910m of seawall from Argyle Street, along the Esplanade to East Princes Street. These defences are not currently incorporated within the national flood mapping used in the analysis. Around the coastline there are sections of the A844 which have historically suffered from erosion problems whilst the A886 has also been identified to have sections at risk of flooding.

River flooding within the area is primarily attributed to the Loch Fad and the Lade, which flows from the loch, through Rothesay and downstream into the Firth of Clyde, affecting both residential and non-residential properties. There are no records of river flooding from this source in Rothesay. There are also areas of predicted river flooding in Ettrick Bay from the Drumachloy Burn. Small areas of agricultural land are also at risk from river flooding from the various burns that cross the island.

There are approximately 70 residential properties at risk of surface water flooding distributed across this Potentially Vulnerable Area. The areas at highest risk from surface water will require the preparation of surface water management plans.

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. Residential properties affected by coastal flooding experience the highest economic impact at approximately 25% of the damages.

Within this Potentially Vulnerable Area it is estimated that climate change will increase the number of residential properties at risk of flooding from approximately 600 to 900 and the number of non-residential properties from approximately 420 to 480.

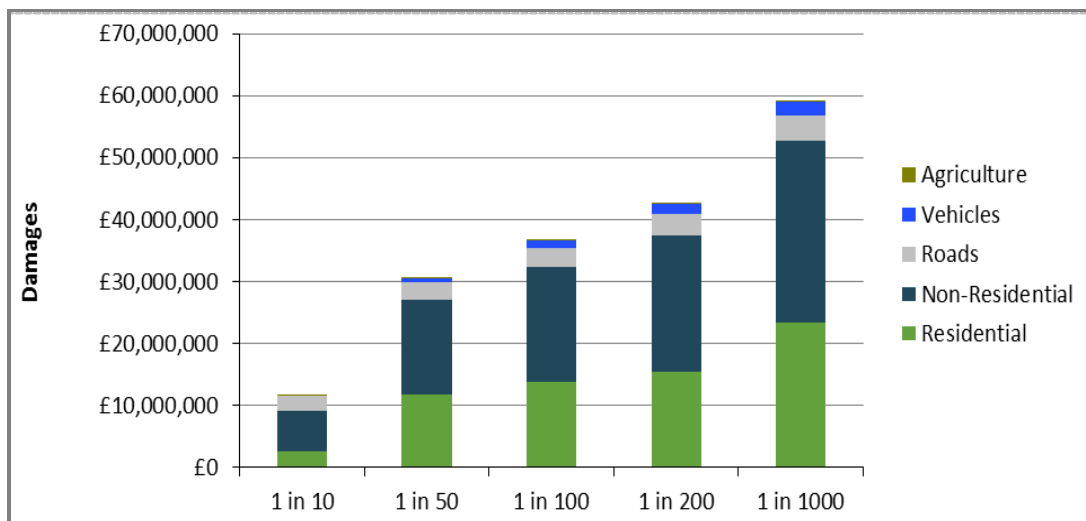
The location of the impacts of flooding is shown in Figure 3. Most of impacts are within Port Bannatyne and Rothesay, with flooding to people and non-residential properties. The A886 north of Port Bannatyne is also at risk of flooding. Eleven designated cultural heritage sites are at risk as well as small areas of environmentally designated sites.

## **History of flooding**

In January 1991, Rothesay suffered significant coastal flooding which caused damages of approximately £4 million. There have been no reported incidents of surface water or river floods within the area.

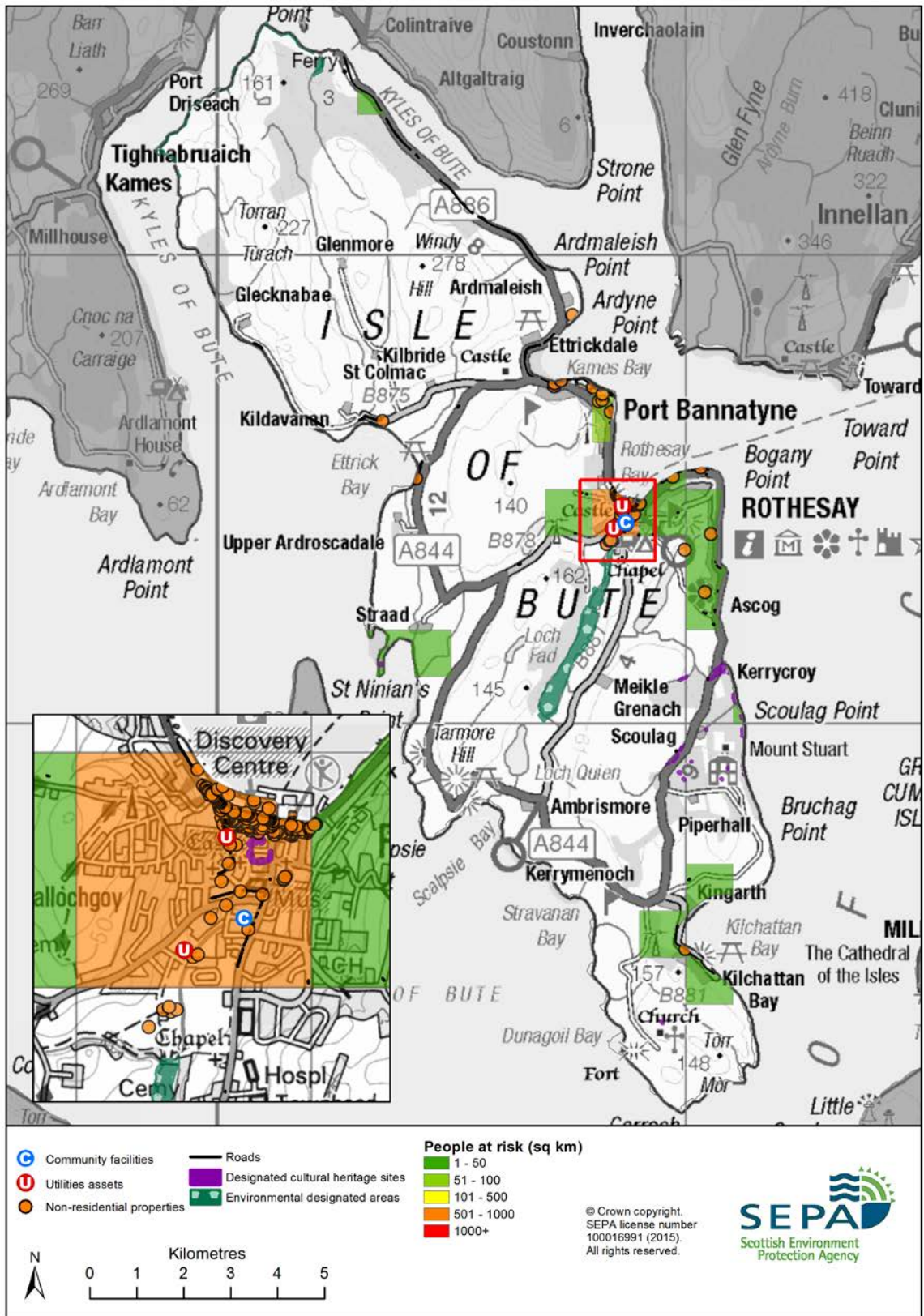
	1 in 10 High likelihood	1 in 200 Medium likelihood	1 in 1000 Low likelihood
Residential properties (total 4,500)	160	600	860
Non-residential properties (total 600)	170	420	470
People	350	1,300	1,900
Community facilities	<10 Healthcare facilities	<10 Healthcare facilities	<10 Healthcare facilities
Utilities assets	<10	<10	<10
Transport links-roads (km)	8.4	12.4	15.4
Environmental designated areas (km <sup>2</sup> )	0.9	1.0	1.0
Designated cultural heritage sites	9	11	15
Agricultural land (km <sup>2</sup> )	1.0	1.6	1.9

**Table 1:** Summary of flooding impacts<sup>1</sup>



**Figure 2:** Damages by flood likelihood

<sup>1</sup> Some receptors are counted more than once if flooded from multiple sources



**Figure 3: Impacts of flooding**

## Objectives to manage flooding in Potentially Vulnerable Area 11/06

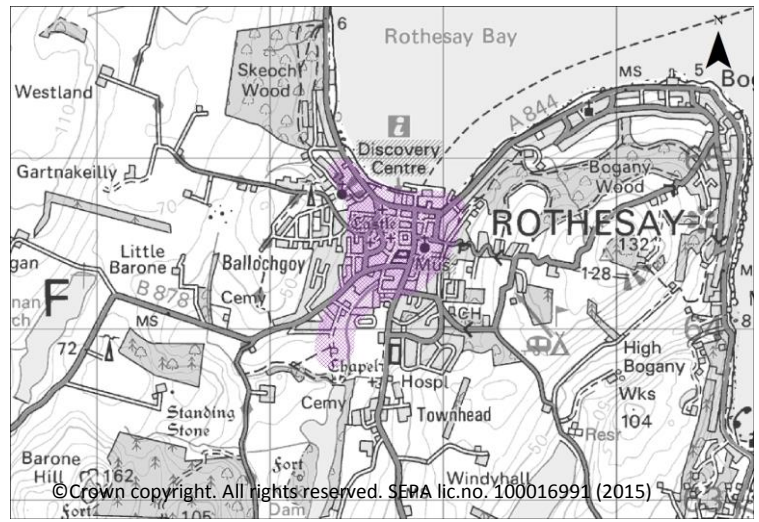
Objectives provide a common goal and shared ambition for managing floods. These objectives have been set by SEPA and agreed with flood risk management authorities following consultation. They were identified through an assessment of the underlying evidence of the causes and impacts of flooding. Target 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 the Isle of Bute Potentially Vulnerable Area.

### Reduce the risk of combined flooding to residential properties and non-residential properties in Rothesay

Indicators:

Target area:

- 480 residential properties
- 400 non-residential properties
- £1.8 million Annual Average Damages



Objective ID: 11004

Target area	Objective	ID	Indicators within PVA
Applies across Clyde and Loch Lomond Local Plan District	Avoid an overall increase in flood risk	11127	<ul style="list-style-type: none"> <li>• 600 residential properties</li> <li>• £2.3 million Annual Average Damages</li> </ul>
Applies across Clyde and Loch Lomond Local Plan District	Reduce overall flood risk	11132	<ul style="list-style-type: none"> <li>• 600 residential properties</li> <li>• £2.3 million Annual Average Damages</li> </ul>
Applies across Clyde and Loch Lomond 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 11/06

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 the Isle of Bute Potentially Vulnerable Area.

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

<b>Action (ID):</b>	<b>FLOOD PROTECTION STUDY (110040005)</b>		
<b>Objective (ID):</b>	Reduce the risk of combined flooding to residential properties and non-residential properties in Rothesay (11004)		
<b>Delivery lead:</b>	Argyll and Bute Council		
<b>Priority:</b>	National:		Within local authority:
	<b>142 of 168</b>		<b>6 of 9</b>
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2022-2027</b>
<b>Description:</b>	A study is recommended to further investigate the feasibility of a flood protection scheme in Rothesay, focusing on the potential to use Kirk Dam for storage, the potential for natural flood management actions to reduce flooding in the area and the benefits of a property level protection scheme in the town. The existing Rothesay Town Centre coastal flood warning area would support property level protection to increase the overall benefit.		
<b>Potential impacts</b>			
<b>Economic:</b>	The flood protection study should consider how to reduce flooding to 160 residential properties and 110 non-residential properties. The potential damages avoided are estimated to be up to £630,000. The economic impact of natural flood management actions is difficult to define. However, these actions can reduce flood risk for high likelihood events. In this location, it has been estimated that 20 residential and non-residential properties could potentially benefit from natural flood management actions.		
<b>Social:</b>	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 there are two utilities which have been identified as potentially benefitting from		

<b>Social:</b>	this action. Natural flood management actions can restore and enhance natural environments and create opportunities for recreation and tourism. There may be changes in visual amenity and land use as a result of this action.
<b>Environmental:</b>	Flood protection studies should consider the positive and negative impacts of proposed actions on the ecological quality of the environment. Natural flood management actions can have a positive impact by restoring and enhancing natural habitats. There is the potential for permanent impacts to the Bute Central Lochs Site of Special Scientific Interest during construction and through loss of habitat, displacement of species and changes in hydrology. There is the potential for negative impacts to the Thom's Water Cuts Scheduled Monument from this action during construction.

<b>Action (ID):</b>	<b>STRATEGIC MAPPING AND MODELLING (111320019)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Scottish Water		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>MAINTAIN FLOOD PROTECTION SCHEME (110040017)</b>		
<b>Objective (ID):</b>	Reduce the risk of combined flooding to residential properties and non-residential properties in Rothesay (11004)		
<b>Delivery lead:</b>	Argyll and Bute Council		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	Rothesay Flood Protection Scheme was constructed in 2004 and consists of approximately 910m of seawall from Argyle Street, along the Esplanade to East Princes Street. This scheme provides protection to the area up to a 100 year flood. These defences will be maintained, and will continue to manage flooding according to the design standard at the time of construction. Levels of flood risk are likely to increase over time as a consequence of climate change.		

<b>Action (ID):</b>	<b>MAINTAIN FLOOD WARNING (111320030)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	SEPA		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	Continue to maintain the Rothesay Town Centre and Kames Bay Pointhouse Crescent flood warning areas which are part of the Firth of Clyde coastal flood warning scheme.		

<b>Action (ID):</b>	<b>FLOOD FORECASTING (111320009)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	SEPA		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>SELF HELP (111320011)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	—		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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.		



<b>Action (ID):</b>	<b>AWARENESS RAISING (111320013)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Responsible authorities		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>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.</p> <p>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.</p>		

<b>Action (ID):</b>	<b>MAINTENANCE (111320007)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Argyll & Bute Council, asset / land managers		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>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.</p>		

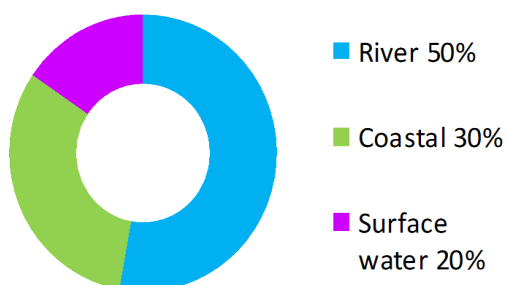
<b>Action (ID):</b>	<b>EMERGENCY PLANS/RESPONSE (111320014)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Category 1 and 2 Responders		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>Providing an emergency response to 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.</p>		

<b>Action (ID):</b>	<b>PLANNING POLICIES (111270001)</b>		
<b>Objective (ID):</b>	Avoid an overall increase in flood risk (11127) Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Planning authority		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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.		

## Dunoon (Potentially Vulnerable Area 11/07)

Local Plan District	Local authority	Main catchment
Clyde and Loch Lomond	Argyll and Bute Council	Cowal / Clyde Sealochs coastal

### Summary of flooding impacts



#### At risk of flooding

- 140 residential properties
- 80 non-residential properties
- £480,000 Annual Average Damages

(damages by flood source shown left)

Summary of flooding impacts

### 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.

Objectives

### Summary of actions to manage flooding

The actions below have been selected to manage flood risk.

<i>Flood protection scheme/works</i>	<i>Natural flood management works</i>	<i>New flood warning</i>	<i>Community flood action groups</i>	<i>Property level protection scheme</i>	<i>Site protection plans</i>
Flood protection study	<i>Natural flood management study</i>	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

Actions

# Dunoon (Potentially Vulnerable Area 11/07)

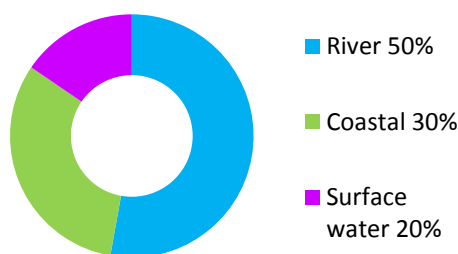
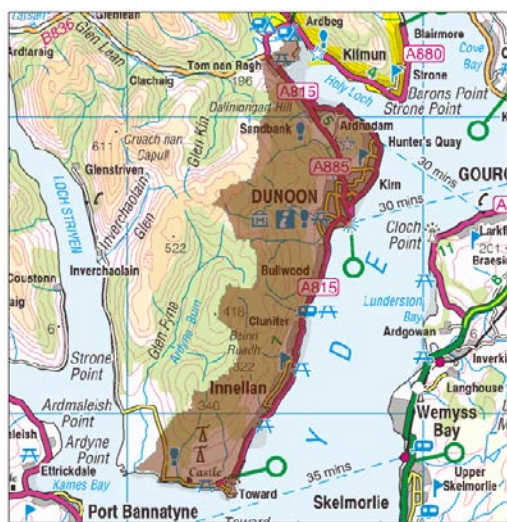
Local Plan District	Local authority	Main catchment
Clyde and Loch Lomond	Argyll and Bute Council	Cowal / Clyde Sealochs coastal

## Background

This Potentially Vulnerable Area is located in the north west of the Clyde and Loch Lomond Local Plan District, along the coast between Holy Loch and Port Bannatyne, and is approximately 40km<sup>2</sup> (shown below).

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

There are approximately 140 residential properties and 80 non-residential properties at risk of flooding. The Annual Average Damages are approximately £480,000.



**Figure 1: Annual Average Damages by flood source**

## Summary of flooding impacts

River flooding within the area is primarily attributed to the Blagaidh and Milton Burns which flow through Dunoon. River flooding in Dunoon impacts residential properties, community services and utilities. In the north, the Little Eachaig River may affect agricultural areas near Dalinlongart. The main transport route (A815) is also affected by river flooding at a number of locations in the area.

Despite the eastern and southern boundaries of the area fronting onto the Firth of Clyde there are relatively few locations affected by coastal flooding. Potentially affected areas include a small number of properties in the south off the A815, properties in the vicinity of the Blagaidh Burn within Dunoon and properties at Sandbank near the marina.

There are approximately 40 residential properties at risk of surface water flooding with the highest impact in Toward and Dunoon, where deep flooding may occur. Scottish Water has reported drainage issues within Dunoon and there has been surface water flooding. The areas at highest risk from surface water flooding will require the preparation of surface water management plans.

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. Residential properties affected by river flooding experience the highest economic impact at approximately 35% of the damages.

Within this Potentially Vulnerable Area it is estimated that climate change will increase the number of residential properties at risk of flooding from approximately 140 to 260 and the number of non-residential properties from approximately 80 to 150.

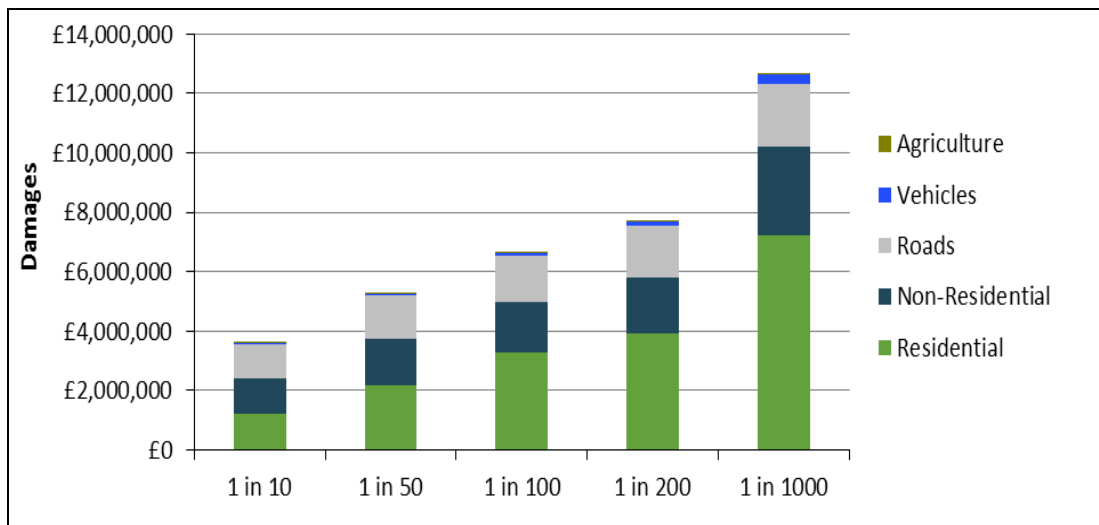
The location of the impacts of flooding is shown in Figure 3. Most of impacts are within Dunoon with flooding to people, non-residential properties, community facilities and utilities. The A815 floods both north and south of Dunoon.

### **History of flooding**

River flooding from the Milton Burn has been recorded in Dunoon on the 9 August 2004 and 28 October 1996. Also within Dunoon, Scottish Water have reported drainage issues.

	1 in 10	1 in 200	1 in 1000
	High likelihood	Medium likelihood	Low likelihood
Residential properties (total 5,800)	40	140	240
Non-residential properties (total 1,300)	40	80	140
People	90	300	530
Community facilities	<10 Includes: educational buildings, emergency services and healthcare facilities	<10 Includes: educational buildings, emergency services and healthcare facilities	<10 Includes: educational buildings, emergency services and healthcare facilities
Utilities assets	<10	10	20
Transport links - roads (km)	4.0	5.9	7.3
Environmental designated areas (km <sup>2</sup> )	0	0	0
Designated cultural heritage sites	4	5	6
Agricultural land (km <sup>2</sup> )	0.3	0.5	0.7

**Table 1:** Summary of flooding impacts<sup>1</sup>



**Figure 2:** Damages by flood likelihood

<sup>1</sup> Some receptors are counted more than once if flooded from multiple sources

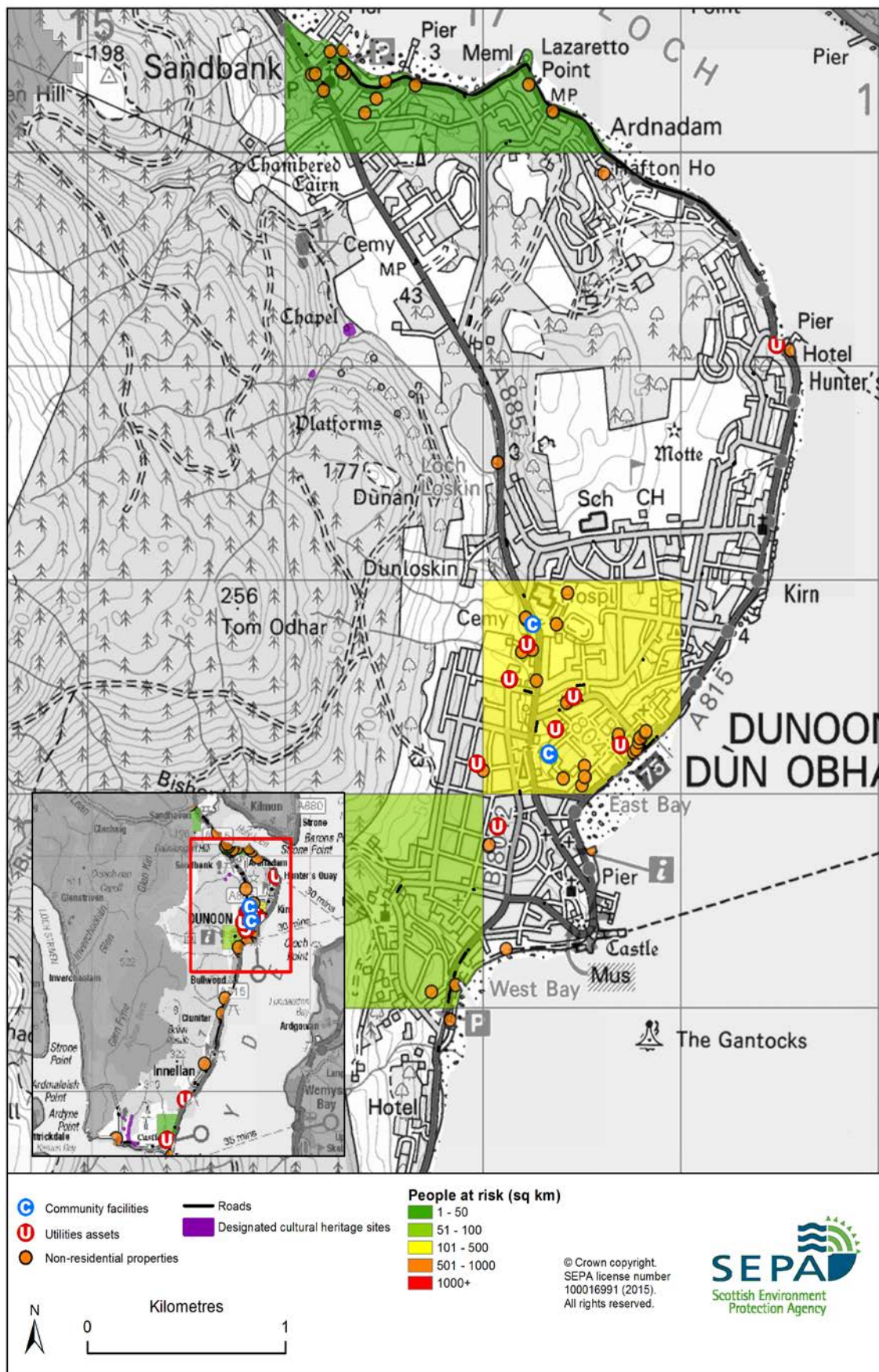


Figure 3: Impacts of flooding

## Objectives to manage flooding in Potentially Vulnerable Area 11/07

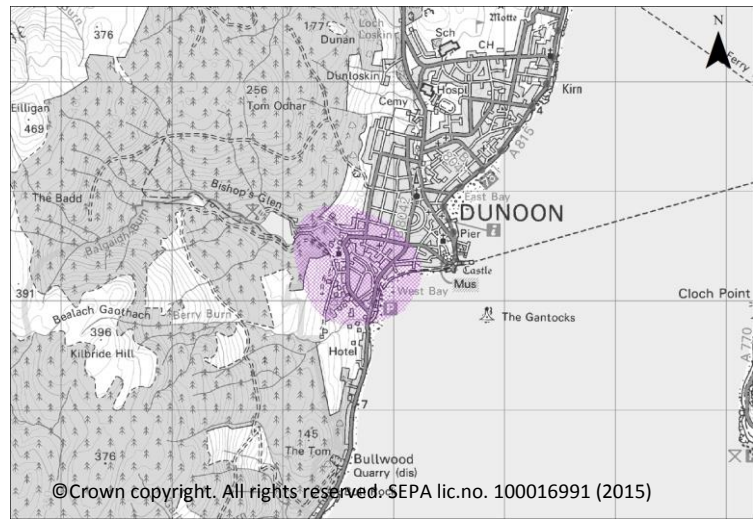
Objectives provide a common goal and shared ambition for managing floods. These objectives have been set by SEPA and agreed with flood risk management authorities following consultation. They were identified through an assessment of the underlying evidence of the causes and impacts of flooding. Target 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 Dunoon Potentially Vulnerable Area.

### Accept that current and future significant flood risks in the Kilbride Road and Crochan Road area are being managed appropriately

Indicators:

- 20 residential properties
- £35,000 Annual Average Damages

Target area:



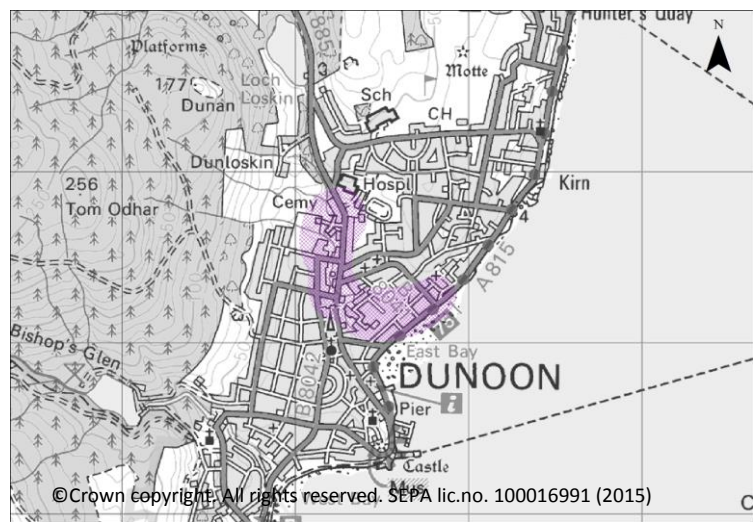
Objective ID: 11005

### Reduce the risk of Milton Burn flooding to residential properties in Dunoon

Indicators:

- 60 residential properties
- £130,000 Annual Average Damages

Target area:



Objective ID: 11006



Target area	Objective	ID	Indicators within PVA
Dunoon	Reduce the economic damages and risk to people from surface water flooding in Dunoon	11083	* See note below
Applies across Clyde and Loch Lomond Local Plan District	Avoid an overall increase in flood risk	11127	<ul style="list-style-type: none"> <li>• 140 residential properties</li> <li>• £480,000 Annual Average Damages</li> </ul>
Applies across Clyde and Loch Lomond Local Plan District	Reduce overall flood risk	11132	<ul style="list-style-type: none"> <li>• 140 residential properties</li> <li>• £480,000 Annual Average Damages</li> </ul>
Applies across Clyde and Loch Lomond 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 11/07 there are 40 residential properties at risk and Annual Average Damages of £74,000.

## Actions to manage flooding in Potentially Vulnerable Area 11/07

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 Dunoon Potentially Vulnerable Area.

Selected actions					
<i>Flood protection scheme/works</i>	<i>Natural flood management works</i>	<i>New flood warning</i>	<i>Community flood action groups</i>	<i>Property level protection scheme</i>	<i>Site protection plans</i>
Flood protection study	<i>Natural flood management study</i>	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

<b>Action (ID):</b>	<b>FLOOD PROTECTION STUDY (110060005)</b>		
<b>Objective (ID):</b>	Reduce the risk of Milton Burn flooding to residential properties in Dunoon (11006)		
<b>Delivery lead:</b>	Argyll and Bute Council		
<b>Priority:</b>	National:		Within local authority:
	<b>103 of 168</b>		<b>3 of 9</b>
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2022-2027</b>
<b>Description:</b>	<p>A study is recommended to further investigate the feasibility of increasing the level of protection in Dunoon, focusing on extending and enhancing the Milton Burn Flood Protection Scheme and property level protection for the residual risk. The study should also look at the potential for Natural Flood Management actions such as land management and runoff control near the town to reduce the impact flooding in the town.</p> <p>There is also a surface water management plan being developed for the area which will look at surface run off and mitigation measures. These two studies should complement each other to develop the most sustainable combination of actions.</p> <p>The flood protection study will therefore be progressed in cycle 2 in order that the assessment of options is informed by the outcome of the surface water management plan.</p>		
<b>Potential impacts</b>			
<b>Economic:</b>	<p>The flood protection study should consider how to reduce flooding to 30 residential properties and 20 non-residential properties. The potential damages avoided are estimated to be up to £3.3 million. The economic impact of natural flood management actions is difficult</p>		

<b>Economic:</b>	to define. However, these actions can reduce flood risk for high likelihood events. In this location, it has been estimated that 30 residential and non-residential properties could potentially benefit from natural flood management actions.
<b>Social:</b>	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 there are three community facilities, two educational buildings and two utilities which have been identified as potentially benefitting from this action. Natural flood management actions can restore and enhance natural environments and create opportunities for recreation and tourism. There may be negative impacts through disturbance to the local community during the construction phase and changes in visual amenity and land use as a result of this action; however, these would be localised impacts.
<b>Environmental:</b>	Flood protection studies should consider the positive and negative impacts of proposed actions on the ecological quality of the environment. Natural flood management actions can have a positive impact by restoring and enhancing natural habitats. There are no international or national level environmental designations that are likely to be directly impacted by this action. There is likely to be a loss of semi-natural habitat in the footprint and vicinity of the defences.

<b>Action (ID):</b>	<b>SURFACE WATER PLAN/STUDY (110830018)</b>		
<b>Objective (ID):</b>	Reduce the economic damages and risk to people from surface water flooding in Dunoon (11083)		
<b>Delivery lead:</b>	Argyll and Bute Council		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>STRATEGIC MAPPING AND MODELLING (111320019)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Scottish Water		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>MAINTAIN FLOOD PROTECTION SCHEME (110050017)</b>		
<b>Objective (ID):</b>	Accept that current and future significant flood risks in the Kilbride Road and Crochan Road area are being managed appropriately (11005)		
<b>Delivery lead:</b>	Argyll and Bute Council		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	Continue to maintain the existing defences in Dunoon.		

<b>Action (ID):</b>	<b>MAINTAIN FLOOD PROTECTION SCHEME (110060017)</b>		
<b>Objective (ID):</b>	Reduce the risk of Milton Burn flooding to residential properties in Dunoon (11006)		
<b>Delivery lead:</b>	Argyll and Bute Council		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	The Milton Burn Flood Protection Scheme was completed in 2012 which consists of a 1.4m bypass pipe, flood wall improvements and the raising of a pedestrian bridge. This scheme reduces the impact of flooding in Dunoon and provides a standard of protection to a 1 in 100 year flood plus climate change in the St Mun's area. These defences will be maintained, and will continue to manage flooding according to the design standard at the time of construction. Unless actions are put in place to enhance the standard of protection, levels of flood risk are likely to increase over time as a consequence of climate change.		

<b>Action (ID):</b>	<b>MAINTAIN FLOOD WARNING (111320030)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	SEPA		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	Continue to maintain the Dunoon Pier and Hunter's Grove flood warning areas which are part of the Firth of Clyde coastal flood warning scheme.		

<b>Action (ID):</b>	<b>FLOOD FORECASTING (111320009)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	SEPA		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>SELF HELP (111320011)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	—		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>AWARENESS RAISING (111320013)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Responsible authorities		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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 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.		

<b>Action (ID):</b>	<b>MAINTENANCE (111320007)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Argyll & Bute Council, asset / land managers		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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.		

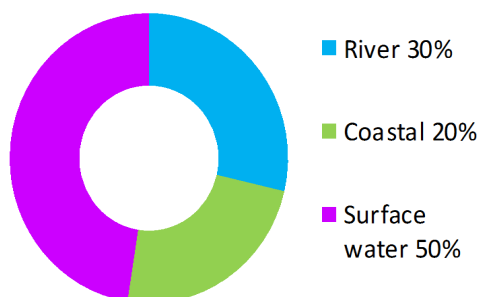
<b>Action (ID):</b>	<b>EMERGENCY PLANS/RESPONSE (111320014)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Category 1 and 2 Responders		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	Providing an emergency response to flooding 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.		

<b>Action (ID):</b>	<b>PLANNING POLICIES (111270001)</b>		
<b>Objective (ID):</b>	Avoid an overall increase in flood risk (11127) Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Planning authority		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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.		

# Greenock to Gourock (Potentially Vulnerable Area 11/08)

Local Plan District	Local authority	Main catchment
Clyde and Loch Lomond	Inverclyde Council	Inverclyde coastal

## Summary of flooding impacts



### At risk of flooding

- 820 residential properties
- 730 non-residential properties
- £1.5 million Annual Average Damages

(damages by flood source shown left)

Summary of flooding impacts

## 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.

Objectives

## 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

Actions

# Greenock to Gourock (Potentially Vulnerable Area 11/08)

Local Plan District	Local authority	Main catchment
Clyde and Loch Lomond	Inverclyde Council	Inverclyde coastal

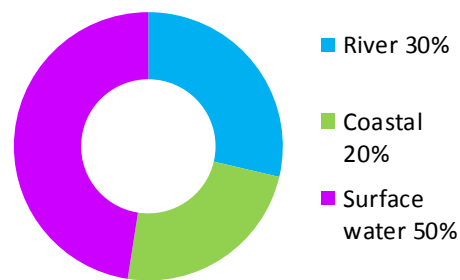
## Background

This Potentially Vulnerable Area is located in the north west of the Clyde and Loch Lomond Local Plan District and is approximately 40km<sup>2</sup> (shown below). The area covers the coastline of the Firth of Clyde from Port Glasgow to Ardgowan in the south west, and includes the settlements of Greenock, Gourock and Port Glasgow.



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

There are approximately 820 residential properties and 730 non-residential properties at risk of flooding. The Annual Average Damages are approximately £1.5 million.



**Figure 1: Annual Average Damages by flood source**

## Summary of flooding impacts

In this area surface water flooding is likely to interact with river flooding where existing watercourses have become extensively culverted. This flooding impacts properties and transport links. The highest risk of surface water flooding is within Greenock on the north side of the A78, between Greenock West railway station and the docklands. The areas at highest risk from surface water flooding will require the preparation of surface water management plans.

River flooding within the area is primarily from small burns including the Hole Burn and Carts Burn, which flow through Greenock and discharge to the Firth of Clyde. These watercourses are partially culverted through the urban area and there have recorded incidents of minor flooding, primarily resulting from exceedance of culvert capacity. In the catchment above Greenock reservoirs have been adapted to provide attenuation during high flows, and reduce flows through the town. There are a number of residential and non-residential properties affected by river flooding. The Greenock Cut aqueduct also flows through Greenock, taking water from Loch Thom to Greenock. This is controlled by a series of sluices along its length.



Coastal flooding is predicted in Port Glasgow, particularly in the area of Coronation Park. It is also likely to affect the dockland areas within Port Glasgow and areas within the vicinity of the West College Scotland Campus, Greenock. Within Gourock Bay, Battery Park is at risk and also properties along the Shore Road. Some agricultural land adjacent to Lunderston Bay, North of Inverkip, will also be affected by coastal flooding. Interaction between sources of river and coastal flooding is likely to occur in the docklands area and the West College Scotland campus area.

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. Non-residential properties affected by surface flooding experience the highest economic impact at approximately 25% of the damages.

Within this Potentially Vulnerable Area it is estimated that climate change will increase the number of residential properties at risk of flooding from approximately 820 to 1,400 and the number of non-residential properties from approximately 730 to 990.

The location of the impacts of flooding is shown in Figure 3. The areas with the greatest impacts are Greenock, Gourock and Port Glasgow with flooding to people, non-residential properties and utilities. Large sections of road and rail infrastructure are susceptible to flooding (notably the A8, A78, A770 and A771), mainly from coastal and surface water sources. There could be significant effects to transport routes where diversion routes are not possible, which includes links to ferry ports and railway infrastructure (notably Greenock West Station).

## History of flooding

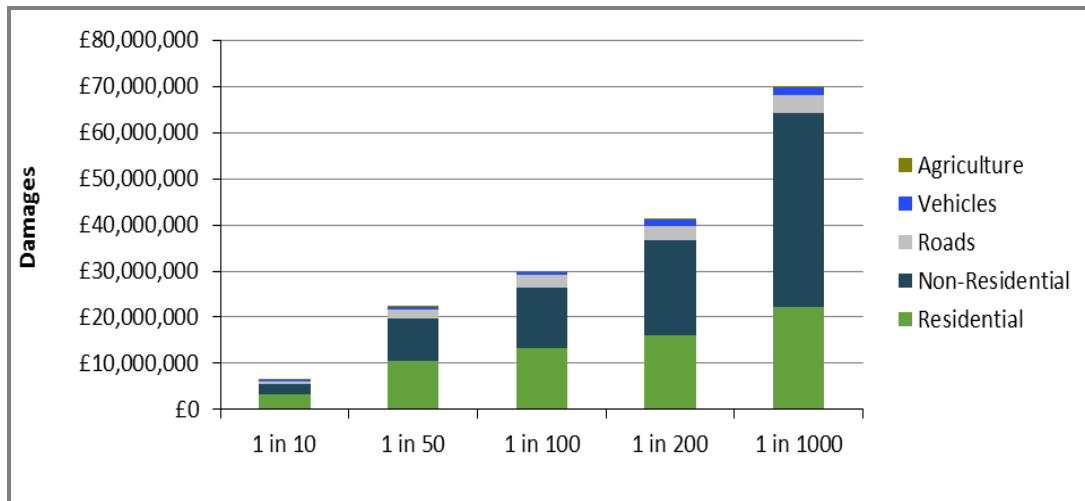
There have been several incidents of flooding reported within this area from the late 19<sup>th</sup> Century. River floods have caused the highest impact to properties and people. The most recent river flooding took place in 2013, flooding several streets in the town centre of Greenock, Oak Mill shopping centre and the A78.

Surface water floods have also occurred in the late 19<sup>th</sup> Century in Port Glasgow, Greenock and Gourock, flooding properties, shipyards, shops, roads and low-lying areas.

In January 2014 coastal floods affected the areas of Gourock, Greenock and Port Glasgow. Cove Road in Gourock was the worst affected. Tidal surges in 1930 and 1974 flooded access to ferry terminals, destroying parts of the port infrastructure, damaging boats and interrupting the ferry service.

	1 in 10 High likelihood	1 in 200 Medium likelihood	1 in 1000 Low likelihood
Residential properties (total 26,000)	150	820	1,100
Non-residential properties (total 5,500)	180	730	860
People	330	1,800	2,400
Community facilities	0	<10 Emergency services	<10 Includes: educational buildings, emergency services and healthcare facilities
Utilities assets	20	50	60
Transport links-road (km)	5.6 (of which 2.8 is A road)	17.2 (of which 8.7 is A road)	19.6 (of which 9.3 is A road)
Transport links-rail (km)	2.8	6.6	7.5
Environmental designated areas (km <sup>2</sup> )	0	0	0
Designated cultural heritage sites	6	8	12
Agricultural land (km <sup>2</sup> )	0.0	0.1	0.1

**Table 1:** Summary of flooding impacts<sup>1</sup>



**Figure 2:** Damages by flood likelihood

<sup>1</sup> Some receptors are counted more than once if flooded from multiple sources



## Objectives to manage flooding in Potentially Vulnerable Area 11/08

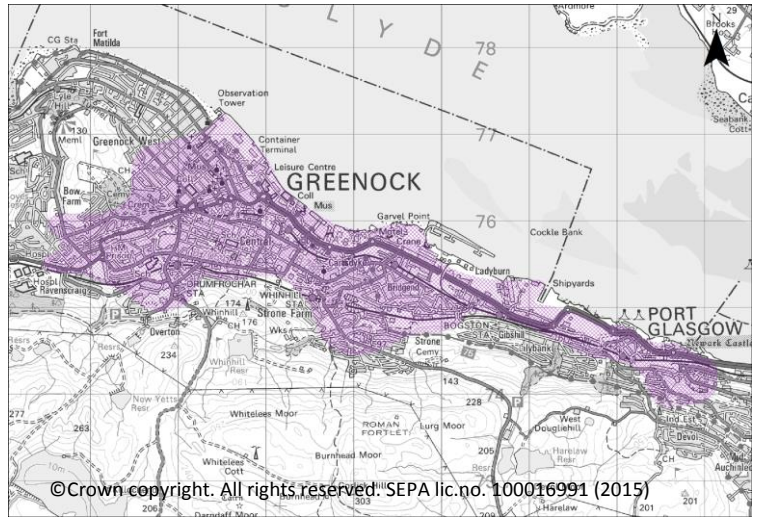
Objectives provide a common goal and shared ambition for managing floods. These objectives have been set by SEPA and agreed with flood risk management authorities following consultation. They were identified through an assessment of the underlying evidence of the causes and impacts of flooding. Target 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 Greenock to Gourock Potentially Vulnerable Area.

### Reduce the risk of river and surface water flooding to residential properties and non-residential properties in Greenock

Indicators:

- 530 residential properties
- 520 non-residential properties
- £930,000 Annual Average Damages

Target area:



Objective ID: 11028

Target area	Objective	ID	Indicators within PVA
Greenock	Reduce the economic damages and risk to people from surface water flooding in Greenock	11108	* See note below
Port Glasgow	Reduce the economic damages and risk to people from surface water flooding in Port Glasgow	11109	* See note below
Applies across Clyde and Loch Lomond Local Plan District	Avoid an overall increase in flood risk	11127	<ul style="list-style-type: none"> <li>• 820 residential properties</li> <li>• £1.5 million Annual Average Damages</li> </ul>
Applies across Clyde and Loch Lomond Local Plan District	Reduce overall flood risk	11132	<ul style="list-style-type: none"> <li>• 820 residential properties</li> <li>• £1.5 million Annual Average Damages</li> </ul>
Applies across Clyde and Loch Lomond 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 11/08 there are 330 residential properties at risk and Annual Average Damages of £720,000.

## Actions to manage flooding in Potentially Vulnerable Area 11/08

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 Greenock to Gourock Potentially Vulnerable Area.

Selected actions					
Flood protection scheme/works	<i>Natural flood management works</i>	<i>New flood warning</i>	<i>Community flood action groups</i>	Property level protection scheme	<i>Site protection plans</i>
<i>Flood protection study</i>	<i>Natural flood management study</i>	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

<b>Action (ID):</b>	<b>FLOOD PROTECTION SCHEME/WORKS (110280006)</b>				
<b>Objective (ID):</b>	Reduce the risk of river and surface water flooding to residential properties and non-residential properties in Greenock (11028)				
<b>Delivery lead:</b>	Inverclyde Council				
<b>Priority:</b>	National:		Within local authority:		
	<b>4 of 42</b>		<b>2 of 4</b>		
<b>Status:</b>	<b>Under development</b>	Indicative delivery:	<b>2016-2021</b>		
<b>Description:</b>	It is recommended that the council look to progress the flood protection scheme proposed for the Coves Burn. The work involves a number of conveyance modification actions including: upgrading of culverts, construction of a new connection chamber and tidal valve. The Controlled Activities Regulations licence has been granted for these works.				
<b>Potential impacts</b>					
<b>Economic:</b>	The scheme will reduce flooding to trunk roads and properties with a potential economic benefit of £3.7 million. The flood protection scheme has an estimated benefit cost ratio of 10.0.				
<b>Social:</b>	A reduction in flood risk would have a positive benefit to the health and wellbeing of the community. There may be negative impacts through disturbance to the local community during the construction phase.				
<b>Environmental:</b>	Flood protection schemes can have both positive and negative impacts on the ecological quality of the environment depending on how they are designed. There are no international, national or local level environmental designations that are likely to be impacted by this action. There is likely to be loss of habitat and displacement of species in the vicinity of the conveyance works; however, these may				

<b>Environmental:</b>	re-establish and return to the area. Downstream of this action there may be negative impacts on water quality through increased erosion and sedimentation.
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<b>Action (ID):</b>	<b>FLOOD PROTECTION SCHEME/WORKS (110280026)</b>		
<b>Objective (ID):</b>	Reduce the risk of river and surface water flooding to residential properties and non-residential properties in Greenock (11028)		
<b>Delivery lead:</b>	Inverclyde Council		
<b>Priority:</b>	National:	Within local authority:	
	<b>9 of 42</b>	<b>3 of 4</b>	
<b>Status:</b>	<b>Under development</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	Work should be progressed as per the Greenock Flood Protection Scheme. The work involves a number of conveyance modification actions, along the Bouverie Burn. The flood protection scheme has an estimated benefit cost ratio of 6.3.		
<b>Potential impacts</b>			
<b>Economic:</b>	The proposed flood protection scheme may benefit residential properties and transport routes in this location, damages avoided are estimated to be £2.8 million.		
<b>Social:</b>	A reduction in flood risk would have a positive benefit to the health and wellbeing of the community. There may be negative impacts through disturbance to the local community during the construction phase.		
<b>Environmental:</b>	Flood protection schemes can have both positive and negative impacts on the ecological quality of the environment depending on how they are designed. There are no international, national or local level environmental designations that are likely to be impacted by this action. There is likely to be loss of habitat and displacement of species in the vicinity of the conveyance works; however, these may re-establish and return to the area. Downstream of this action there may be negative impacts on water quality through increased erosion and sedimentation.		

<b>Action (ID):</b>	<b>SURFACE WATER PLAN/STUDY (111080018)</b>		
<b>Objective (ID):</b>	Reduce the economic damages and risk to people from surface water flooding in Greenock (11108)		
<b>Delivery lead:</b>	Inverclyde Council		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>SURFACE WATER PLAN/STUDY (111080019)</b>		
<b>Objective (ID):</b>	Reduce the economic damages and risk to people from surface water flooding in Greenock (11108)		
<b>Delivery lead:</b>	Scottish Water in partnership with Inverclyde Council		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>SURFACE WATER PLAN/STUDY (111090018)</b>		
<b>Objective (ID):</b>	Reduce the economic damages and risk to people from surface water flooding in Port Glasgow (11109)		
<b>Delivery lead:</b>	Inverclyde Council		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>SURFACE WATER PLAN/STUDY (111090019)</b>		
<b>Objective (ID):</b>	Reduce the economic damages and risk to people from surface water flooding in Port Glasgow (11109)		
<b>Delivery lead:</b>	Scottish Water in partnership with Inverclyde Council		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>STRATEGIC MAPPING AND MODELLING (111320019)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Scottish Water		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	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.		



<b>Action (ID):</b>	<b>MAINTAIN FLOOD PROTECTION SCHEME (110280017)</b>		
<b>Objective (ID):</b>	Reduce the risk of river and surface water flooding to residential properties and non-residential properties in Greenock (11028)		
<b>Delivery lead:</b>	Inverclyde Council		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	There are V-notches on spillways from 5 reservoirs upstream of Greenock which act as automatic attenuation. They restrict the discharge from the reservoirs and reduce peak flows in watercourses downstream during periods of heavy rain. These defences will be maintained, and will continue to manage flooding according to the design standard at the time of construction. Levels of flood risk are likely to increase over time as a consequence of climate change.		

<b>Action (ID):</b>	<b>MAINTAIN FLOOD WARNING (111320030)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	SEPA		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	Continue to maintain the Gourock Cove Road and the Greenock and Port Glasgow flood warning areas which are part of the Firth of Clyde coastal flood warning scheme.		

<b>Action (ID):</b>	<b>FLOOD FORECASTING (111320009)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	SEPA		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>SELF HELP (111320011)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	—		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>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.</p> <p>Inverclyde Council have purchased flood protection products for use throughout Inverclyde.</p>		

<b>Action (ID):</b>	<b>AWARENESS RAISING (111320013)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Responsible authorities		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>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.</p> <p>From 2016 SEPA will work towards raising awareness of flood risk through partnership activities with Transport Scotland.</p> <p>Local authorities will be undertaking additional awareness raising activities. Further details will be set out in the Local FRM Plan.</p>		

<b>Action (ID):</b>	<b>MAINTENANCE (111320007)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Inverclyde Council, asset / land managers		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>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.</p>		

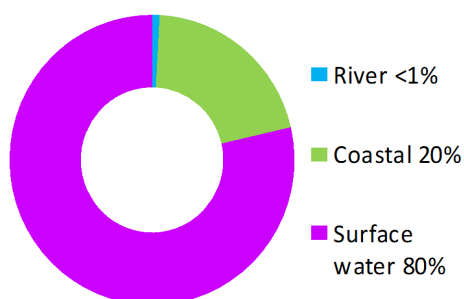
<b>Action (ID):</b>	<b>EMERGENCY PLANS/RESPONSE (111320014)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Category 1 and 2 Responders		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>Providing an emergency response to 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.</p>		

<b>Action (ID):</b>	<b>PLANNING POLICIES (111270001)</b>		
<b>Objective (ID):</b>	Avoid an overall increase in flood risk (11127) Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Planning authority		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>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.</p>		

## Clyde south - Port Glasgow to Inchinnan (Potentially Vulnerable Area 11/09)

Local Plan District	Local authority	Main catchment
Clyde and Loch Lomond	Inverclyde Council, Renfrewshire Council	Firth of Clyde – Renfrew to Port Glasgow

### Summary of flooding impacts



#### At risk of flooding

- 190 residential properties
- 60 non-residential properties
- £310,000 Annual Average Damages

(damages by flood source shown left)

Summary of flooding impacts

### 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.

Objectives

### 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

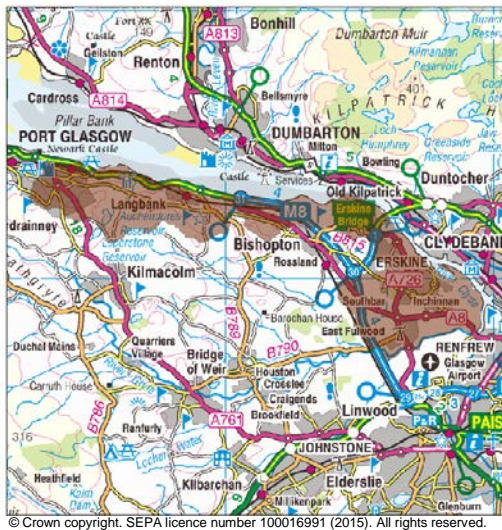
Actions

# Clyde south – Port Glasgow to Inchinnan (Potentially Vulnerable Area 11/09)

Local Plan District	Local authority	Main catchment
Clyde and Loch Lomond	Inverclyde Council, Renfrewshire Council	Firth of Clyde – Renfrew to Port Glasgow

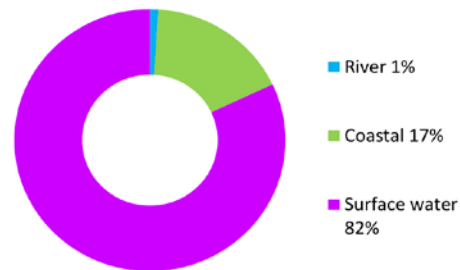
## Background

This Potentially Vulnerable Area is located to the west of Glasgow City, at the mouth of the River Clyde, spanning from Port Glasgow in the west to Erskine and Inchinnan in the east, with the southern border along the Black Cart Water (shown below). This area is approximately 40km<sup>2</sup>.



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

There are approximately 190 residential properties and 60 non-residential properties at risk of flooding. The Annual Average Damages are approximately £310,000.



**Figure 1: Annual Average Damages by flood source**

## Summary of flooding impacts

The greatest risk of flooding in the area is attributed to surface water with the majority of these impacts in Erskine. This flooding is shown to impact residential and non-residential properties along with community facilities and utilities. The areas at highest risk from surface water flooding will require the preparation of surface water management plans.

The northern boundary of this area fronts onto the estuary of the River Clyde. The main impacts of coastal flooding are to transport routes, notably the M8 near the junction with the A8 and a short section of the A8 west of Langbank. In terms of urban areas, non-residential properties are deemed to be at risk in Erskine from the River Clyde estuary and also via tidal areas of the Black Cart Water.

River flooding is not extensive in this area and is primarily attributed to the Finlaystone Burn, to the west of Langbank, and the Black Cart Water, to the south of Erskine. River flooding of the Finlaystone Burn is predicted to affect areas of agricultural land and forestry. The Black Cart Water essentially forms the southern

boundary of the area with a relatively large floodplain affecting roads along its northern bank.

Interaction between coastal and river flooding is a potential issue within the lower reaches of the Black Cart Water, as it is tidally influenced downstream of the M8 in the vicinity of Glasgow Airport. There is also an interaction between tidal and surface water flooding in the vicinity of Langbank, where elevated tidal levels reduce the functionality of the drainage network.

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. Residential properties affected by surface flooding experience the highest economic impact at approximately 60% of the damages. Non-residential properties and road infrastructure also provide a notable portion of the potential damages.

Within this Potentially Vulnerable Area it is estimated that climate change will increase the number of residential properties at risk of flooding from approximately 190 to 250 and the number of non-residential properties from approximately 60 to 80.

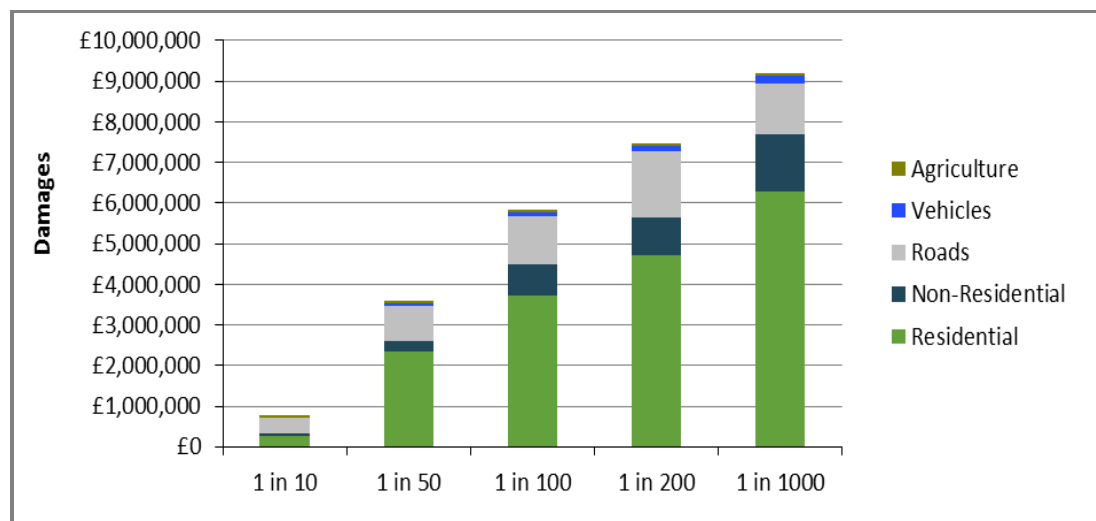
The location of the impacts of flooding is shown in Figure 3. The impacts are centred around Erskine and Port Glasgow with people, non-residential properties, utilities and the A726 at Erskine affected.

## **History of flooding**

Surface water flooding occurred between November and December 2006 when flooding affected the A8 carriageway near Inchinnan. This was due to a combination of high tides, blocked road gullies and the culvert capacity being exceeded. During the same period there was also flooding from a combination of sources in the Erskine area.

	1 in 10	1 in 200	1 in 1000
	High likelihood	Medium likelihood	Low likelihood
Residential properties (total 6,900)	20	190	250
Non-residential properties (total 9,100)	20	60	80
People	40	420	550
Community facilities	<10 Educational buildings	<10 Includes: educational buildings and healthcare facilities	<10 Includes: educational buildings and healthcare facilities
Utilities assets	10	20	20
Transport links - roads (km)	1.7 (of which 0.2 is motorway and 1.9 is A road)	4.4 (of which 1.5 is motorway and 4.1 is A road )	5.2 (of which 2.2 is motorway and 4.6 is A road )
Transport links - rail (km)	0.4	1.2	1.6
Environmental designated areas (km <sup>2</sup> )	2.2	2.4	2.5
Designated cultural heritage sites	10	11	11
Agricultural land (km <sup>2</sup> )	2.4	3.1	3.4

**Table 1:** Summary of flooding impacts<sup>1</sup>



**Figure 2:** Damages by flood likelihood

<sup>1</sup> Some receptors are counted more than once if flooded from multiple sources

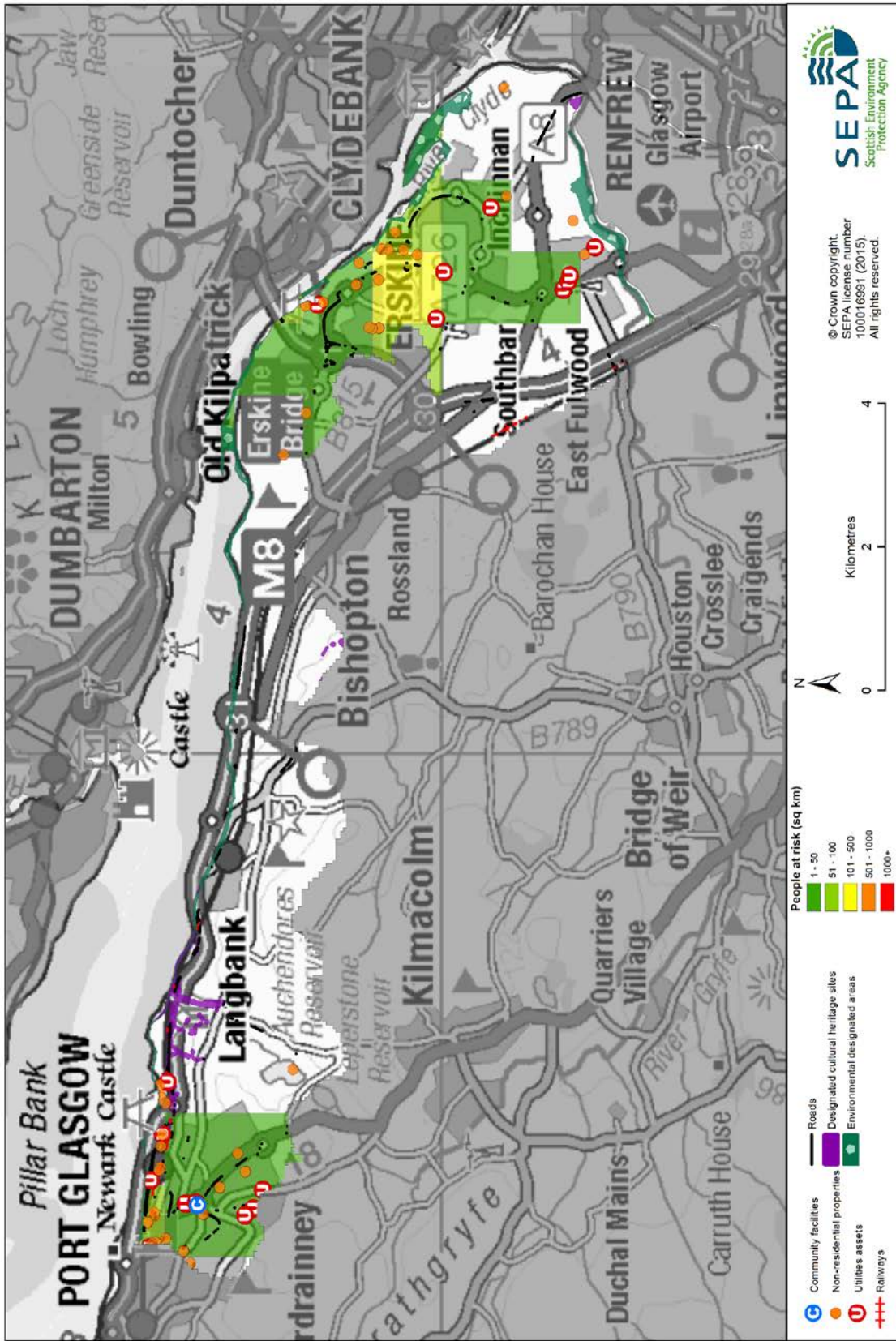


Figure 3: Impact of flooding



## Objectives to manage flooding in Potentially Vulnerable Area 11/09

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 Clyde south - Port Glasgow to Inchinnan Potentially Vulnerable Area.

Target area	Objective	ID	Indicators within PVA
Langbank	Reduce the physical or disruption risk related to the transport network for rail.	11302	<ul style="list-style-type: none"> <li>• 0.3km of rail track at 2 locations</li> </ul>
Port Glasgow	Reduce the economic damages and risk to people from surface water flooding in Port Glasgow	11109	* See note below
Inchinnan	Reduce the economic damages and risk to people from surface water flooding in Inchinnan	11115	* See note below
Applies across Clyde and Loch Lomond Local Plan District	Avoid an overall increase in flood risk	11127	<ul style="list-style-type: none"> <li>• 190 residential properties</li> <li>• £310,000 Annual Average Damages</li> </ul>
Applies across Clyde and Loch Lomond Local Plan District	Reduce overall flood risk	11132	<ul style="list-style-type: none"> <li>• 190 residential properties</li> <li>• £310,000 Annual Average Damages</li> </ul>
Applies across Clyde and Loch Lomond 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 11/09 there are 190 residential properties at risk and Annual Average Damages of £260,000.

## Actions to manage flooding in Potentially Vulnerable Area 11/09

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 Clyde south - Port Glasgow to Inchinnan 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

<b>Action (ID):</b>	<b>FLOOD PROTECTION SCHEME/WORKS (11302021)</b>		
<b>Objective (ID):</b>	Reduce the physical or disruption risk related to the transport network for rail. (11302)		
<b>Delivery lead:</b>	Network Rail		
<b>Status:</b>	<b>Under development</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	Network Rail will carry out civil engineering work which will reduce flood risk to identified sections of the rail network within this Potentially Vulnerable Area.		

<b>Action (ID):</b>	<b>SURFACE WATER PLAN/STUDY (111091018)</b>		
<b>Objective (ID):</b>	Reduce the economic damages and risk to people from surface water flooding in Port Glasgow (11109)		
<b>Delivery lead:</b>	Inverclyde Council		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>SURFACE WATER PLAN/STUDY (111091019)</b>		
<b>Objective (ID):</b>	Reduce the economic damages and risk to people from surface water flooding in Port Glasgow (11109)		
<b>Delivery lead:</b>	Scottish Water in partnership with Inverclyde Council		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>SURFACE WATER PLAN/STUDY (111150018)</b>		
<b>Objective (ID):</b>	Reduce the economic damages and risk to people from surface water flooding in Inchinnan (11115)		
<b>Delivery lead:</b>	Renfrewshire Council		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2022-2027</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>SURFACE WATER PLAN/STUDY (111150019)</b>		
<b>Objective (ID):</b>	Reduce the economic damages and risk to people from surface water flooding in Inchinnan (11115)		
<b>Delivery lead:</b>	Scottish Water in partnership with Renfrewshire Council		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>STRATEGIC MAPPING AND MODELLING (111320019)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Scottish Water		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>FLOOD FORECASTING (111320009)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	SEPA		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>SELF HELP (111320011)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	—		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>AWARENESS RAISING (111320013)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Responsible authorities		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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 work towards raising awareness of flood risk through partnership activities with Transport Scotland and local infrastructure operators. Local authorities will be undertaking additional awareness raising activities. Further details will be set out in the Local FRM Plan.		

<b>Action (ID):</b>	<b>MAINTENANCE (111320007)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Inverclyde Council and Renfrewshire Council, asset / land managers		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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.		

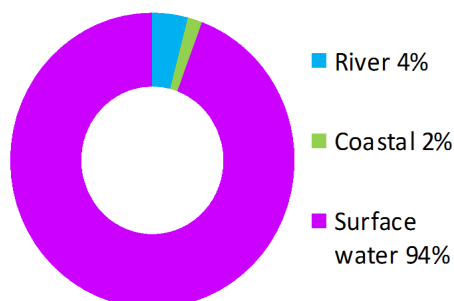
<b>Action (ID):</b>	<b>EMERGENCY PLANS/RESPONSE (111320014)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Category 1 and 2 Responders		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	Providing an emergency response to flooding 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.		

<b>Action (ID):</b>	<b>PLANNING POLICIES (111270001)</b>		
<b>Objective (ID):</b>	Avoid an overall increase in flood risk (11127) Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Planning authority		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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.		

## Bishopton (Potentially Vulnerable Area 11/10)

Local Plan District	Local authority	Main catchment
Clyde and Loch Lomond	Renfrewshire Council	River Gryfe

### Summary of flooding impacts



### At risk of flooding

- 30 residential properties
- <10 non-residential properties
- £35,000 Annual Average Damages

(damages by flood source shown left)

Summary of flooding impacts

### 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.

Objectives

### Summary of actions to manage flooding

The actions below have been selected to manage flood risk.

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

Actions

## Bishopton (Potentially Vulnerable Area 11/10)

Local Plan District	Local authority	Main catchment
Clyde and Loch Lomond	Renfrewshire Council	River Gryfe

### Background

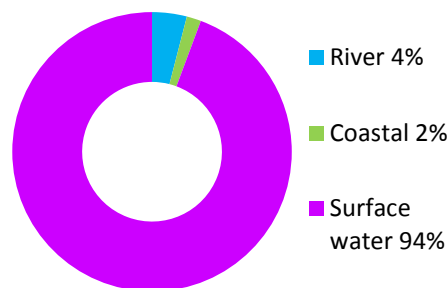
This Potentially Vulnerable Area is located to the west of Glasgow City and is approximately 20km<sup>2</sup> (shown below). The area is centred on Bishopton and incorporates a large amount of wooded areas which surround the site of the former Bishopton Royal Ordnance Factory.



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

There are approximately 30 residential properties at risk of flooding. The Annual Average Damages are approximately £35,000.



**Figure 1: Annual Average Damages by flood source**

### Summary of flooding impacts

Surface water flooding is the primary source of risk in the area. It occurs throughout the area, including the Craighend area of Erskine with impacts to sections of the transport network, notably railway lines, the M8, M989 and Greenock Road. There is historical evidence of surface water flooding on Greenock Road, with damage to the carriageway recorded. The areas at highest risk from surface water flooding will require the preparation of surface water management plans.

River flooding is primarily from the Craighton and Dargavel Burns. The floodplain along both these watercourses is almost entirely within the confines of an industrial site, which is located off Station Road. A detailed flood risk model of these two watercourses indicates that the risk of river flooding could potentially be greater than that indicated in the national modelling. Local measures are in place to reduce the risk of flooding from these watercourses. In the south east corner of the area the Dargavel Burn discharges to the River Gryfe, which in itself has a relatively large floodplain at this location, with some residential properties at risk of flooding.

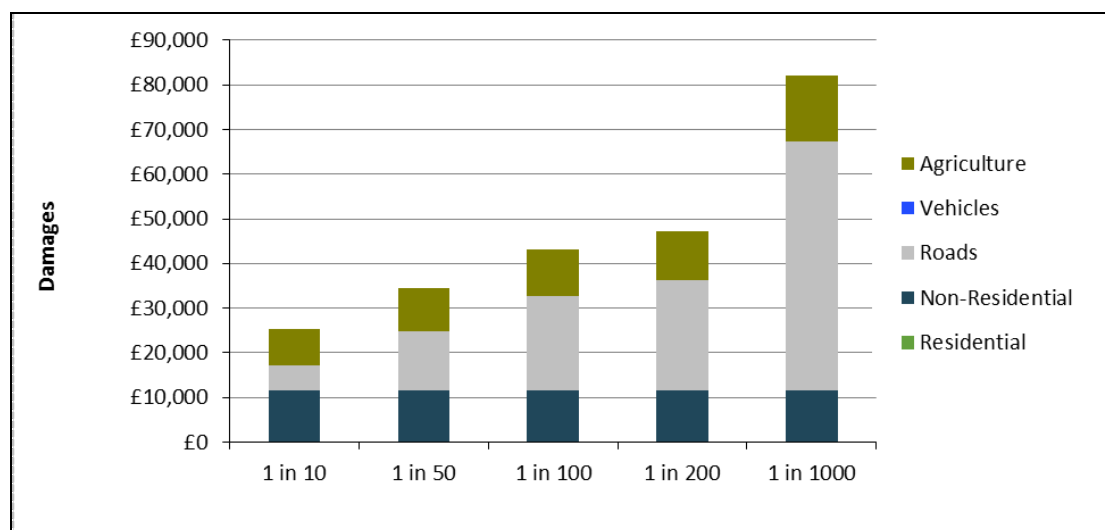
The risk of flooding to people and property, as well as to community facilities, utilities, the transport network, designated sites and agricultural land is summarised in Table 1. The damages associated with floods of different likelihood are shown in Figure 2.

Surface water damages may be under-represented in Figure 2 due to limitations in the available modelling output. The damages from surface water flooding to residential properties are likely to provide the greatest contribution to damages, not shown within the Figure 2.

The location of the impacts of flooding is shown in Figure 3. The greatest impacts are in Erskine.

	1 in 10 High likelihood	1 in 200 Medium likelihood	1 in 1000 Low likelihood
Residential properties (total 2,400)	20	30	30
Non-residential properties (total 120)	<10	<10	<10
People	40	60	60
Community facilities	0	0	0
Utilities assets	0	0	0
Transport links-roads (km)	0.7 (of which 0.1 is motorway)	1.0 (of which 0.1 is motorway)	1.3 (of which 0.2 is motorway)
Transport links-rail (km)	4.4	7.4	10.2
Environmental designated areas (km <sup>2</sup> )	0	0	0
Designated cultural heritage sites	2	2	2
Agricultural land (km <sup>2</sup> )	0.5	0.6	0.6

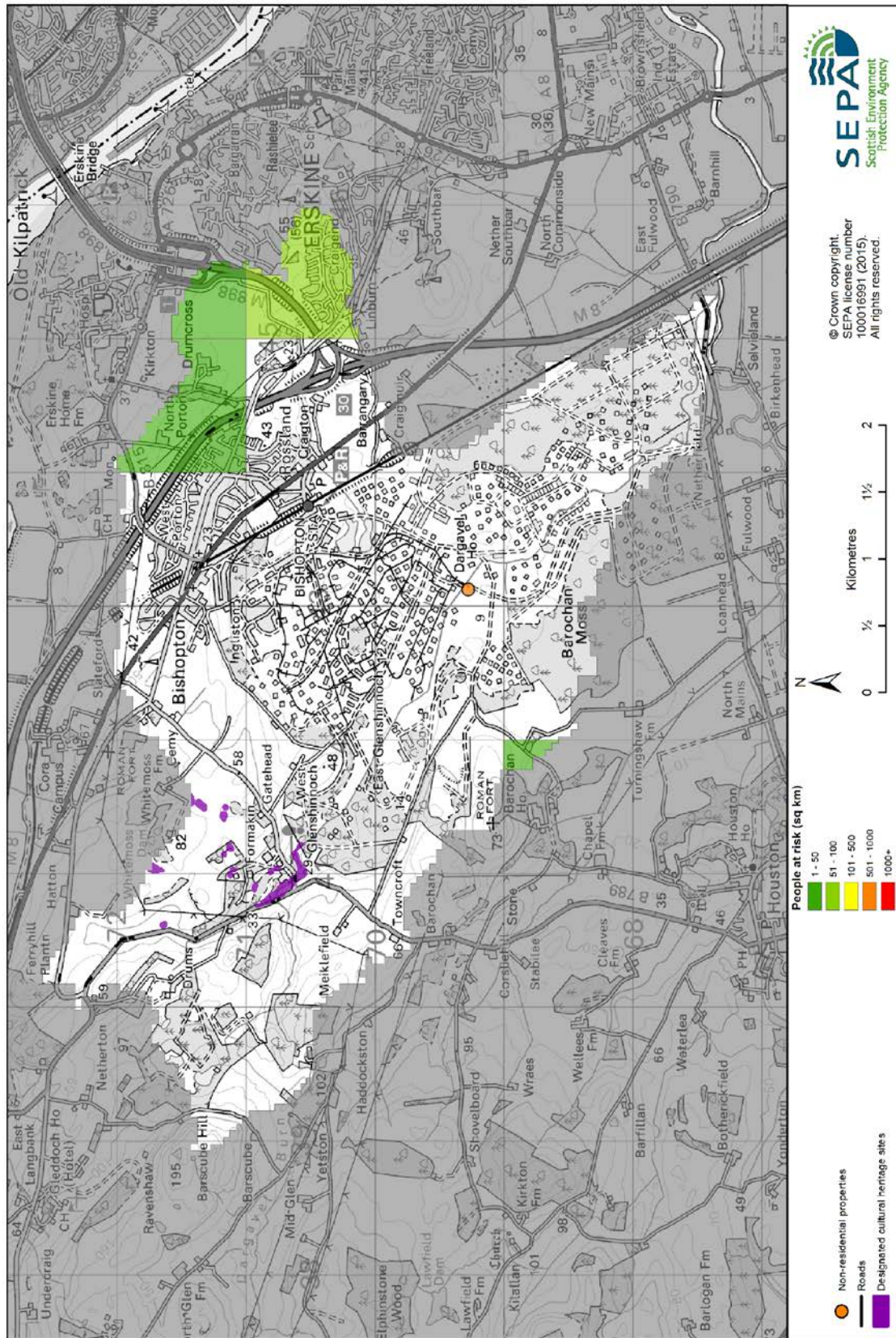
**Table 1:** Summary of flooding impacts<sup>1</sup>



**Figure 2:** Damages by flood likelihood

<sup>1</sup> Some receptors are counted more than once if flooded from multiple sources





**Figure 3: Impact of flooding**

## History of flooding

There have been several reported incidents of flooding within the Potentially Vulnerable Area. Surface water flooding has been the main source of flooding in the Rossland area with records dating back to 1991. Surface water flooding in 2006 and 2008, caused sewerage problems and flooded the A8 carriageway. Outside of the Rossland area there is a relatively low incidence of flooding.

## Objectives to manage flooding in Potentially Vulnerable Area 11/10

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 Bishopton Potentially Vulnerable Area.

Target area	Objective	ID	Indicators within PVA
Erskine	Reduce the economic damages and risk to people from surface water flooding in Erskine	11114	* See note below
Applies across Clyde and Loch Lomond Local Plan District	Avoid an overall increase in flood risk	11127	<ul style="list-style-type: none"> <li>• 30 residential properties</li> <li>• £35,000 Annual Average Damages</li> </ul>
Applies across Clyde and Loch Lomond Local Plan District	Reduce overall flood risk	11132	<ul style="list-style-type: none"> <li>• 30 residential properties</li> <li>• £35,000 Annual Average Damages</li> </ul>
Applies across Clyde and Loch Lomond 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 11/10 there are 30 residential properties at risk and Annual Average Damages of £32,000.

## Actions to manage flooding in Potentially Vulnerable Area 11/10

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 Bishopton Potentially Vulnerable Area.

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

<b>Action (ID):</b>	<b>SURFACE WATER PLAN/STUDY (111141018)</b>		
<b>Objective (ID):</b>	Reduce the economic damages and risk to people from surface water flooding in Erskine (11114)		
<b>Delivery lead:</b>	Renfrewshire Council		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2022-2027</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>SURFACE WATER PLAN/STUDY (111141019)</b>		
<b>Objective (ID):</b>	Reduce the economic damages and risk to people from surface water flooding in Erskine (11114)		
<b>Delivery lead:</b>	Scottish Water in partnership with Renfrewshire Council		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>STRATEGIC MAPPING AND MODELLING (111320019)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Scottish Water		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>FLOOD FORECASTING (111320009)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	SEPA		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>SELF HELP (111320011)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	—		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>AWARENESS RAISING (111320013)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Responsible authorities		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>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.</p> <p>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.</p>		

<b>Action (ID):</b>	<b>MAINTENANCE (111320007)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Renfrewshire Council, asset / land managers		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>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.</p>		

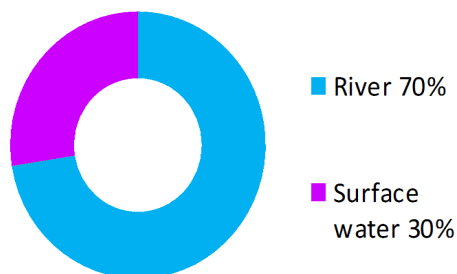
<b>Action (ID):</b>	<b>EMERGENCY PLANS/RESPONSE (111320014)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Category 1 and 2 Responders		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>Providing an emergency response to 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.</p>		

<b>Action (ID):</b>	<b>PLANNING POLICIES (111270001)</b>		
<b>Objective (ID):</b>	Avoid an overall increase in flood risk (11127) Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Planning authority		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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.		

## Gryfe catchment - Bridge of Weir to Houston (Potentially Vulnerable Area 11/11)

Local Plan District	Local authority	Main catchment
Clyde and Loch Lomond	Inverclyde Council, Renfrewshire Council	River Gryfe

### Summary of flooding impacts



#### At risk of flooding

- 190 residential properties
- 20 non-residential properties
- £430,000 Annual Average Damages

(damages by flood source shown left)

Summary of flooding impacts

### 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.

Objectives

### 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

Actions



## Gryfe catchment – Bridge of Weir to Houston (Potentially Vulnerable Area 11/11)

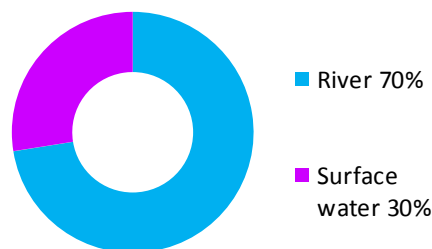
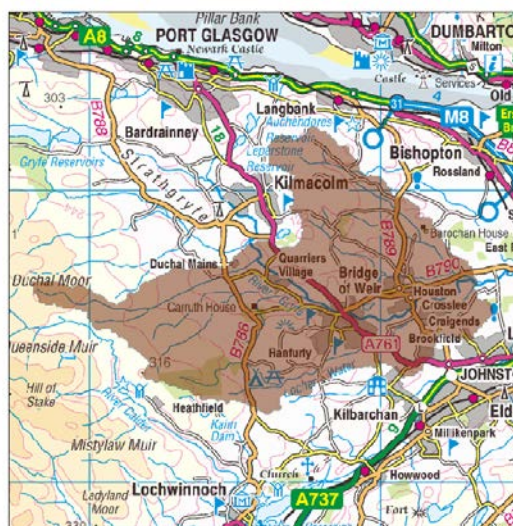
Local Plan District	Local authority	Main catchment
Clyde and Loch Lomond	Inverclyde Council, Renfrewshire Council	River Gryfe

### Background

The Potentially Vulnerable Area is located to the south west of Glasgow City, situated between Langbank in the north, Johnstone to the south and the River Calder (shown below). It is approximately 70km<sup>2</sup> and incorporates the villages of Houston, Bridge of Weir and Quarriers Village.

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

There are approximately 190 residential properties and 20 non-residential properties at risk of flooding. The Annual Average Damages are approximately £430,000.



**Figure 1:** Annual Average Damages by flood source

### Summary of flooding impacts

River flooding is primarily from the Gotter Water, Mill Burn, Lochar Water and the River Gryfe. In Quarriers Village there is a risk of flooding to properties associated with the Gotter Water. The main transport route at risk is the A761. Flooding from the River Gryfe is predicted to affect residential properties in Bridge of Weir, Crosslee and Craigends, where the channel is restricted by bridges at a number of locations. The river is also predicted to affect the B789 in Crosslee. Renfrewshire Council have an existing flood protection scheme on the River Gryfe at Crosslee Park, Crosslee.

Surface water flooding is likely to affect residential properties within the Bridge of Weir, Crosslee and Craigends, where there is an increase in the number of structures on the River Gryfe. The areas at highest risk from surface water flooding will require the preparation of surface water management plans.

Interaction between sources of river and surface water flooding is likely to occur on the Mill Burn in High and North Branchal and on the Gotter Water in Quarriers Village.

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. Non-residential properties affected by river flooding experience the highest economic impact at approximately 40% of the damages. Residential properties affected by surface water flooding also provide a similar contribution to economic damages.

Within this Potentially Vulnerable Area it is estimated that climate change will increase the number of residential properties at risk of flooding from approximately 190 to 270 and the number of non-residential properties from approximately 20 to 50.

The location of the impacts of flooding is shown in Figure 3. Most of the impacts are around Bridge of Weir, Crosslee, Houston and Quarriers Village, with flooding to people, non-residential properties and utilities and the A761 at Bridge of Weir.

## History of flooding

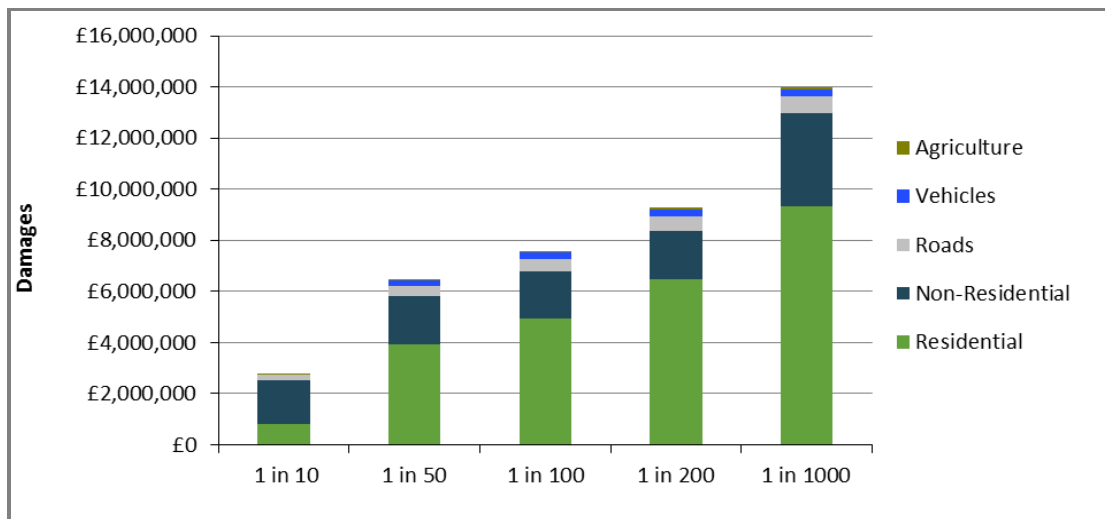
Properties and agricultural land in Houston, Craigends and Crosslee have suffered river flooding in the past between 1874 and 1887, and more recently in December 2006. The winter floods of 2006/7 recorded peak flows in the major watercourses, with the flow measured downstream of Crosslee on the River Gryfe on the 13 December 2006 suggesting a peak flow return period no greater than 1 in 50 years.

Between the 10-12 December 1994, major flooding occurred in rivers and urban watercourses across the Glasgow and its surrounding areas. A slow-moving weather system delivered persistent rain over a 48 hour period, across a wide geographical area. Previously recorded peak river flows were exceeded in all major catchments in the region. Renfrewshire was affected by this flood when surface water flows exceeded the capacity of the sewer and watercourses, resulting in substantive overland flow and inundation of property. This flooding was considerably greater than the 2006 flood. Serious flooding occurred at Brierie Hill, Crosslee and Sandholes Road, Brookfield.

Surface water flooding has been regularly reported in this Potentially Vulnerable Area, mainly impacting roads and properties in the Houston area. Residential properties in Crosslee were affected by surface water flooding in 1988, 1990, 1993, 2004 and 2006. The records are particularly concentrated on the A761 carriageway at Bridge of Weir, with more recent occurrences in November and December of 2006 and 2007.

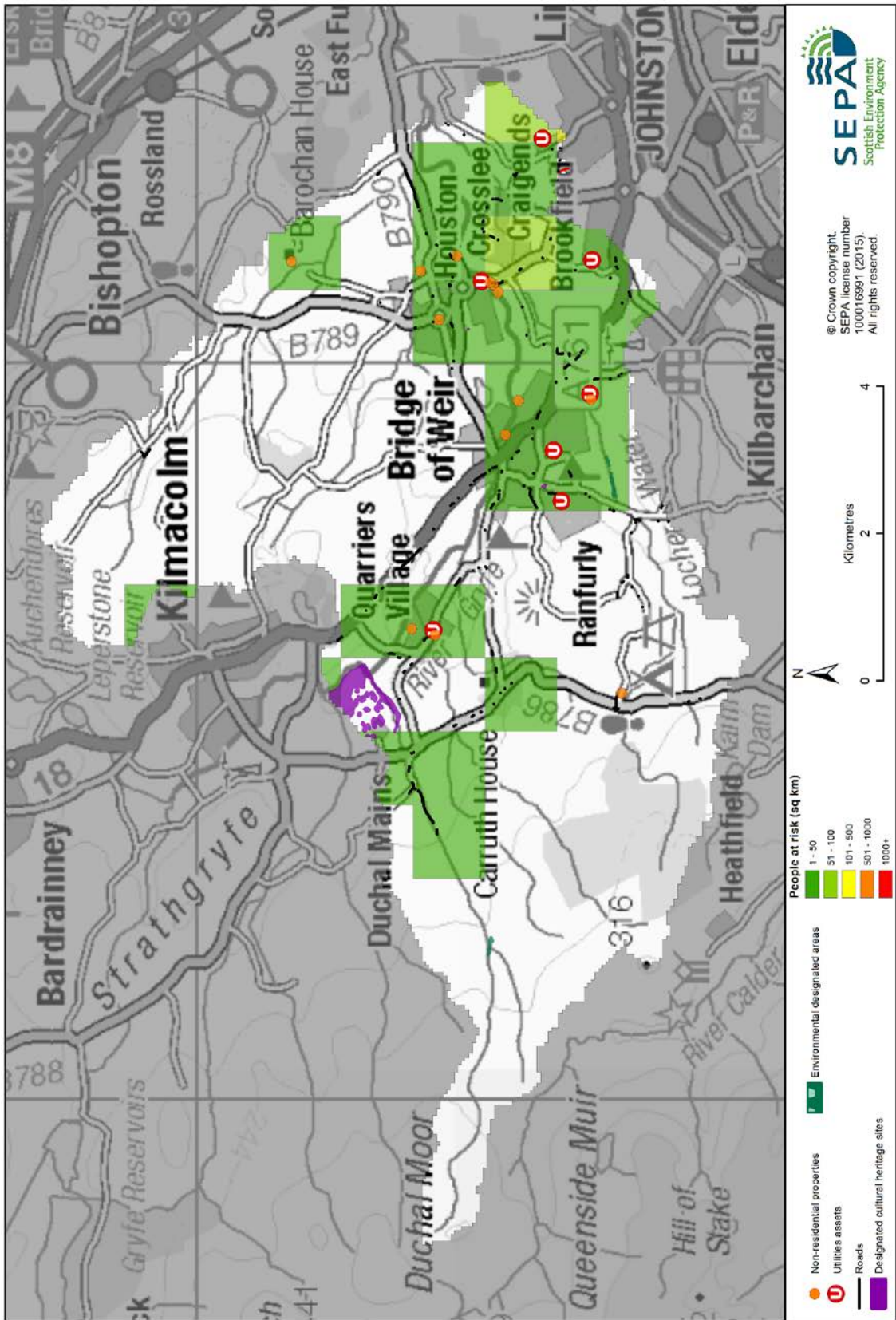
	1 in 10 High likelihood	1 in 200 Medium likelihood	1000 Low likelihood
Residential properties (total 5,600)	20	190	250
Non-residential properties (total 610)	20	20	50
People	50	410	540
Community facilities	0	0	0
Utilities assets	<10	<10	<10
Transport links-roads (km)	2.1	4.4	5.0
Environmental designated areas (km <sup>2</sup> )	<0.1	<0.1	<0.1
Designated cultural heritage sites	2	4	5
Agricultural land (km <sup>2</sup> )	2.0	2.4	2.7

**Table 1:** Summary of flooding impacts<sup>1</sup>



**Figure 2:** Damages by flood likelihood

<sup>1</sup> Some receptors are counted more than once if flooded from multiple sources



**Figure 3: Impacts of flooding**

## Objectives to manage flooding in Potentially Vulnerable Area 11/11

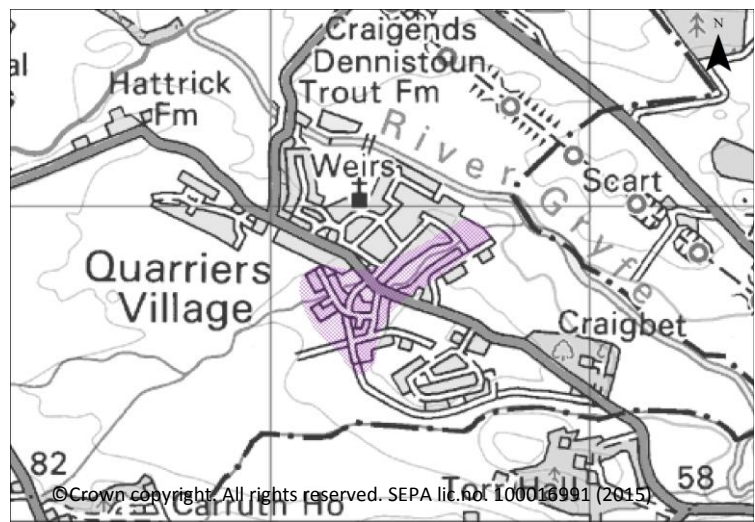
Objectives provide a common goal and shared ambition for managing floods. These objectives have been set by SEPA and agreed with flood risk management authorities following consultation. They were identified through an assessment of the underlying evidence of the causes and impacts of flooding. Target 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 Gryfe catchment - Bridge of Weir to Houston Potentially Vulnerable Area.

### Reduce the risk of flooding from the Gotter Water and River Gryfe to residential properties in Quarriers Village

Indicators:

Target area:

- 60 residential properties



Objective ID: 11033

Target area	Objective	ID	Indicators within PVA
Johnstone and Kilbarchan	Reduce the economic damages and risk to people from surface water flooding in Johnstone and Kilbarchan	11116	* See note below
Linwood	Reduce the economic damages and risk to people from surface water flooding in Linwood	11117	* See note below
Applies across Clyde and Loch Lomond Local Plan District	Avoid an overall increase in flood risk	11127	<ul style="list-style-type: none"> <li>• 190 residential properties</li> <li>• £430,000 Annual Average Damages</li> </ul>
Applies across Clyde and Loch Lomond Local Plan District	Reduce overall flood risk	11132	<ul style="list-style-type: none"> <li>• 190 residential properties</li> <li>• £430,000 Annual Average Damages</li> </ul>
Applies across Clyde and Loch Lomond 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 11/11 there are 120 residential properties at risk and Annual Average Damages of £110,000.

## Actions to manage flooding in Potentially Vulnerable Area 11/11

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 Gryfe catchment - Bridge of Weir to Houston 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

<b>Action (ID):</b>	<b>FLOOD PROTECTION SCHEME/WORKS (110330006)</b>				
<b>Objective (ID):</b>	Reduce the risk of flooding from the Gotter Water and River Gryfe to residential properties in Quarriers Village (11033)				
<b>Delivery lead:</b>	Inverclyde Council				
<b>Priority:</b>	National:		Within local authority:		
	<b>41 of 42</b>		<b>4 of 4</b>		
<b>Status:</b>	<b>Under development</b>	Indicative delivery:	<b>2016-2021</b>		
<b>Description:</b>	It is recommended that Inverclyde Council look to progress the flood protection scheme proposed for the Gotter Water in Quarrier's Village. Inverclyde Council have completed a study which investigated the creation of embankments on the south bank of the watercourse upstream of Quarrier's Village, with flood defence walls downstream of the embankments on both banks along the reach. The study should be progressed to develop a detailed design of the scheme. SEPA will review the output of the study for inclusion in the Flood Maps.				
<b>Potential impacts</b>					
<b>Economic:</b>	The proposed scheme may benefit 20 residential properties at risk of flooding in this location, damages avoided are estimated to be £270,000. The flood protection scheme has an estimated benefit cost ratio of 1.1.				
<b>Social:</b>	A reduction in flood risk would have a positive benefit to the health and wellbeing of the community. There may be negative impacts through disturbance to the local community during the construction phase and changes in visual amenity and land use as a result of this action.				

<b>Environmental:</b>	Flood protection schemes can have both positive and negative impacts on the ecological quality of the environment depending on how they are designed. There are no international, national or local level environmental designations that are likely to be impacted by this action. There is likely to be a loss of habitat and displacement of species in the vicinity of these works. There is the potential for creation of new wetland habitats. Downstream of these actions there may be negative impacts on water quality through increased erosion and sedimentation.
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<b>Action (ID):</b>	<b>NEW FLOOD WARNING (111320010)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	SEPA		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>post 2021</b>
<b>Description:</b>	The area under consideration includes properties affected by flooding from the River Gryfe. A review of the flood risk in this location is required to assess the potential for flood warning delivery and subsequent to that appropriate timescales for delivery.		

<b>Action (ID):</b>	<b>SURFACE WATER PLAN/STUDY (111160018)</b>		
<b>Objective (ID):</b>	Reduce the economic damages and risk to people from surface water flooding in Johnstone and Kilbarchan (11116)		
<b>Delivery lead:</b>	Renfrewshire Council		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>SURFACE WATER PLAN/STUDY (111170018)</b>		
<b>Objective (ID):</b>	Reduce the economic damages and risk to people from surface water flooding in Linwood (11117)		
<b>Delivery lead:</b>	Renfrewshire Council		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2022-2027</b>
<b>Description:</b>	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.		



<b>Action (ID):</b>	<b>SURFACE WATER PLAN/STUDY (111170019)</b>		
<b>Objective (ID):</b>	Reduce the economic damages and risk to people from surface water flooding in Linwood (11117)		
<b>Delivery lead:</b>	Scottish Water in partnership with Renfrewshire Council		
<b>Status:</b>	<b>Ongoing</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>STRATEGIC MAPPING AND MODELLING (111320019)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Scottish Water		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>FLOOD FORECASTING (111320009)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	SEPA		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>SELF HELP (111320011)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	—		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>AWARENESS RAISING (111320013)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Responsible authorities		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>MAINTENANCE (111320007)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Inverclyde Council and Renfrewshire Council, asset / land managers		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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.		

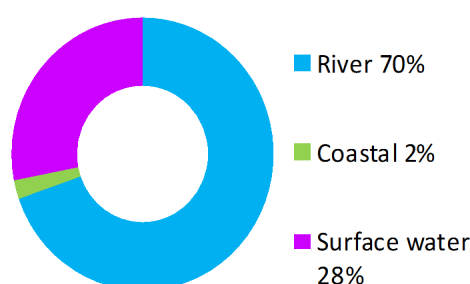
<b>Action (ID):</b>	<b>EMERGENCY PLANS/RESPONSE (111320014)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Category 1 and 2 Responders		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>Providing an emergency response to 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.</p>		

<b>Action (ID):</b>	<b>PLANNING POLICIES (111270001)</b>		
<b>Objective (ID):</b>	Avoid an overall increase in flood risk (11127) Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Planning authority		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>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.</p>		

## Black Cart Water catchment - Lochwinnoch to Johnstone (Potentially Vulnerable Area 11/12)

Local Plan District	Local authority	Main catchment
Clyde and Loch Lomond	East Renfrewshire Council, Inverclyde Council, North Ayrshire Council, Renfrewshire Council	Black Cart Water

### Summary of flooding impacts



#### At risk of flooding

- 1,300 residential properties
- 550 non-residential properties
- £2.6 million Annual Average Damages

(damages by flood source shown left)

Summary of flooding impacts

### 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.

Objectives

### Summary of actions to manage flooding

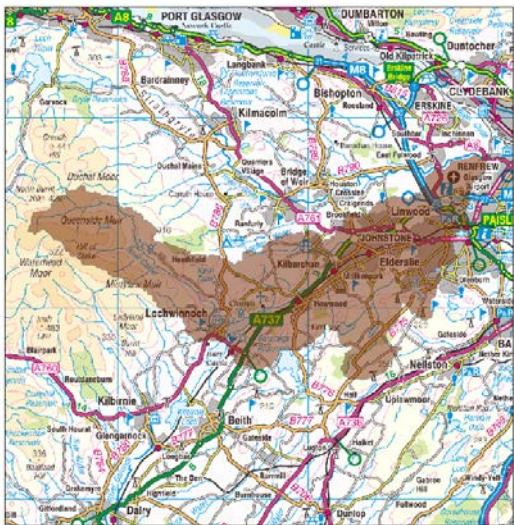
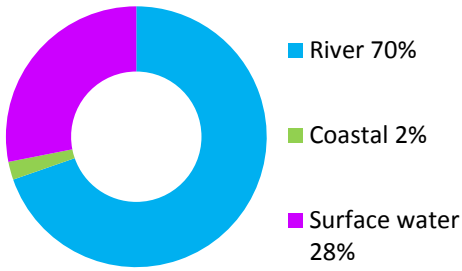
The actions below have been selected to manage flood risk.

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

Actions

# Black Cart Water catchment – Lochwinnoch to Johnstone (Potentially Vulnerable Area 11/12)

Local Plan District	Local authority	Main catchment
Clyde and Loch Lomond	East Renfrewshire Council, Inverclyde Council, North Ayrshire Council, Renfrewshire Council	Black Cart Water

Background	
<p>This Potential Vulnerable Area is located to the south west of Glasgow City incorporating the catchments of the Black Cart Water, River Calder and Old Patrick Water (shown below). The area spans between Glasgow Airport in the north east, the A737 as far as Barr Loch and Queenside Muir in the west, incorporating part of Paisley, Johnstone and several villages. It is approximately 120km<sup>2</sup>.</p>  <p><small>© Crown copyright. SEPA licence number 100016991 (2015). All rights reserved.</small></p>	<p>The area has a risk of river, surface water and coastal flooding. The majority of damages are caused by river flooding.</p> <p>There are approximately 1,300 residential properties and 550 non-residential properties at risk of flooding. The Annual Average Damages are approximately £2.6 million.</p>  <p><b>Figure 1: Annual Average Damages by flood source</b></p>

## Summary of flooding impacts

River flooding within the area is primarily from the Black Cart Water. Within Linwood it is predicted that river flooding will affect people and properties, with flooding predicted upstream from the confluences of the River Gryfe and Candren Burn with the Black Cart Water. Transport routes (notably railway lines, Glasgow Airport and the A737) are also likely to be impacted. Agricultural land in the north east of the area is at risk of flooding from the Black Cart Water.

Surface water flooding is shown to impact residential properties along with sections of the M8 and A726. Flooding is primarily in the urban areas of Johnstone and

Linwood, where there are a number of minor culverted tributaries of the Black Cart Water. These have historically contributed to flood risk within the area. The areas at highest risk from surface water flooding will require the preparation of surface water management plans.

Local studies have identified that this national assessment underestimates the level of risk in Johnstone. This is in part due the risk from small watercourses which have not been included in the national flood mapping. Interaction between sources of river and surface water flooding is predicted to occur within the urban areas of Johnstone and Linwood. Interaction between sources of river and coastal flooding is predicted to occur in the lower reaches of the Black Cart Water.

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. Residential properties affected by river flooding experience the highest economic impact at approximately 60% of the damages.

Within this Potentially Vulnerable Area it is estimated that climate change will increase the number of residential properties at risk of flooding from approximately 1,300 to 1,900 and the number of non-residential properties from approximately 550 to 750.

The location of the impacts of flooding is shown in Figure 3. The largest concentration of impacts is in Johnstone and Paisley with flooding to people, non-residential properties, utilities, roads and railways.

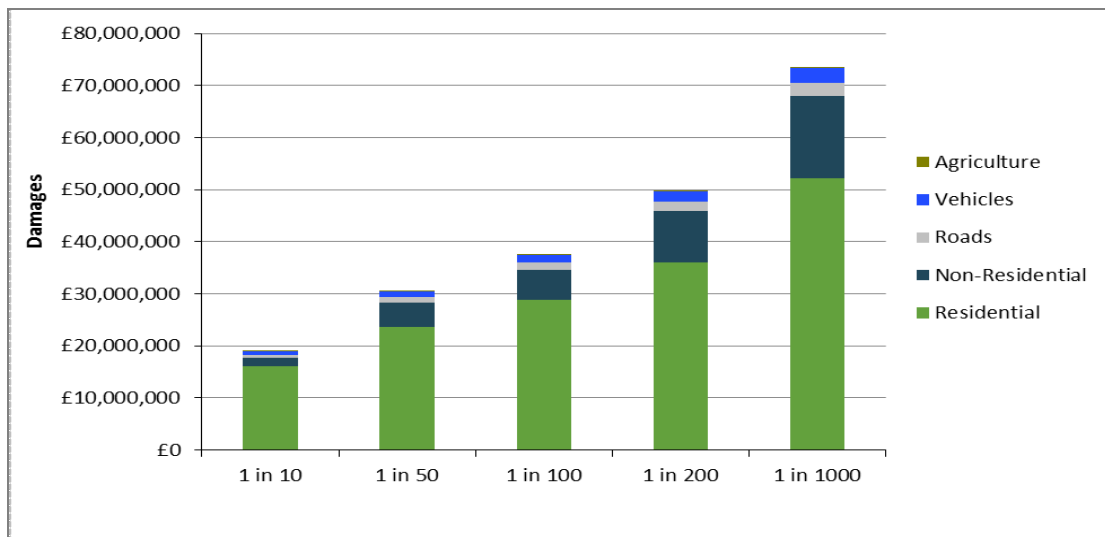
## **History of flooding**

The area has experienced a number of floods which have affected properties and transport routes. Major flooding occurred in rivers and urban watercourses between the 10 and 12 December 1994 when a slow moving weather system delivered persistent rain over a 48 hour period across a wide geographical area. Previously recorded peak river flows were exceeded in major catchments in the region. This event resulted in 180 residential properties in Ferguslie Park, Paisley, being flooded from a 1 in 60 year flow in the Candren Burn. The same event resulted in residential property and road inundation from an unnamed tributary to the Black Cart Water in the Kintyre Avenue area of Linwood.

Surface water flooding was reported in 1998 which affected properties at Low Barholm. River flooding was reported in 2004 resulting in road closures and flooding around properties. Further flooding occurred throughout the area in November and December 2006, with further flooding in January 2007. During this time the capacity of drainage systems in the area was exceeded by the high volumes of water. River and surface water flooding impacted transport and properties, with impacted areas including, Millikenspark, Johnstone centre and Elderslie.

	1 in 10 High likelihood	1 in 200 Medium likelihood	1 in 1000 Low likelihood
Residential properties (total 31,000)	540	1,300	1,900
Non-residential properties (total 7,100)	160	550	750
People	1,200	2,900	4,200
Community facilities	<10 Educational buildings	<10 Educational buildings	<10 Includes: educational buildings and emergency services
Utilities assets	20	60	70
Transport links-roads (km)	8.1 (of which 0.1 is motorway and 1.0 A road)	19.2 (of which 0.3 is motorway and 2.4 A road)	24.1 (of which 0.3 is motorway and 3.2 A road)
Transport links-rail (km)	4.4	6.8	7.5
Transport links-airports	1	1	1
Environmental designated areas (km <sup>2</sup> )	2.5	2.5	2.6
Designated cultural heritage sites	6	8	9
Agricultural land (km <sup>2</sup> )	3.6	5.5	6.5

**Table 1:** Summary of flooding impacts<sup>1</sup>



**Figure 2:** Damages by flood likelihood

<sup>1</sup> Some receptors are counted more than once if flooded from multiple sources

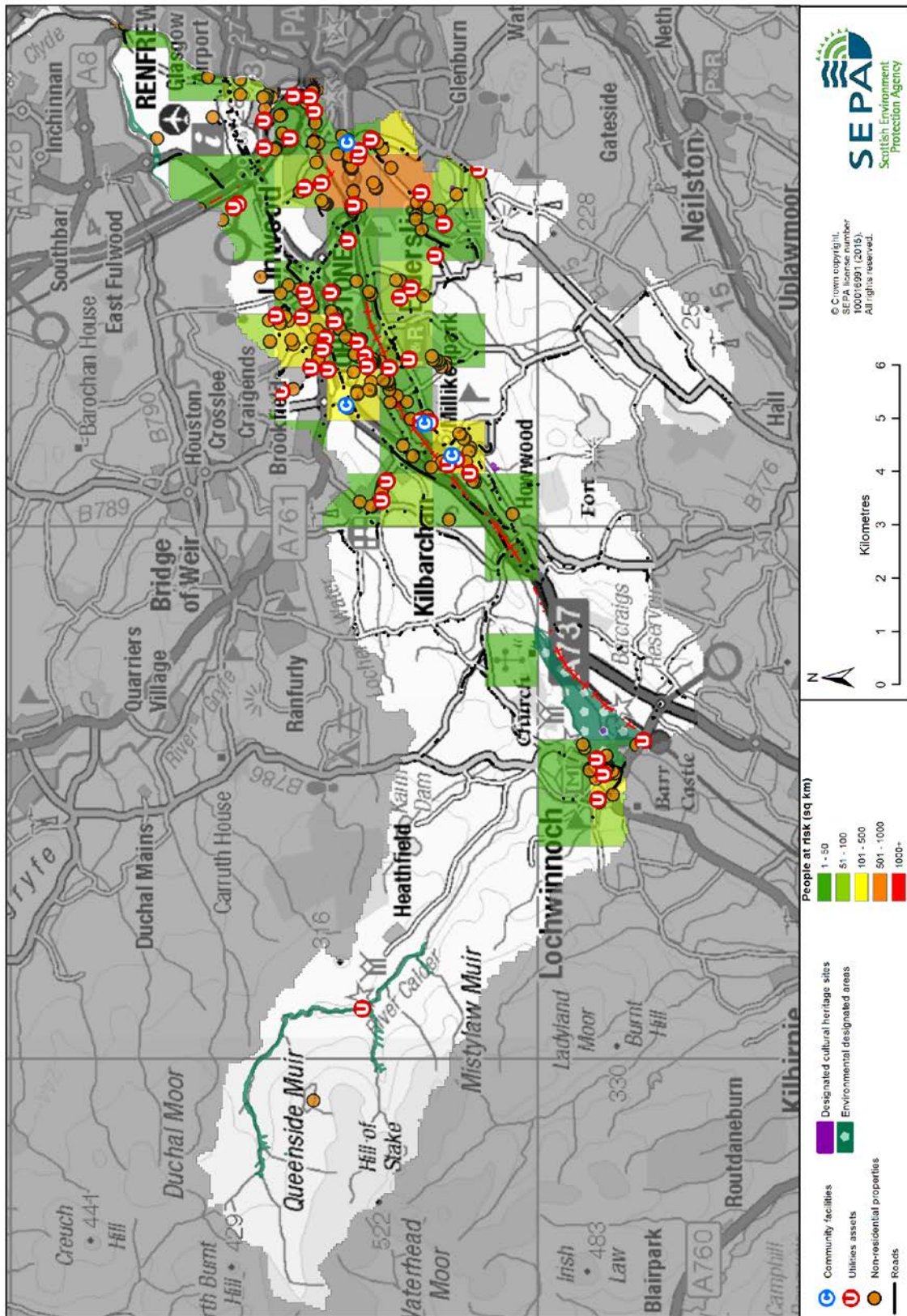


Figure 3: Impacts of flooding



## Objectives to manage flooding in Potentially Vulnerable Area 11/12

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 Black Cart Water catchment - Lochwinnoch to Johnstone Potentially Vulnerable Area.

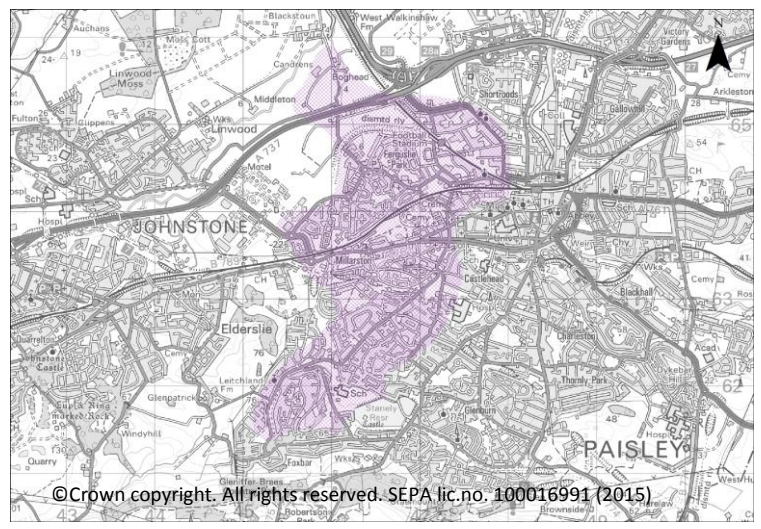
### Reduce the risk of river and surface water flooding to residential properties and non-residential properties in the Candren Burn catchment

Indicators:

- 840 residential properties
- 160 non-residential properties
- £1.7 million Annual Average Damages

Objective ID: 11044

Target area:



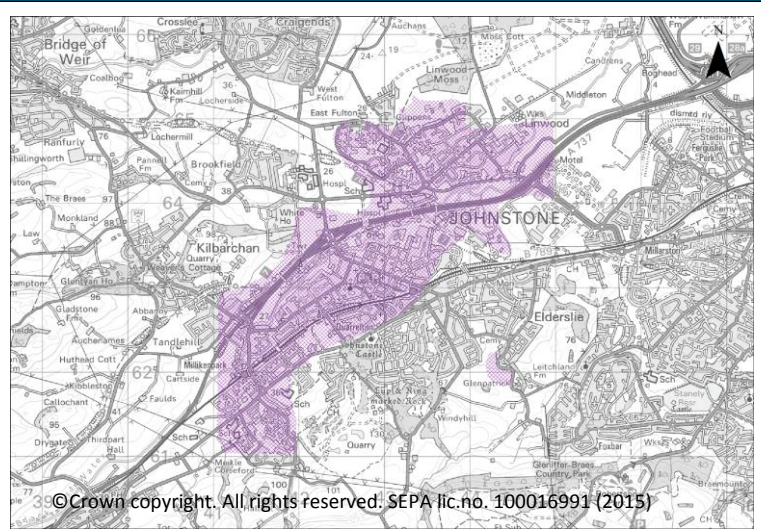
### Reduce the risk of river and surface water flooding to residential properties, non-residential properties, community facilities and transport routes in Johnstone

Indicators:

- 180 residential properties
- 230 non-residential properties
- £320,000 Annual Average Damages
- 3 educational buildings
- 3.5km of road

Objective ID: 11049

Target area:

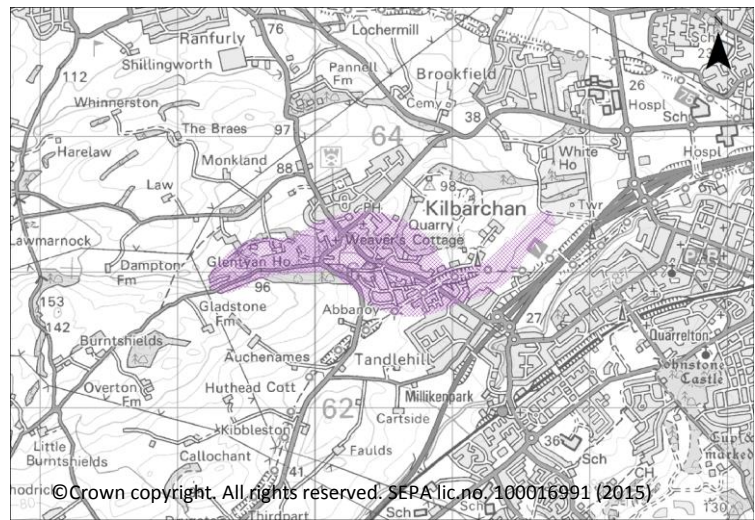


**Reduce the risk of flooding from the Kilbarchan Burn and surface water to residential properties, non-residential properties and transport routes in Kilbarchan**

Indicators:

Target area:

- 40 residential properties
- 30 non-residential properties
- £60,000 Annual Average Damages
- 0.6km of road



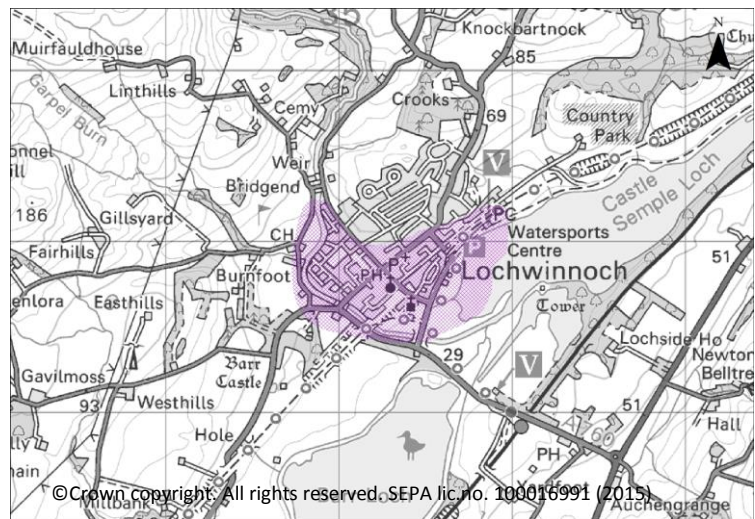
Objective ID: 11050

**Reduce the risk of river flooding to residential properties, non-residential properties and transport routes in Lochwinnoch**

Indicators:

Target area:

- 60 residential properties
- 30 non-residential properties
- £140,000 Annual Average Damages
- 1.1km of road



Objective ID: 11052

Target area	Objective	ID	Indicators within PVA
Lochwinnoch	Reduce the physical or disruption risk related to the transport network for rail.	11303	<ul style="list-style-type: none"> <li>• 4.1km of rail track at 25 locations</li> </ul>
Johnstone and Kilbarchan	Reduce the economic damages and risk to people from surface water flooding in Johnstone and Kilbarchan	11116	* See note below
Linwood	Reduce the economic damages and risk to people from surface water flooding in Linwood	11117	* See note below
Paisley	Reduce the economic damages and risk to people from surface water flooding in Paisley	11118	* See note below
Applies across Clyde and Loch Lomond Local Plan District	Avoid an overall increase in flood risk	11127	<ul style="list-style-type: none"> <li>• 1,300 residential properties</li> <li>• £2.6 million Annual Average Damages</li> </ul>
Applies across Clyde and Loch Lomond Local Plan District	Reduce overall flood risk	11132	<ul style="list-style-type: none"> <li>• 1,300 residential properties</li> <li>• £2.6 million Annual Average Damages</li> </ul>
Applies across Clyde and Loch Lomond 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 11/12 there are 590 residential properties at risk and Annual Average Damages of £720,000.

## Actions to manage flooding in Potentially Vulnerable Area 11/12

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 Black Cart Water catchment - Lochwinnoch to Johnstone Potentially Vulnerable Area.

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

<b>Action (ID):</b>	<b>FLOOD PROTECTION SCHEME/WORKS (11303021)</b>		
<b>Objective (ID):</b>	Reduce the physical or disruption risk related to the transport network for rail. (11303)		
<b>Delivery lead:</b>	Network Rail		
<b>Status:</b>	<b>Under development</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	Network Rail will carry out civil engineering work which will reduce flood risk to identified sections of the rail network within this Potentially Vulnerable Area.		

<b>Action (ID):</b>	<b>FLOOD PROTECTION STUDY (110440005)</b>		
<b>Objective (ID):</b>	Reduce the risk of river and surface water flooding to residential properties and non-residential properties in the Candren Burn catchment (11044)		
<b>Delivery lead:</b>	Renfrewshire Council		
<b>Priority:</b>	National:	Within local authority:	
	<b>14 of 168</b>	<b>2 of 6</b>	
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	A study is recommended to further investigate the feasibility of a flood protection scheme along the Candren Burn, focusing on the use of sustainable drainage systems and short sections of flood defences. The study should also examine the potential benefit of property level protection both as a single action and in combination		

	with other actions. Other actions may also be considered to select the most sustainable combination of actions.
<b>Potential impacts</b>	
<b>Economic:</b>	The flood protection study should consider how to reduce flood risk to 660 residential properties and 60 non-residential properties in this location, with potential damages avoided of up to £48 million.
<b>Social:</b>	A reduction in flood risk would have a positive benefit to the health and wellbeing of the community. In addition there are three utilities which have been identified as potentially benefitting from this action. There may be changes in visual amenity and land use as a result of this action.
<b>Environmental:</b>	Flood protection studies should consider the positive and negative impacts of proposed actions on the ecological quality of the environment. This study is proposed for the Candren Burn (water body ID 10022). The physical condition of this river is identified by river basin management planning to be at less than good status. Future works could improve the condition of the river or degrade it. Opportunities to improve the condition of the river should be considered by coordinating with river basin management planning. There are no international or national level environmental designations that are likely to be impacted by this action. There is likely to be a loss of semi-natural habitat in the footprint and vicinity of the defences. There is the potential for local negative impacts on morphology and sediment dynamics which in turn may increase sediment load. There are several listed buildings to the north of Old Mill Road, whose setting may be impacted by direct defences.

<b>Action (ID):</b>	<b>FLOOD PROTECTION STUDY (110490005)</b>		
<b>Objective (ID):</b>	Reduce the risk of river and surface water flooding to residential properties, non-residential properties, community facilities and transport routes in Johnstone (11049)		
<b>Delivery lead:</b>	Renfrewshire Council		
<b>Priority:</b>	National:	Within local authority:	
	<b>16 of 168</b>	<b>3 of 6</b>	
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	<p>A study is recommended to further investigate the feasibility of actions recommended in the Green Networks Integrated Urban Infrastructure report. These focused on the potential to create small areas of offline storage at a number of locations within Johnstone and the potential to improve culvert conveyance and investigate culvert daylighting. In addition to this the study should examine the potential benefit of automatic property level protection and sustainable drainage systems. Other actions may also be considered to select the most sustainable combination of actions. This may be combined into the study investigating the flood risk within Kilbarchan (action 110500005).</p> <p>This study is linked to the Johnstone and Kilbarchan surface water management plans which will help to identify the potential of some actions.</p>		
<b>Potential impacts</b>			

<b>Economic:</b>	The flood protection study should consider how to reduce flood risk to 740 residential and non-residential properties in this location, with potential damages avoided of up to £39 million.
<b>Social:</b>	A reduction in flood risk would have a positive benefit to the health and wellbeing of the community. In addition there are two utilities which have been identified as potentially benefitting from this action. There may be changes in visual amenity and land use as a result of this action.
<b>Environmental:</b>	Flood protection studies should consider the positive and negative impacts of proposed actions on the ecological quality of the environment. There are no international or national level environmental designations that are likely to be impacted by this action. There is likely to be a loss of agricultural land and semi-natural habitats in the footprint of a storage area. There is the potential for local positive impacts on biodiversity with the creation of small wetland areas. Downstream of the modified culverts there may be slight negative impacts on water quality through increased erosion and sedimentation on the Black Cart Water.

<b>Action (ID):</b>	<b>FLOOD PROTECTION STUDY (110520005)</b>		
<b>Objective (ID):</b>	Reduce the risk of river flooding to residential properties, non-residential properties and transport routes in Lochwinnoch (11052)		
<b>Delivery lead:</b>	Renfrewshire Council		
<b>Priority:</b>	National:	Within local authority:	
	<b>75 of 168</b>	<b>4 of 6</b>	
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	A study is recommended to further investigate the feasibility of a flood protection scheme along the River Calder within Lochwinnoch, focusing on the benefit of direct defences. Other actions may also be considered to select the most sustainable combination of actions. A separate study looking at natural flood management actions will also cover this area.		
<b>Potential impacts</b>			
<b>Economic:</b>	The flood protection study should consider how to reduce flood risk to 60 residential properties and 20 non-residential properties in this location, with potential damages avoided of up to £4.5 million.		
<b>Social:</b>	A reduction in flood risk would have a positive benefit to the health and wellbeing of the community. In addition there is one utility which has been identified as potentially benefitting from this action. Natural flood management actions can restore and enhance natural environments and create opportunities for recreation and tourism. There may be changes in visual amenity and land use as a result of this action. Any defences would need to be well set back from Castle Semple Loch to minimise impacts.		
<b>Environmental:</b>	Flood protection studies should consider the positive and negative impacts of proposed actions on the ecological quality of the environment. Natural flood management actions can have a positive impact by restoring and enhancing natural habitats. This action has the potential for permanent, direct, negative impacts on the Castle Semple and Barr Loch Site of Special Scientific Interest. There is		

<b>Environmental:</b>	likely to be a loss of natural and semi-natural habitat in the footprint and vicinity of the defences. If defences are not well set back from Castle Semple Loch and its associated wetlands there is the potential for significant negative impacts on site status, water quality and hydromorphology. Development should take place outside the Site of Special Scientific Interest designation area; however, it should not affect the ecological connectivity of the site.
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<b>Action (ID):</b>	<b>FLOOD PROTECTION STUDY (110500005)</b>		
<b>Objective (ID):</b>	Reduce the risk of flooding from the Kilbarchan Burn and surface water to residential properties, non-residential properties and transport routes in Kilbarchan (11050)		
<b>Delivery lead:</b>	Renfrewshire Council		
<b>Priority:</b>	National: <b>122 of 168</b>	Within local authority: <b>6 of 6</b>	
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	<p>A study is recommended to further investigate the feasibility of a flood protection scheme in Kilbarchan. The study will focus on storage for the Kilbarchan Burn at Bog Park and improved conveyance of the Kilbarchan Burn through Kilbarchan by upgrading of culverts and watercourse channel. A separate study (action 11050003) will also investigate managing the sediment getting into the channel using natural flood management actions. Other actions may also be considered to select the most sustainable combination of actions.</p> <p>The study may be combined into the study investigating the flood risk within Johnstone (action 110490005).</p> <p>This study is linked to the Johnstone and Kilbarchan surface water management plans which will help to identify the potential of some actions, including sustainable drainage systems.</p>		
<b>Potential impacts</b>			
<b>Economic:</b>	The flood protection study should consider how to reduce flood risk to 20 residential properties and 12 non-residential properties in this location, with potential damages avoided of up to £1.6 million. The economic impact of natural flood management actions is difficult to define. However, these actions can reduce flood risk for high likelihood events. In this location, it has been estimated that 20 residential and non-residential properties could potentially benefit from natural flood management actions.		
<b>Social:</b>	A reduction in flood risk would have a positive benefit to the health and wellbeing of the community. In addition there are two utilities which have been identified as potentially benefitting from this action. Natural flood management actions can restore and enhance natural environments and create opportunities for recreation and tourism. There may be changes in visual amenity and land use as a result of this action.		
<b>Environmental:</b>	Flood protection studies should consider the positive and negative impacts of proposed actions on the ecological quality of the environment. Natural flood management actions can have a positive impact by restoring and enhancing natural habitats. There are no international or national level environmental designations that are		

<b>Environmental:</b>	likely to be impacted by this action. There will be a loss of improved grasslands at Bog Park; however, there is the potential for long term positive impacts with the creation of new wetland habitat with this action. There may be increased flows from the conveyance action which could have localised erosion impacts downstream. Modification of conveyance may cause the short term loss of some habitats and displacement of species, which should recolonise and return to the area following construction activities. Modification of conveyance in this area will need to be sensitive to the setting of the Kilbarchan heritage conservation area.
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<b>Action (ID):</b>	<b>NATURAL FLOOD MANAGEMENT STUDY (110500003)</b>		
<b>Objective (ID):</b>	Reduce the risk of flooding from the Kilbarchan Burn and surface water to residential properties, non-residential properties and transport routes in Kilbarchan (11050)		
<b>Delivery lead:</b>	Renfrewshire Council		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	It is recommended that a natural flood management study should be carried out to further investigate the potential benefit for sediment management at Kilbarchan. This may be carried out as a separate study or as part of the flood protection study within this area.		
<b>Potential impacts</b>			
<b>Economic:</b>	The economic impacts have not been defined at this stage.		
<b>Social:</b>	A reduction in flood risk would have a positive benefit to the health and wellbeing of the community.		
<b>Environmental:</b>	Natural flood management actions can have a positive impact on the ecological quality of the environment by restoring and enhancing natural habitats. There are no international or national level environmental designations that are likely to be impacted by this action. There are likely to be local improvements in water quality through reduced sedimentation; however, increased flows may have localised erosion impacts downstream. Sediment management works may cause the short term loss of some habitats and displacement of species, which should recolonise and return to the area following sediment management activities.		

<b>Action (ID):</b>	<b>NATURAL FLOOD MANAGEMENT STUDY (110520003)</b>		
<b>Objective (ID):</b>	Reduce the risk of river flooding to residential properties, non-residential properties and transport routes in Lochwinnoch (11052)		
<b>Delivery lead:</b>	Renfrewshire Council		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	It is recommended that a natural flood management study should be carried out to further investigate the potential benefit for runoff control and sediment management in Lochwinnoch. The study should look at the land management upstream of Lochwinnoch and start engagement with local land owners to establish the potential for		



	works. This may be carried out as a separate study or as part of the flood protection study within this area (action 110520005).
<b>Potential impacts</b>	
<b>Economic:</b>	The economic impacts have not been defined at this stage.
<b>Social:</b>	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.
<b>Environmental:</b>	Natural flood management actions can have a positive impact on the ecological quality of the environment by restoring and enhancing natural habitats. Runoff control actions could affect the Renfrewshire Heights Site of Special Scientific Interest. 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 Renfrewshire Heights Special Protection Area. There are likely to be local improvements in water quality through reduced sedimentation; however, increased flows may have localised erosion impacts downstream where the River Calder meets Castle Semple Loch Site of Special Scientific Interest. Implementation of bank restoration in this area will need to be sensitive to the setting of the Lochwinnoch heritage conservation area.

<b>Action (ID):</b>	<b>SURFACE WATER PLAN/STUDY (111161018)</b>		
<b>Objective (ID):</b>	Reduce the economic damages and risk to people from surface water flooding in Johnstone and Kilbarchan (11116)		
<b>Delivery lead:</b>	Renfrewshire Council		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>SURFACE WATER PLAN/STUDY (111171018)</b>		
<b>Objective (ID):</b>	Reduce the economic damages and risk to people from surface water flooding in Linwood (11117)		
<b>Delivery lead:</b>	Renfrewshire Council		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2022-2027</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>SURFACE WATER PLAN/STUDY (111171019)</b>		
<b>Objective (ID):</b>	Reduce the economic damages and risk to people from surface water flooding in Linwood (11117)		
<b>Delivery lead:</b>	Scottish Water in partnership with Renfrewshire Council		
<b>Status:</b>	<b>Ongoing</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>SURFACE WATER PLAN/STUDY (111180018)</b>		
<b>Objective (ID):</b>	Reduce the economic damages and risk to people from surface water flooding in Paisley (11118)		
<b>Delivery lead:</b>	Renfrewshire Council		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	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. The Metropolitan Glasgow Strategic Drainage Partnership will support the 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.		

<b>Action (ID):</b>	<b>STRATEGIC MAPPING AND MODELLING (111320016)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	SEPA		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	SEPA will seek to incorporate additional surface water data into the flood maps to improve understanding of flood risk. Approximately 2,200km <sup>2</sup> 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.		

<b>Action (ID):</b>	<b>STRATEGIC MAPPING AND MODELLING (111320019)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Scottish Water		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>MAINTAIN FLOOD PROTECTION SCHEME (110490017)</b>		
<b>Objective (ID):</b>	Reduce the risk of river and surface water flooding to residential properties, non-residential properties, community facilities and transport routes in Johnstone (11049)		
<b>Delivery lead:</b>	Renfrewshire Council		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	The Collier Street / Rankine Street Flood Protection Scheme has been designed to protect properties in the area against a 200 year flood inclusive of climate change allowances. This scheme will be maintained, and will continue to manage flooding according to the design standard at the time of construction. Levels of flood risk are likely to increase over time as a consequence of climate change.		

<b>Action (ID):</b>	<b>FLOOD FORECASTING (111320009)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	SEPA		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>SELF HELP (111320011)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	—		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>AWARENESS RAISING (111320013)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Responsible authorities		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>MAINTENANCE (111320007)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Local authorities, asset / land managers		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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.		

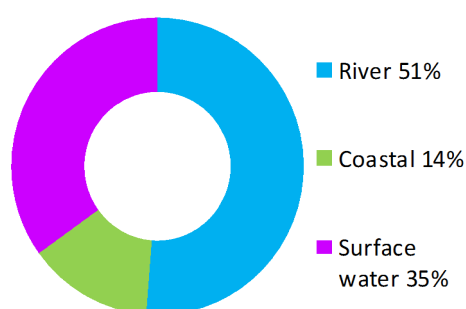
<b>Action (ID):</b>	<b>EMERGENCY PLANS/RESPONSE (111320014)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Category 1 and 2 Responders		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>Providing an emergency response to 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.</p>		

<b>Action (ID):</b>	<b>PLANNING POLICIES (111270001)</b>		
<b>Objective (ID):</b>	Avoid an overall increase in flood risk (11127) Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Planning authority		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>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.</p>		

## White Cart Water catchment (Potentially Vulnerable Area 11/13)

Local Plan District	Local authority	Main catchment
Clyde and Loch Lomond	East Ayrshire Council, East Renfrewshire Council, Glasgow City Council, Renfrewshire Council, South Lanarkshire Council	White Cart Water

### Summary of flooding impacts



#### At risk of flooding

- 4,700 residential properties
- 2,800 non-residential properties
- £10 million Annual Average Damages

(damages by flood source shown left)

Summary of flooding impacts

### 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.

Objectives

### Summary of actions to manage flooding

The actions below have been selected to manage flood risk.

Flood protection scheme/works	<i>Natural flood management works</i>	<i>New flood warning</i>	Community flood action groups	<i>Property level protection scheme</i>	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

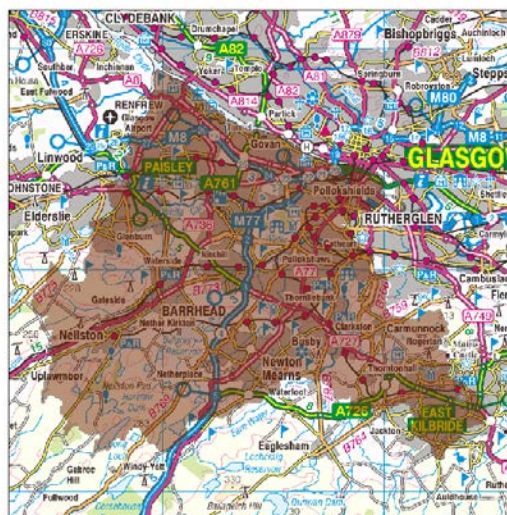
Actions

## White Cart Water catchment (Potentially Vulnerable Area 11/13)

Local Plan District	Local authority	Main catchment
Clyde and Loch Lomond	East Ayrshire, East Renfrewshire Council, Glasgow City Council, Renfrewshire Council, South Lanarkshire Council	White Cart Water

### Background

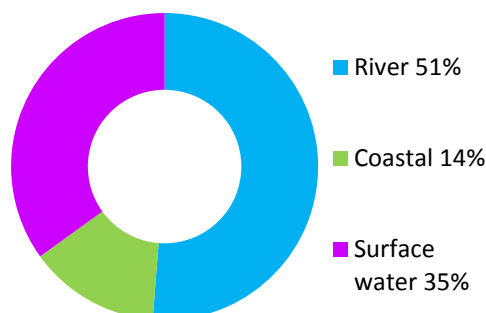
This Potentially Vulnerable Area incorporates the Paisley, Pollokshields, Barrhead, Newton Mearns and East Kilbride areas to the south west of Glasgow City centre (shown below). It is approximately 190km<sup>2</sup>.



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

There are approximately 4,700 residential properties and 2,800 non-residential properties at risk of flooding. The Annual Average Damages are approximately £10 million.



**Figure 1: Annual Average Damages by flood source**

### Summary of flooding impacts

River flooding is primarily attributed to the White Cart Water which flows from east to west through the area. Tributaries of the White Cart Water, the Brock Burn/Levern Water and Capelrig/Auldhouse Burn, are also predicted to cause flooding in Nitshill and Pollokshaws respectively. Further tributaries of the White Cart Water (the Espediar and Hawkhead Burns) are also predicted to cause flooding in the Paisley area. Another tributary of the White Cart Water is the Kitch Water which is predicted to be the main source of river flooding in East Kilbride.

The White Cart Water Flood Protection Scheme consists of three large floodwater reservoirs, over five miles of hard defences and storm water pumping stations. It is designed to protect properties in 1 in 100 year floods but will also help to reduce the impact of flooding during more extreme floods.

There is a potential risk of surface water flooding throughout this area, principally within Pollokshaws and Paisley where a large number of properties are impacted. There are a number of main transport routes also at risk including; sections of railway line, M8, M77, A726, A739 and A761. The areas at highest risk from surface water flooding will require the preparation of surface water management plans.

Scottish Water and local authorities have completed a number of studies in the area. These have included strategic and detailed assessments of surface water risk and its interaction with river flooding as well as considering mitigation actions. Many of these studies have been helped by the partnership working developed within the Metropolitan Glasgow Strategic Drainage Partnership. This has led to the implementation of schemes and works to protect properties from river and surface water flooding.

There is a risk of coastal flooding attributed to the tidal influence on the River Clyde along the northern boundary of the Potentially Vulnerable Area. Residential properties at risk of flooding are located within the communities of Renfrew, Govan and Pollokshields.

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. Residential properties affected by river flooding experience the highest economic impact at approximately 30% of the damages.

Within this Potentially Vulnerable Area it is estimated that climate change will increase the number of residential properties at risk of flooding from approximately 4,700 to 8,000 and the number of non-residential properties from approximately 2,800 to 4,600.

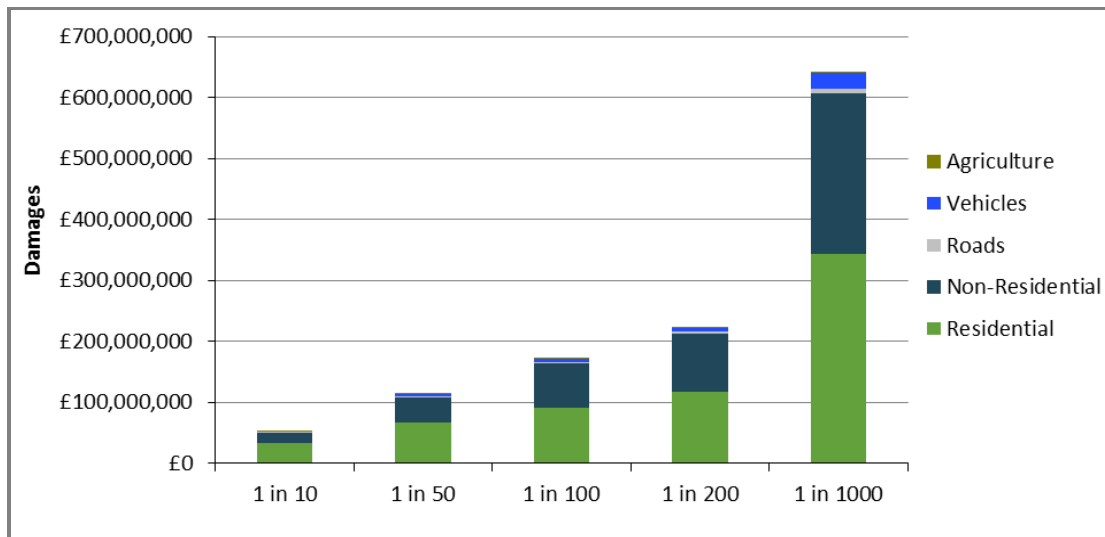
The location of the impacts of flooding in the north of the area is shown in Figure 3a impacts in the south are shown in Figure 3b. Flooding impacts are widespread within this area with almost all urban areas impacted.

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 is one asset identified as being at risk of flooding.



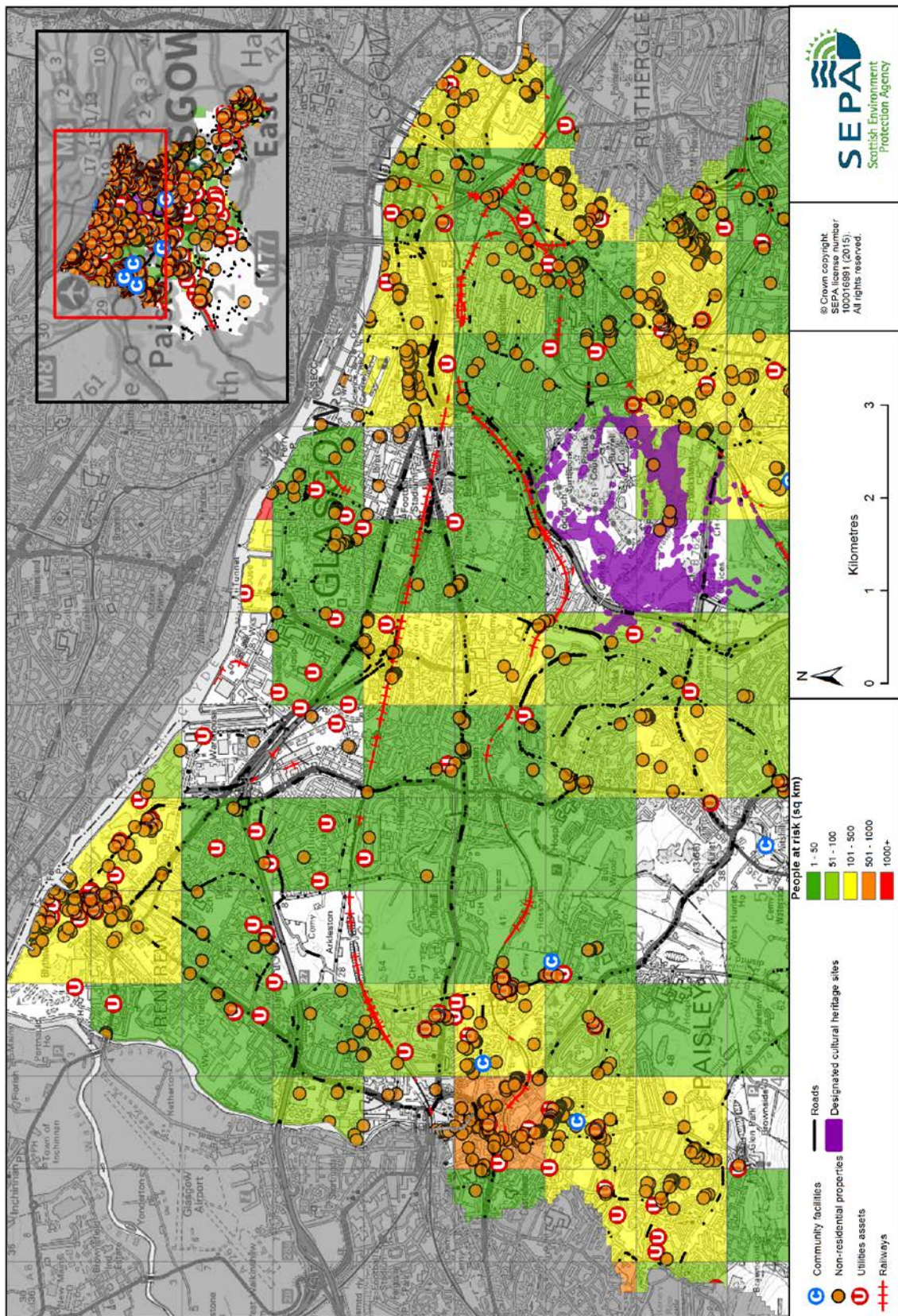
	1 in 10 High likelihood	1 in 200 Medium likelihood	1 in 1000 Low likelihood
<b>Residential properties (total 180,000)</b>	1,200	4,700	14,000
<b>Non-residential properties (total 32,000)</b>	530	2,800	5,800
<b>People</b>	2,700	10,000	31,000
<b>Community facilities</b>	<10 Includes: emergency services and healthcare facilities	20 Includes: educational buildings, emergency services and healthcare facilities	30 Includes: educational buildings, emergency services and healthcare facilities
<b>Utilities assets</b>	50	160	230
<b>Transport links - roads (km)</b>	15.8 (of which 1.9 is motorway and 2.1 is A road)	45.4 (of which 5.8 is motorway and 5.1 is A road)	67.4 (of which 7.1 is motorway and 6.4 is A road)
<b>Transport links - rail (km)</b>	10.4	32.2	38.6
<b>Environmental designated areas (km<sup>2</sup>)</b>	0.1	0.1	0.1
<b>Designated cultural heritage sites</b>	24	53	57
<b>Agricultural land (km<sup>2</sup>)</b>	2.7	3.1	3.1

**Table 1:** Summary of flooding impacts<sup>1</sup>



**Figure 2:** Damages by flood likelihood

<sup>1</sup> Some receptors are counted more than once if flooded from multiple sources



**Figure 3a: Impacts of flooding**

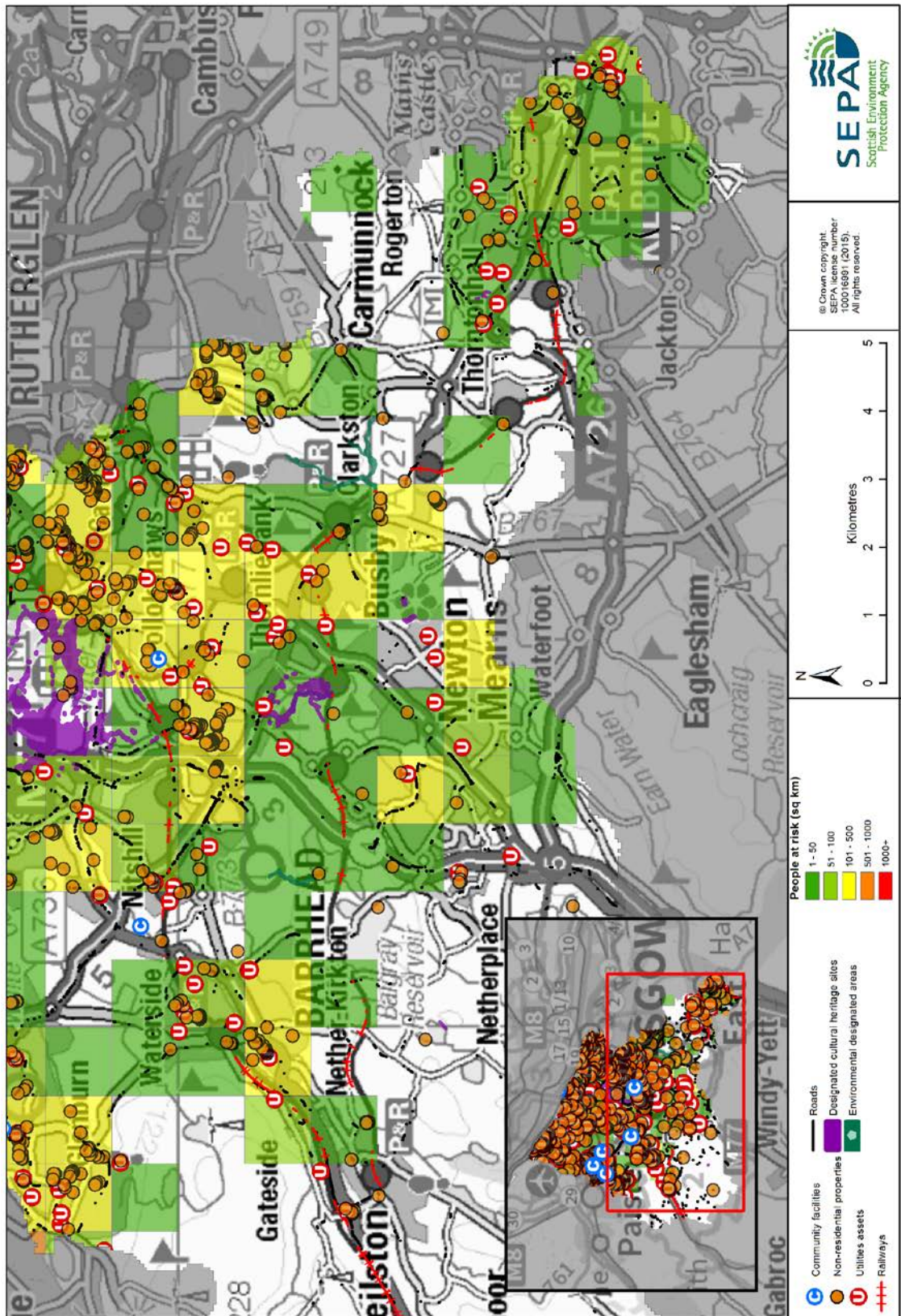


Figure 3b: Impacts of flooding

## History of flooding

There is a long history of flooding in this area with over 20 significant floods in the last 100 years. River flooding from the White Cart Water affected Glasgow City in 1903, affecting over 500 properties. The last major flood was in 1984 when the White Cart Water again flooded over 500 properties.

Between the 10-12 December 1994, major flooding occurred in rivers and urban watercourses across the Glasgow and its surrounding areas. A slow-moving weather system delivered persistent rain over a 48 hour period across a wide geographical area. Previously recorded peak river flows were exceeded in major catchments in the region. The River Clyde is thought to have reached its highest level in 150 years. In this Potentially Vulnerable Area 60-year return period flows were recorded on the Espedair Burn, Glen Burn, Hawkhead Burn (all in Paisley) and the Mill Burn (Penilee, Hillington and Renfrew). The flood waters affected numerous commercial and residential properties, utilities, community facilities, roads and agricultural land, and evacuation of residents was required.

Surface water flooding impacted the south of Paisley and at the M8 near Hillington industrial estate in 2006, mainly affecting roads and properties. Coastal flooding records are concentrated in Ferry Road, Renfrew, dating back to 1897. Since then there have been 16 recorded incidents, most recently in 2000, 2002 and 2006, mainly affecting local roads. This area can be affected by a combination of high tides and heavy rainfall.

## Objectives to manage flooding in Potentially Vulnerable Area 11/13

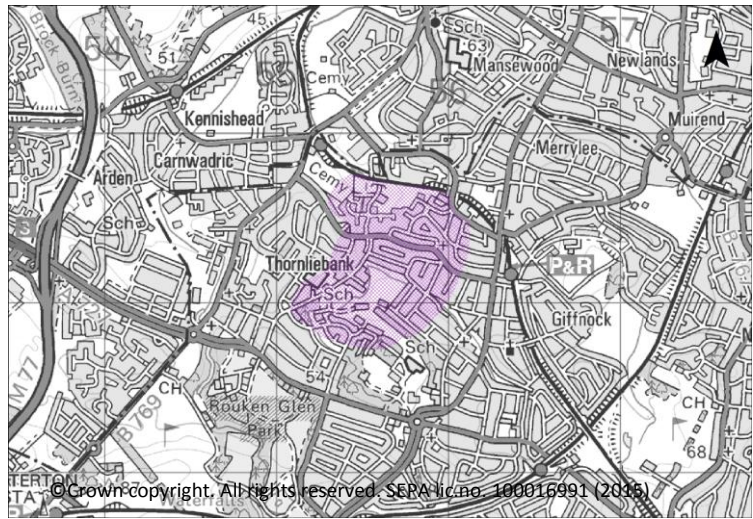
Objectives provide a common goal and shared ambition for managing floods. These objectives have been set by SEPA and agreed with flood risk management authorities following consultation. They were identified through an assessment of the underlying evidence of the causes and impacts of flooding. Target 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 White Cart Water catchment Potentially Vulnerable Area.

### Reduce the risk of river and surface water flooding to residential properties in Giffnock

Indicators:

- 60 residential properties
- £130,000 Annual Average Damages

Target area:



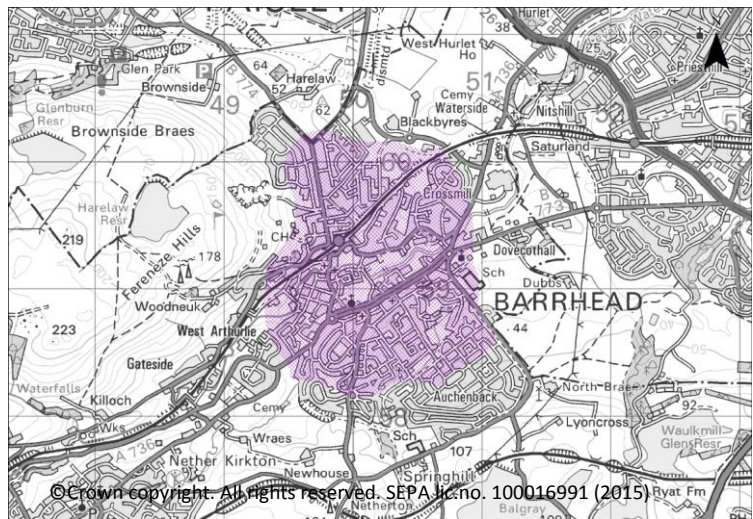
Objective ID: 11012

### Reduce the risk of river and surface water flooding to residential properties and non-residential properties in Barrhead

Indicators:

- 230 residential properties
- 80 non-residential properties
- £820,000 Annual Average Damages

Target area:



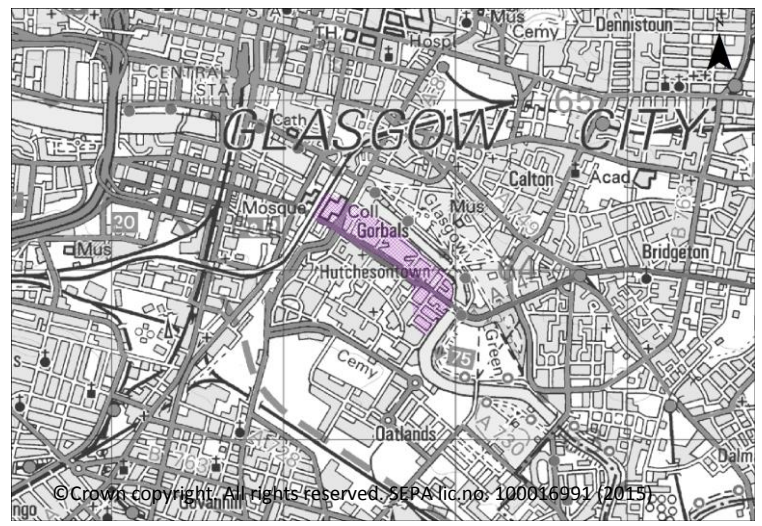
Objective ID: 11013

**Reduce the risk of flooding to non-residential properties and community facilities in Gorbals from the River Clyde**

Indicators:

Target area:

- £110,000 Annual Average Damages
- Historical record of flooding shows risk to community and education facilities.



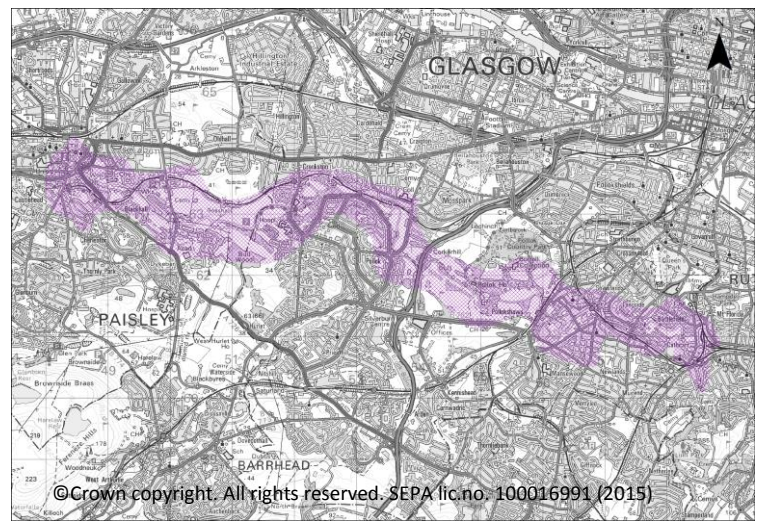
Objective ID: 11017

**Reduce the risk of river flooding to residential properties and non-residential properties from the White Cart Water**

Indicators:

Target area:

- 630 residential properties
- 390 non-residential properties
- £1.4 million Annual Average Damages



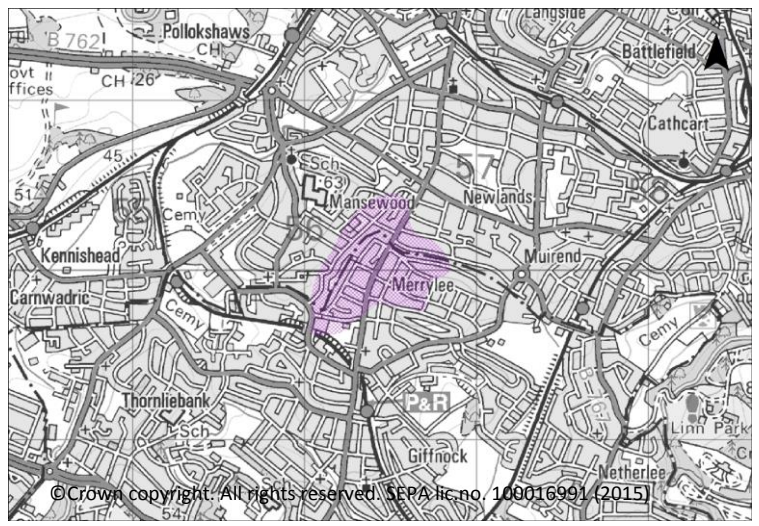
Objective ID: 11019

**Reduce the risk of river and surface water flooding to residential properties and non-residential properties in Merrylee**

Indicators:

Target area:

- 270 residential properties
- 40 non-residential properties
- £1.3 million Annual Average Damages



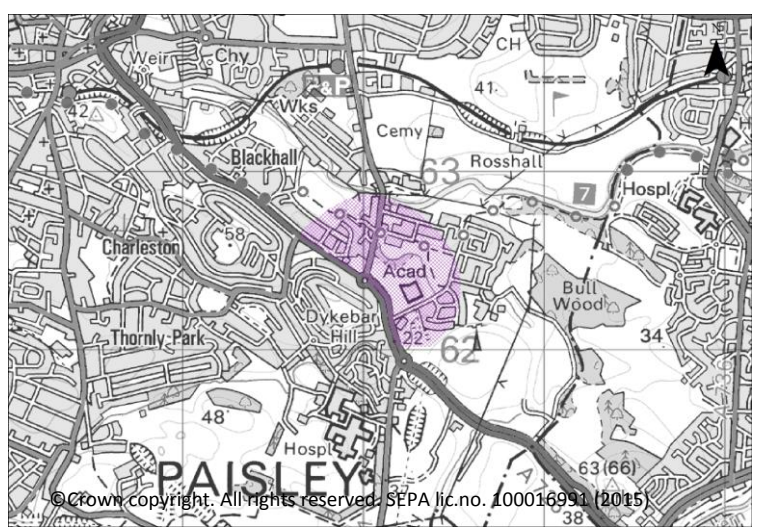
Objective ID: 11027

**Reduce the risk of flooding from the Hawkhead Burn and surface water to residential properties and non-residential properties in Paisley**

Indicators:

Target area:

- 30 residential properties
- <10 non-residential properties
- £89,000 Annual Average Damages



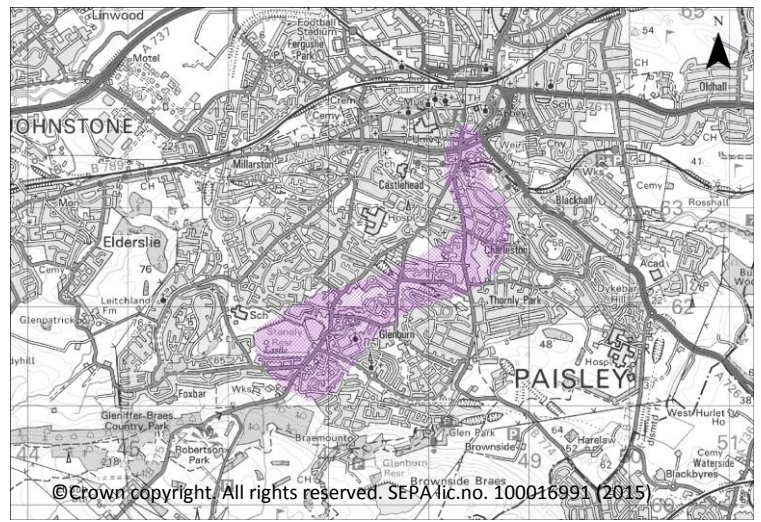
Objective ID: 11058

**Reduce the risk of flooding from the Espedair Burn / Gleniffer Burn and surface water to residential properties, non-residential properties, community facilities and transport routes in Paisley**

Indicators:

Target area:

- 670 residential properties
- 260 non-residential properties
- £980,000 Annual Average Damages
- 1.3km of road



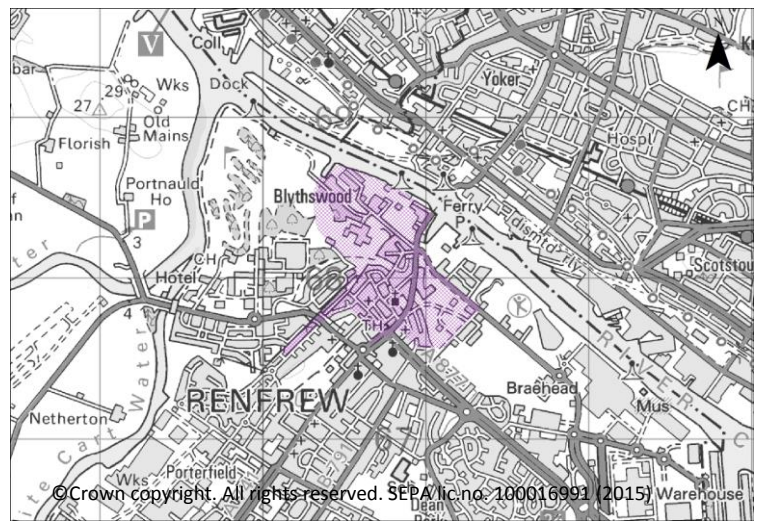
Objective ID: 11059

**Reduce the risk of coastal flooding to residential properties, non-residential properties and transport routes in Renfrew North**

Indicators:

Target area:

- 330 residential properties
- 220 non-residential properties
- £980,000 Annual Average Damages
- 0.9km of road



Objective ID: 11063

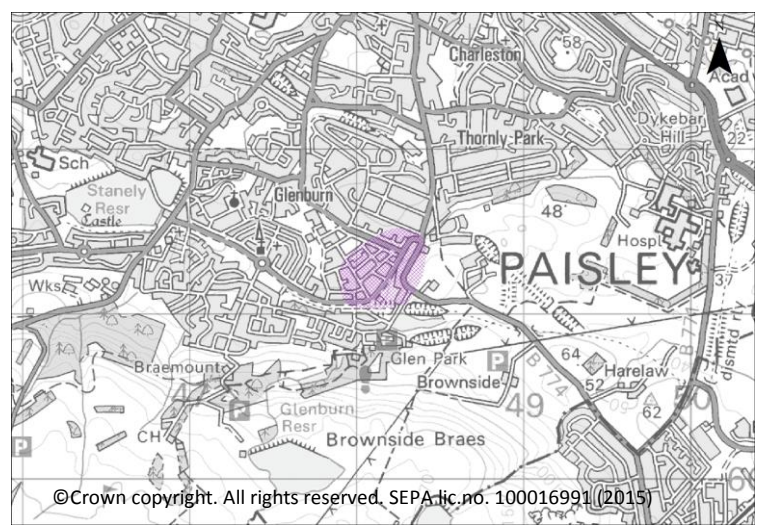


**Reduce the risk of river / surface water flooding to residential properties north of Thornley Reservoir**

Indicators:

Target area:

- 50 residential properties
- 30 non-residential properties
- £92,000 Annual Average Damages



Objective ID: 11082

Target area	Objective	ID	Indicators within PVA
Glasgow	Reduce the economic damages and number of people at risk of surface water flooding in Glasgow City	11007	* See note below
Barrhead	Reduce the economic damages and risk to people from surface water flooding in Barrhead	11088	* See note below
Merrylee, Thornliebank, Giffnock and Eastwood North	Reduce economic damages and risk to people from surface water flooding in Merrylee, Thornliebank, Giffnock and Eastwood North	11089	* See note below
Newton Mearns	Reduce the economic damages and risk to people from surface water flooding in Newton Mearns	11090	* See note below
Darnley Mains, Glasgow	Reduce the economic damages and risk to people from surface water flooding in Darnley Mains	11092	* See note below
Hillington and Cardonald	Reduce the economic damages and risk to people from surface water flooding in Hillington and Cardonald	11106	* See note below
Paisley	Reduce the economic damages and risk to people from surface water flooding in Paisley	11118	* See note below
East Kilbride	Reduce the economic damages and risk to people from surface water flooding in East Kilbride	11119	* See note below
Newlands	Reduce the economic damages and risk to people from surface water flooding in Newlands	11130	* See note below
Nitshill and Priesthill	Reduce the economic damages and risk to people from surface water flooding in Nitshill and Priesthill	11131	* See note below
Applies across Clyde and Loch Lomond Local Plan District	Avoid an overall increase in flood risk	11127	<ul style="list-style-type: none"> <li>• 4,700 residential properties</li> <li>• £10 million Annual Average Damages</li> </ul>
Applies across Clyde and Loch Lomond Local Plan District	Reduce overall flood risk	11132	<ul style="list-style-type: none"> <li>• 4,700 residential properties</li> <li>• £10 million Annual Average Damages</li> </ul>
Applies across Clyde and Loch Lomond 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 11/13 there are 2,700 residential properties at risk and Annual Average Damages of £3.5 million.

## Actions to manage flooding in Potentially Vulnerable Area 11/13

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 White Cart Water catchment Potentially Vulnerable Area.

Selected actions					
Flood protection scheme/works	<i>Natural flood management works</i>	<i>New flood warning</i>	Community flood action groups	<i>Property level protection scheme</i>	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

<b>Action (ID):</b>	<b>FLOOD PROTECTION SCHEME/WORKS (110190006)</b>		
<b>Objective (ID):</b>	Reduce the risk of river flooding to residential properties and non-residential properties from the White Cart Water (11019)		
<b>Delivery lead:</b>	Glasgow City Council		
<b>Priority:</b>	National:		Within local authority:
	<b>26 of 42</b>		<b>1 of 2</b>
<b>Status:</b>	<b>Under development</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	<p>It is recommended that the council look to progress the flood protection scheme proposed for the White Cart Water. The scheme is an extension of the existing defences, and will increase the level of protection to a number of properties along parts of the Auldhouse Burn and White Cart Water.</p> <p>The proposed scheme includes building flood walls in locations where properties are still identified to be at risk.</p> <p>The flood mapping for the White Cart Water and Auldhouse Burn should be revised to include all defences to understand any remaining residual risk now and in the future.</p>		
<b>Potential impacts</b>			
<b>Economic:</b>	The proposed scheme may benefit 90 residential properties and 10 non-residential properties at risk of flooding in this location, damages avoided are estimated to be £8.9 million. The flood protection scheme has an estimated benefit cost ratio of 1.45.		
<b>Social:</b>	A reduction in flood risk would have a positive benefit to the health and wellbeing of the community.		
<b>Environmental:</b>	Flood protection schemes can have both positive and negative impacts on the ecological quality of the environment depending on how they are designed. These flood protection works are proposed		

<b>Environmental:</b>	for the Auldhouse Burn (water body ID 10003). The physical condition of this river is identified by river basin management planning to be at less than good status. Future works could improve the condition of the river or degrade it. Opportunities to improve the condition of the river should be considered by coordinating with river basin management planning.
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<b>Action (ID):</b>	<b>FLOOD PROTECTION SCHEME/WORKS (110120006)</b>		
<b>Objective (ID):</b>	Reduce the risk of river and surface water flooding to residential properties in Giffnock (11012)		
<b>Delivery lead:</b>	Scottish Water		
<b>Status:</b>	<b>Ongoing</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	<p>The Sewer Flooding Project by Scottish Water propose a new pumping station (at Woodfarm playing fields) which will receive storm flows from the existing combined sewer network. A new rising main will transfer storm flows from this pumping station to a new combined sewer overflow at Robslee Drive.</p> <p>As part of Scottish Water's Unsatisfactory Intermittent Discharge (UID) projects a diversion at Thornliebank is being carried out which will intercept flow and divert it to the Shieldhall Tunnel.</p> <p>The Scottish Water Shieldhall Tunnel Project is a proposed trunk sewer through Pollok Park which will add capacity and conveyance for the catchment flows to reach Shieldhall Wastewater Treatment Works and at times of extreme storm conditions, act as online storage for the combined flows.</p>		
<b>Potential impacts</b>			
<b>Economic:</b>	These projects are not principally designed to protect against flooding however they may help to reduce the impact of flooding in the local areas. As a consequence the benefits have not been assessed.		
<b>Social:</b>	A reduction in flood risk would have a positive benefit to the health and wellbeing of the community.		
<b>Environmental:</b>	Flood protection works can have both positive and negative impacts on the ecological quality of the environment depending on how they are designed.		

<b>Action (ID):</b>	<b>FLOOD PROTECTION SCHEME/WORKS (110630006)</b>		
<b>Objective (ID):</b>	Reduce the risk of coastal flooding to residential properties, non-residential properties and transport routes in Renfrew North (11063)		
<b>Delivery lead:</b>	Renfrewshire Council		
<b>Status:</b>	<b>Ongoing</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	The North Renfrew Flood Protection Scheme is currently under construction and consists of embankments, demountable barriers, raised ground and a new pumping station.		

Potential impacts	
<b>Economic:</b>	The proposed scheme may benefit 350 residential properties at risk of flooding in this location, damages avoided are estimated to be £19 million. The flood protection scheme has an estimated benefit cost ratio of 2.2.
<b>Social:</b>	A reduction in flood risk would have a positive benefit to the health and wellbeing of the community. There may be negative impacts through disturbance to the local community during the construction phase.
<b>Environmental:</b>	Flood protection schemes can have both positive and negative impacts on the ecological quality of the environment depending on how they are designed. This flood protection scheme is proposed for the Inner Clyde Estuary (water body ID 200510). The physical condition of this estuary is identified by river basin management planning 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. There are no international, national or local level environmental designations that are likely to be impacted by this action. There is likely to be a loss of semi-natural habitat in the footprint and vicinity of the defences; however, these are unlikely to be of significant ecological value. Tree loss should be avoided where possible in the construction of defences. There should be no negative impacts on water quality and hydromorphology as the defences are set well back from all watercourses.

<b>Action (ID):</b>	<b>FLOOD PROTECTION STUDY (110590005)</b>		
<b>Objective (ID):</b>	Reduce the risk of river / surface water flooding to residential properties north of Thornley Reservoir (11082) Reduce the risk of flooding from the Espedair Burn / Gleniffer Burn and surface water to residential properties, non-residential properties, community facilities and transport routes in Paisley (11059)		
<b>Delivery lead:</b>	Renfrewshire Council		
<b>Priority:</b>	National:	Within local authority:	
	<b>11 of 168</b>	<b>1 of 6</b>	
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2022-2027</b>
<b>Description:</b>	Scottish Water in partnership with the local authority are undertaking an Integrated Catchment Modelling of the Espedair Burn and sewers in Paisley which will assess a new interceptor sewer. This interceptor sewer is designed to remove significant storm sewage from the culverted burn, with the aim of improving receiving water quality and aesthetics. Flood risk reduction is not a design objective of the works. It is recommended that the outcomes of the integrated catchment model are reviewed to determine the current risk from the Espedair Burn and sewers and the potential future risk with climate change. This will determine if / when further work is required to investigate how to reduce the flood risk. If future work was required it should investigate the use of the Upper and Lower Glen Dams and Glenburn Reservoir for storage,		

	<p>increasing culvert conveyance and construction of direct defences. The benefit of a property level protection scheme and sustainable drainage systems should be assessed to see if they can improve the level of protection. Other actions may also be considered to select the most sustainable combination of actions.</p> <p>These actions would also serve to benefit properties north of Thornley reservoir.</p> <p>This study will not be able to commence until the integrated catchment study has been completed, therefore the expected delivery date has been moved to 2022 - 2027.</p>
<b>Potential impacts</b>	
<b>Economic:</b>	The flood protection study should consider how to reduce flood risk to 700 residential properties and 270 non-residential properties in this location, with potential damages avoided of up to £30 million.
<b>Social:</b>	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 there are one emergency service and four 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.
<b>Environmental:</b>	Flood protection studies should consider the positive and negative impacts of proposed actions on the ecological quality of the environment. There are no international or national level environmental designations that are likely to be impacted by this action. Raising water levels within the Loch has the potential to negatively impact upon the existing flora and fauna in the reservoir. There is likely to be a loss of habitat and displacement of species in the vicinity of the conveyance and defences works; however, these may re-establish and return to the area. There is the potential for local negative impacts on morphology and sediment dynamics which in turn may increase sediment load. There is the potential for negative impacts on water quality and hydromorphology if defences are not set back from the watercourse.

<b>Action (ID):</b>	<b>FLOOD PROTECTION STUDY (110270005)</b>		
<b>Objective (ID):</b>	Reduce economic damages and risk to people from surface water flooding in Merrylee, Thornliebank, Giffnock and Eastwood North (11089) Reduce the risk of river and surface water flooding to residential properties and non-residential properties in Merrylee (11027)		
<b>Delivery lead:</b>	Glasgow City Council		
<b>Priority:</b>	National:		Within local authority:
	<b>16 of 168</b>		<b>2 of 8</b>
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	A study is recommended to further investigate flood risk in Merrylee. The current strategic mapping does not have sufficient detail to represent the culverts and potentially overestimates the risk in the area. A detailed study of the burns including culverted sections should be developed to identify any potential constraints and identify the flood risk to people and properties. This study will be carried out		

	<p>by Glasgow City Council with the cooperation of East Renfrewshire Council.</p> <p>Review of the study will establish the level of risk and if further stages are required to examine actions to manage flooding.</p> <p>The flood mapping from the study should be used to revise SEPA's strategic mapping.</p>
<b>Potential impacts</b>	
<b>Economic:</b>	Current strategic modelling identifies 270 residential properties and 40 non-residential properties at risk of flooding in this location. The study should look to revise these values and identify a potential benefit from any works.
<b>Social:</b>	A reduction in flood risk would have a positive benefit to the health and wellbeing of the community.
<b>Environmental:</b>	Flood protection studies should consider the positive and negative impacts of proposed actions on the ecological quality of the environment.

<b>Action (ID):</b>	<b>FLOOD PROTECTION STUDY (110130005)</b>		
<b>Objective (ID):</b>	Reduce the economic damages and risk to people from surface water flooding in Barrhead (11088) Reduce the risk of river and surface water flooding to residential properties and non-residential properties in Barrhead (11013)		
<b>Delivery lead:</b>	East Renfrewshire Council		
<b>Priority:</b>	National:		Within local authority:
	<b>49 of 168</b>		<b>1 of 2</b>
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	<p>A study is recommended to further investigate the feasibility of a flood protection scheme to reduce the risk of river flooding in Barrhead. The study will focus on placing direct defences along the watercourses and the potential for runoff control and floodplain restoration using natural flood management. This study should also include an assessment of the potential benefit of a property level protection scheme in Barrhead. Other actions may also be considered to select the most sustainable combination of actions.</p> <p>This study is linked to a surface water management plan for the area and any recommendations should be considered.</p>		
<b>Potential impacts</b>			
<b>Economic:</b>	The flood protection study should consider how to reduce flooding to 130 residential properties and 30 non-residential properties in this location. The potential damages avoided are estimated to be up to £10.3 million. The economic impact of natural flood management actions is difficult to define. However, these actions can reduce flood risk for high likelihood events. In this location, it has been estimated that 20 residential and non-residential properties could potentially benefit from natural flood management actions.		
<b>Social:</b>	A reduction in flood risk would have a positive benefit to the health and wellbeing of the community. In addition there are four utilities which have been identified as potentially benefitting from this action. Natural flood management actions can restore and enhance natural		

<b>Social:</b>	environments and create opportunities for recreation and tourism. There may be changes in visual amenity and land use as a result of this action.
<b>Environmental:</b>	Flood protection studies should consider the positive and negative impacts of proposed actions on the ecological quality of the environment. Natural flood management actions can have a positive impact by restoring and enhancing natural habitats. This study is proposed for the Levern Water (water body ID 10007). The physical condition of this river is identified by river basin management planning to be at less than good status. Future works could improve the condition of the river or degrade it. Opportunities to improve the condition of the river should be considered by coordinating with river basin management planning. There are no international or national level environmental designations that are likely to be impacted by this action. There is likely to be a loss of semi-natural habitat in the footprint and vicinity of the defences.

<b>Action (ID):</b>	<b>FLOOD PROTECTION STUDY (110120005)</b>		
<b>Objective (ID):</b>	Reduce the risk of river and surface water flooding to residential properties in Giffnock (11012)		
<b>Delivery lead:</b>	East Renfrewshire Council		
<b>Priority:</b>	National:	Within local authority:	
	<b>79 of 168</b>	<b>2 of 2</b>	
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2022-2027</b>
<b>Description:</b>	<p>A diversion at Thornliebank is being carried out by Scottish Water which may alleviate some flooding in the area.</p> <p>Upon completion of the Scottish Water work a study is recommended to investigate if there is any remaining flood risk.</p> <p>If a risk remains, the study investigate the feasibility for a flood protection scheme, including the benefit of direct flood defences and the creation of an offline storage area adjacent to the Woodfarm playing fields.</p> <p>This study should also consider property level protection to reduce the residual risk. Other actions may also be considered to select the most sustainable combination of actions.</p>		
<b>Potential impacts</b>			
<b>Economic:</b>	The flood protection study should consider how to reduce flood risk to 50 residential properties and 5 non-residential properties. The potential damages avoided are estimated to be up to £4.6 million.		
<b>Social:</b>	A reduction in flood risk would have a positive benefit to the health and wellbeing of the community. In addition there is one utility which has been identified as potentially benefitting from this action. There may be changes in visual amenity and land use as a result of this action.		
<b>Environmental:</b>	Flood protection studies should consider the positive and negative impacts of proposed actions on the ecological quality of the environment. There are no international or national level environmental designations that are likely to be impacted by this action. There is likely to be a loss of semi-natural habitat in the footprint and vicinity of the defences. There may be a loss of semi-		



<b>Environmental:</b>	natural habitats and recreational land in the footprint of the storage area. However, there is the potential for creation of new wetland habitats.
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<b>Action (ID):</b>	<b>FLOOD PROTECTION STUDY (110580005)</b>		
<b>Objective (ID):</b>	Reduce the risk of flooding from the Hawkhead Burn and surface water to residential properties and non-residential properties in Paisley (11058)		
<b>Delivery lead:</b>	Renfrewshire Council		
<b>Priority:</b>	National:	Within local authority:	
	<b>110 of 168</b>	<b>5 of 6</b>	
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2022-2027</b>
<b>Description:</b>	<p>A study is recommended to further investigate the feasibility of a flood protection scheme on the Hawkhead Burn in Paisley, focusing on formalising storage upstream of the former railway line and school, improving the conveyance of the burn and construction of direct defences along the Hawkhead Burn through Paisley. The study should also examine the potential benefit of property level protection both as a single action and in combination with other actions. Other actions may also be considered to select the most sustainable combination of actions.</p> <p>This study is linked to the Paisley surface water management plan which will help to identify the potential of some actions , including sustainable drainage systems.</p>		
<b>Potential impacts</b>			
<b>Economic:</b>	The flood protection study should consider how to reduce flood risk to 30 residential properties and 1 non-residential property in this location, with potential damages avoided of up to £2.7 million.		
<b>Social:</b>	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. There may be negative impacts through disturbance to the local community during the construction phase.		
<b>Environmental:</b>	<p>Flood protection studies should consider the positive and negative impacts of proposed actions on the ecological quality of the environment. There may be a loss of semi-natural and agricultural habitats in the footprint of the storage and defences. There is likely to be a loss of habitat and displacement of species in the vicinity of the conveyance works; however, these may re-establish and return to the area. There is the potential for creation of new wetland habitats. Implementation of the storage action may have permanent negative impacts on the water body morphology. Modification of conveyance and defences in this area has the potential to impact upon Jennys Well Local Nature Reserve through temporary disruption, loss of habitat and displacement of species during construction works. There may be indirect downstream water quality impacts on the White Cart Water during construction works. There are unlikely to be impacts on heritage features, unless works are to extend onto the land of Ross House, which could impact the setting of the listed building.</p>		

<b>Action (ID):</b>	<b>FLOOD PROTECTION STUDY (110170005)</b>		
<b>Objective (ID):</b>	Reduce the risk of flooding to non-residential properties and community facilities in Gorbals from the River Clyde (11017)		
<b>Delivery lead:</b>	Glasgow City Council		
<b>Priority:</b>	National:	Within local authority:	
	<b>156 of 168</b>	<b>8 of 8</b>	
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	It is recommended that the Gorbals Tidal weir morphology study should be progressed to further investigate the potential risk to key community facilities on the south bank of the Clyde. The outcomes of this study should be used to determine if /when further action is required to increase the level of protection to these facilities.		
<b>Potential impacts</b>			
<b>Economic:</b>	The study will be used to identify the level of risk to non-residential buildings and community facilities in the area.		
<b>Social:</b>	A reduction in flood risk would have a positive benefit to the health and wellbeing of the community.		
<b>Environmental:</b>	Flood protection studies should consider the positive and negative impacts of proposed actions on the ecological quality of the environment. This study is proposed for the Inner Clyde Estuary (water body ID 200510). The physical condition of this estuary is identified by river basin management planning 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.		

<b>Action (ID):</b>	<b>NATURAL FLOOD MANAGEMENT STUDY (110590003)</b>		
<b>Objective (ID):</b>	Reduce the risk of river / surface water flooding to residential properties north of Thornley Reservoir (11082) Reduce the risk of flooding from the Espedair Burn / Gleniffer Burn and surface water to residential properties, non-residential properties, community facilities and transport routes in Paisley (11059)  Reduce the risk of river flooding to residential properties and non-residential properties from the White Cart Water (11019)		
<b>Delivery lead:</b>	Glasgow Clyde Valley Green Network on behalf of local authorities		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	The strategic assessment identified that there are widespread areas with the potential for natural flood management, therefore a catchment wide natural flood management study is recommended for the White Cart Water catchment. The study should focus on the potential for runoff control and sediment management within the tributaries of the White Cart Water, however it should also examine how these might combine to reduce flows to the White Cart Water itself.		

Potential impacts	
<b>Economic:</b>	The economic impact of natural flood management actions is difficult to define. However, these actions can reduce risk for high likelihood events.
<b>Social:</b>	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 natural flood management study area. In addition there are one emergency service and four utilities which have been identified as potentially benefitting from this action. Natural flood management actions can restore and enhance natural environments and create opportunities for recreation and tourism.
<b>Environmental:</b>	Natural flood management actions can have a positive impact on the ecological quality of the environment by restoring and enhancing natural habitats.

<b>Action (ID):</b>	<b>SURFACE WATER PLAN/STUDY (110070018)</b>		
<b>Objective (ID):</b>	Reduce the economic damages and number of people at risk of surface water flooding in Glasgow City (11007)		
<b>Delivery lead:</b>	Glasgow City Council		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2028-2033</b>
<b>Description:</b>	The area must be covered by a strategy to manage and reduce surface water flood risk and identify the most sustainable actions to achieve the objectives. This strategy has been developed by the Metropolitan Glasgow Strategic Drainage Partnership. The detailed objectives and actions to manage and reduce surface water flood risk will be set out in the area specific surface water management plans described below.		

<b>Action (ID):</b>	<b>SURFACE WATER PLAN/STUDY (110880018)</b>		
<b>Objective (ID):</b>	Reduce the economic damages and risk to people from surface water flooding in Barrhead (11088)		
<b>Delivery lead:</b>	East Renfrewshire Council		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	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. The Metropolitan Glasgow Strategic Drainage Partnership will support the 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.		

<b>Action (ID):</b>	<b>SURFACE WATER PLAN/STUDY (110890018)</b>		
<b>Objective (ID):</b>	Reduce economic damages and risk to people from surface water flooding in Merrylee, Thornliebank, Giffnock and Eastwood North (11089)		

<b>Delivery lead:</b>	East Renfrewshire Council		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2027</b>
<b>Description:</b>	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. The Metropolitan Glasgow Strategic Drainage Partnership will support the process and improve knowledge and understanding of surface water flood risk and interactions with other sources of flooding e.g. with the sewer network and watercourses. Merrylee section of the plan to be completed in the first cycle with remaining areas to be completed during the second Flood Risk Management cycle.		

<b>Action (ID):</b>	<b>SURFACE WATER PLAN/STUDY (110900018)</b>		
<b>Objective (ID):</b>	Reduce the economic damages and risk to people from surface water flooding in Newton Mearns (11090)		
<b>Delivery lead:</b>	East Renfrewshire Council		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	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. The Metropolitan Glasgow Strategic Drainage Partnership will support the process and improve knowledge and understanding of surface water flood risk and interactions with other sources of flooding e.g. with the sewer network and watercourses.		

<b>Action (ID):</b>	<b>SURFACE WATER PLAN/STUDY (110920018)</b>		
<b>Objective (ID):</b>	Reduce the economic damages and risk to people from surface water flooding in Darnley Mains (11092)		
<b>Delivery lead:</b>	Glasgow City Council		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	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. The Metropolitan Glasgow Strategic Drainage Partnership will support the 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.		

<b>Action (ID):</b>	<b>SURFACE WATER PLAN/STUDY (111060018)</b>		
<b>Objective (ID):</b>	Reduce the economic damages and risk to people from surface water flooding in Hillington and Cardonald (11106)		
<b>Delivery lead:</b>	Glasgow City Council		

<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	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. The plan is being carried out by Glasgow City Council and Renfrewshire Council. The Metropolitan Glasgow Strategic Drainage Partnership will support the 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.		

<b>Action (ID):</b>	<b>SURFACE WATER PLAN/STUDY (111181018)</b>		
<b>Objective (ID):</b>	Reduce the economic damages and risk to people from surface water flooding in Paisley (11118)		
<b>Delivery lead:</b>	Renfrewshire Council		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	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. The Metropolitan Glasgow Strategic Drainage Partnership will support the 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.		

<b>Action (ID):</b>	<b>SURFACE WATER PLAN/STUDY (111190018)</b>		
<b>Objective (ID):</b>	Reduce the economic damages and risk to people from surface water flooding in East Kilbride (11119)		
<b>Delivery lead:</b>	South Lanarkshire Council		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>SURFACE WATER PLAN/STUDY (111190019)</b>		
<b>Objective (ID):</b>	Reduce the economic damages and risk to people from surface water flooding in East Kilbride (11119)		
<b>Delivery lead:</b>	Scottish Water in partnership with South Lanarkshire Council		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	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 and		

watercourses.
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<b>Action (ID):</b>	<b>SURFACE WATER PLAN/STUDY (111300018)</b>		
<b>Objective (ID):</b>	Reduce the economic damages and risk to people from surface water flooding in Newlands (11130)		
<b>Delivery lead:</b>	Glasgow City Council		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2022-2027</b>
<b>Description:</b>	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. The Metropolitan Glasgow Strategic Drainage Partnership will support the 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.		

<b>Action (ID):</b>	<b>SURFACE WATER PLAN/STUDY (111310018)</b>		
<b>Objective (ID):</b>	Reduce the economic damages and risk to people from surface water flooding in Nitshill and Priesthill (11131)		
<b>Delivery lead:</b>	Glasgow City Council		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2022-2027</b>
<b>Description:</b>	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. The Metropolitan Glasgow Strategic Drainage Partnership will support the 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.		

<b>Action (ID):</b>	<b>STRATEGIC MAPPING AND MODELLING (111320019)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Scottish Water		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>MAINTAIN FLOOD PROTECTION SCHEME (110190017)</b>		
<b>Objective (ID):</b>	Reduce the risk of river flooding to residential properties and non-residential properties from the White Cart Water (11019)		
<b>Delivery lead:</b>	Glasgow City Council		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	In Langside and Shawlands there are sections of direct flood defences constructed along the White Cart Water and Auldhouse Burn as part of the White Cart Water Flood Protection Scheme which provide protection to the area. This scheme along with the new phase of work, will be maintained, and will continue to manage flooding according to the design standard at the time of construction. Levels of flood risk are likely to increase over time as a consequence of climate change.		

<b>Action (ID):</b>	<b>MAINTAIN FLOOD PROTECTION SCHEME (110590017)</b>		
<b>Objective (ID):</b>	Reduce the risk of flooding from the Espedair Burn / Gleniffer Burn and surface water to residential properties, non-residential properties, community facilities and transport routes in Paisley (11059)		
<b>Delivery lead:</b>	Renfrewshire Council		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	The Moredun Flood Protection Scheme at Moredun playing fields provides offline storage from the Espedair Burn to a standard of protection of up to a 100 year flood. This scheme will be maintained, and will continue to manage flooding according to the design standard at the time of construction. Levels of flood risk are likely to increase over time as a consequence of climate change.		

<b>Action (ID):</b>	<b>MAINTAIN FLOOD PROTECTION SCHEME (110630017)</b>		
<b>Objective (ID):</b>	Reduce the risk of coastal flooding to residential properties, non-residential properties and transport routes in Renfrew North (11063)		
<b>Delivery lead:</b>	Renfrewshire Council		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	The North Renfrew Flood Protection Scheme consists of embankments, demountable barriers, raised ground and a new pumping station. This scheme will be maintained, and will continue to manage flooding according to the design standard at the time of construction.		

<b>Action (ID):</b>	<b>MAINTAIN FLOOD WARNING (111320030)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	SEPA		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>Continue to maintain the Alyth Crescent, Pollok, Pollokshaws, Pollok Country Park and the Shawlands, Langside and Cathcart flood warning areas which are part of the White Cart Water flood warning scheme.</p> <p>Continue to maintain the Glasgow Quay Walls and Renfrew flood warning areas which are part of the Firth of Clyde coastal flood warning scheme.</p>		

<b>Action (ID):</b>	<b>FLOOD FORECASTING (111320009)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	SEPA		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>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.</p>		

<b>Action (ID):</b>	<b>COMMUNITY FLOOD ACTION GROUPS (110190012)</b>		
<b>Objective (ID):</b>	Reduce the risk of river flooding to residential properties and non-residential properties from the White Cart Water (11019)		
<b>Delivery lead:</b>	Community		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>The local community set up the White Cart Action group, to raise awareness of flood risk in the area. Although the White Cart Water scheme has reduced flood risk, it is recommended that the group continues to carry out these functions.</p>		



<b>Action (ID):</b>	<b>SELF HELP (111320011)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	—		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>AWARENESS RAISING (111320013)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Responsible authorities		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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 and promote Floodline. This will be achieved through SEPA-led education events. The South Lanarkshire Council winter awareness campaign, between October and March includes information on flooding. Local authorities will be undertaking additional awareness raising activities. Further details will be set out in the Local FRM Plan.		

<b>Action (ID):</b>	<b>MAINTENANCE (111320007)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Local authorities, asset / land managers		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>SITE PROTECTION PLANS (110190015)</b>		
<b>Objective (ID):</b>	Reduce the risk of river flooding to residential properties and non-residential properties from the White Cart Water (11019)		
<b>Delivery lead:</b>	Glasgow City Council		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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. The site protection plans that are in place for Strathclyde Police Horse and Dog Training Division and the cattle in Pollok Country Park should be maintained and periodically reviewed.		

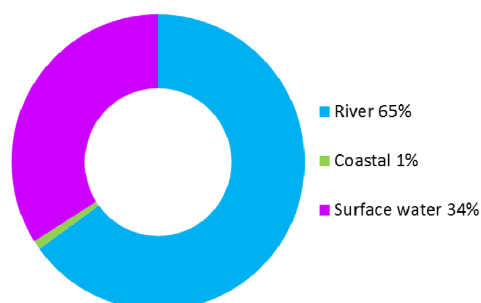
<b>Action (ID):</b>	<b>EMERGENCY PLANS/RESPONSE (111320014)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Category 1 and 2 Responders		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	Providing an emergency response to flooding 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.		

<b>Action (ID):</b>	<b>PLANNING POLICIES (111270001)</b>		
<b>Objective (ID):</b>	Avoid an overall increase in flood risk (11127) Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Planning authority		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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.		

## Rutherglen (Potentially Vulnerable Area 11/14)

Local Plan District	Local authority	Main catchment
Clyde and Loch Lomond	Glasgow City Council, South Lanarkshire Council	Cityford Burn

### Summary of flooding impacts



#### At risk of flooding

- 1,800 residential properties
- 280 non-residential properties
- £3.2 million Annual Average Damages

(damages by flood source shown left)

Summary of flooding impacts

### 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.

Objectives

### Summary of actions to manage flooding

The actions below have been selected to manage flood risk.

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

Actions

## Rutherglen (Potentially Vulnerable Area 11/14)

Local Plan District	Local authority	Main catchment
Clyde and Loch Lomond	Glasgow City Council, South Lanarkshire Council	Cityford Burn

### Background

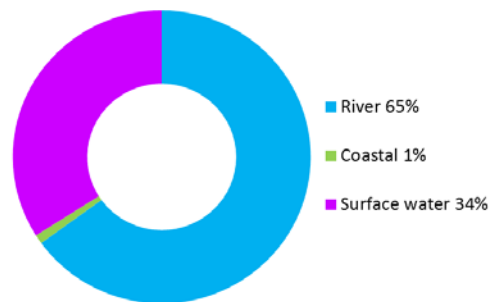
This Potentially Vulnerable Area is located to the south of Glasgow City centre and is approximately 10km<sup>2</sup> (shown below). It incorporates Rutherglen, spanning south to the Cathkin Braes.



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

There are approximately 1,800 residential properties and 280 non-residential properties at risk of flooding. The Annual Average Damages are approximately £3.2 million.



**Figure 1:** Annual Average Damages by flood source

### Summary of flooding impacts

River flooding is from the River Clyde and the Cityford Burn. The Cityford Burn has sections of open channel and sections of culvert as it flows in a northerly direction through Castlemilk, Croftfoot and Rutherglen and into the Clyde. The majority of river flooding is from the Cityford Burn, which primarily affects residential properties, but also non-residential properties, community facilities, utilities and sections of the road network (notably the A730).

The Clyde flows in a north-westerly direction along the northern boundary of the area. There are two locations where river flooding is attributed to the Clyde in the vicinity of the Dalmarnock Road and also Richmond Park. At both of these locations a number of non-residential properties and sections of the road network are predicted to be affected. In the latter location there is an interaction with tidal flooding.

Interaction between surface water flooding and river flooding is a potential problem within the area. Surface water flooding is mainly located along the line of the Cityford Burn, which is an indication of the low lying topography of the river corridor, but also areas which have been historically culverted. Surface water flooding is also predicted at isolated locations with a large number of residential and non-residential properties, transport routes (notably railway lines, A728 and A730), community facilities and

utilities impacted. The areas at highest risk from surface water flooding will require the preparation of surface water management plans.

Scottish Water and local authorities have completed a number of studies, including strategic and detailed assessments of the risk from surface water flooding and interaction with river flooding along with mitigation measures. Many of these studies have been helped by the partnership working developed within the Metropolitan Glasgow Strategic Drainage Partnership. This has led to the implementation of schemes and works to protect properties from river and surface water flooding.

Coastal flooding does not contribute significantly to the overall risk within the Potentially Vulnerable Area, with only a small area adjacent to the River Clyde predicted to be at risk. At this location, Richmond Park, the adjacent sports ground, the A728 and a number of industrial units are affected. This location, opposite Glasgow Green, has a tidal weir which limits tidal influence further up the River Clyde.

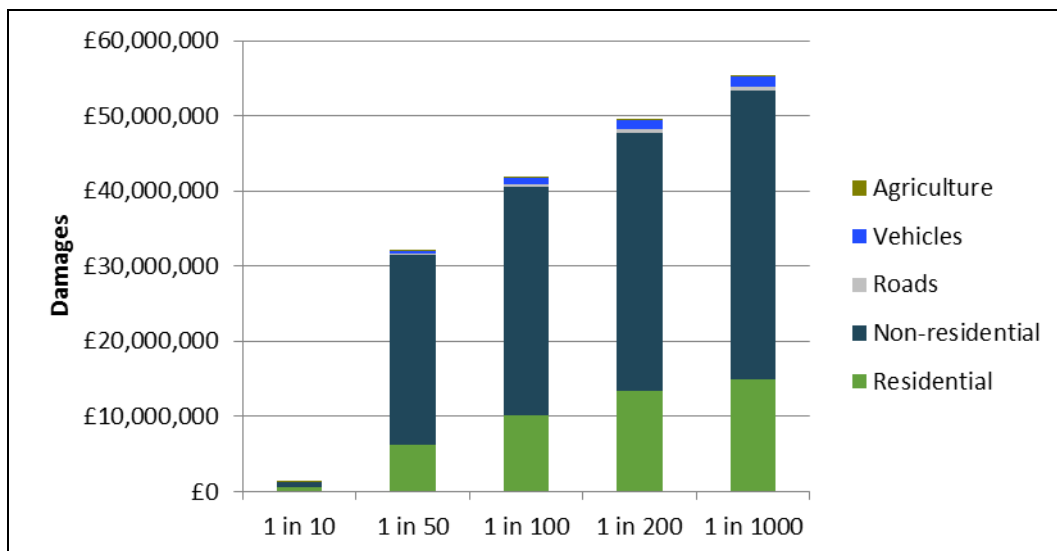
The risk of flooding to people and property, as well as to community facilities, utilities, the transport network, designated sites and agricultural land is summarised in Table 1. The damages associated with floods of different likelihood are shown in Figure 2. Non-residential properties affected by river flooding experience the highest economic impacts.

Within this Potentially Vulnerable Area it is estimated that climate change will increase the number of residential properties at risk of flooding from approximately 1,800 to 2,100 and the number of non-residential properties from approximately 280 to 360.

The location of the impacts of flooding is shown in Figure 3. Flooding impacts are widespread within this area, with concentrations of flooding around Castlemilk and Croftfoot.

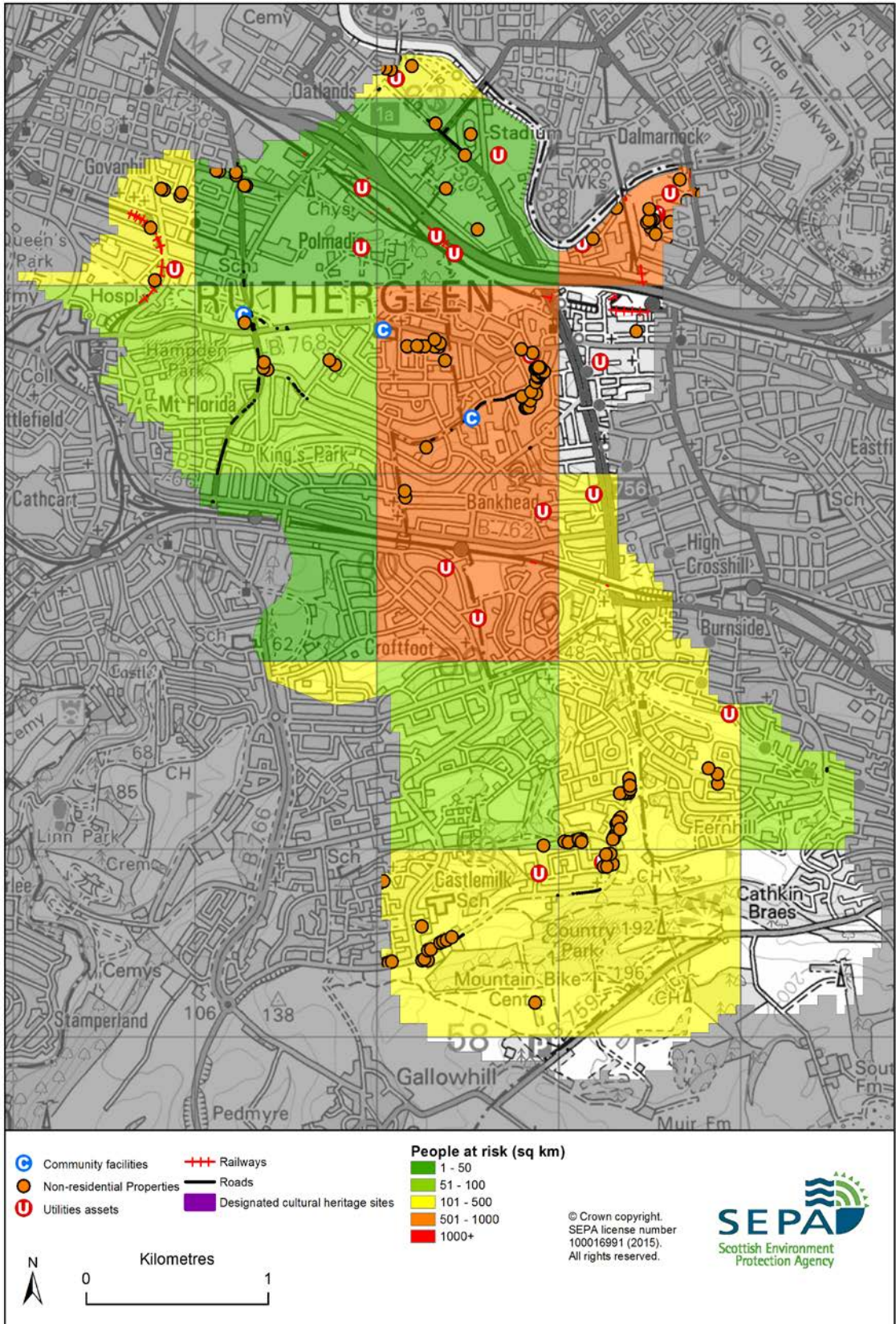
	1 in 10 High likelihood	1 in 200 Medium likelihood	1 in 1000 Low likelihood
Residential properties (total 22,000)	510	1,800	2,400
Non-residential properties (total 2700)	70	280	380
People	1,100	4,000	5,300
Community facilities	<10 Healthcare facilities	<10 Includes: educational buildings, emergency services and healthcare facilities	<10 Includes: educational buildings, emergency services and healthcare facilities
Utilities assets	<10	30	40
Transport links - roads (km)	1.4	5.6	7.1
Transport links - rail (km)	0.5	1.5	1.9
Environmental designated areas (km <sup>2</sup> )	0	0	0
Designated cultural heritage sites	0	0	0
Agricultural land (km <sup>2</sup> )	0.01	0.04	0.04

**Table 1:** Summary of flooding impacts<sup>1</sup>



**Figure 2:** Damages by flood likelihood

<sup>1</sup> Some receptors are counted more than once if flooded from multiple sources



**Figure 3: Impacts of flooding**

## History of flooding

There have been 40 reported incidents of flooding in this Potentially Vulnerable Area. The majority of records are from river flooding from the River Clyde. Major floods from this river occurred in 1864 and 1903. In September 1948 the Clyde flooded, resulting in one fatality. The river is tidally influenced and these floods were a combined effect of high tides and river flooding.

In December 1994 flooding throughout the area affected properties, roads and land in the Shawfield area and Rutherglen. This flood promoted greater awareness of the potential risk in the area and was a driver for the South Lanarkshire Council flooding programme. The River Clyde was thought to have reached its highest level in 150 years, covered an area of 50km<sup>2</sup> and resulted in damages estimated at £100 million. Sewer flooding was also recorded in this event.

On 10 May 2004 flooding in Mill Street, Rutherglen affected major roads and properties. A combination of river and surface water flooding was recorded on 30 July 2002 in Toryglen, Carrick Road, Abbotsford, Dryburgh, Rosslyn Avenue and Cathcart Road. On 17 July 2011, flooding to Street Level on Cathkin Road and Inchmurrin Drive affected properties, gardens and roads. This flood was associated with heavy surface runoff and watercourse overtopping.

Surface water flooding has been recorded in Rutherglen at Toryglen Road and Mill Street in December 1999, affecting multiple properties and roads.



## Objectives to manage flooding in Potentially Vulnerable Area 11/14

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 Rutherglen Potentially Vulnerable Area.

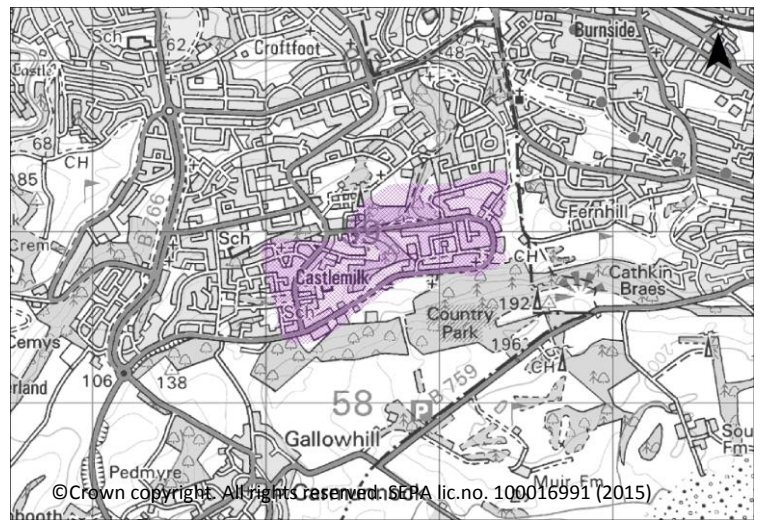
### Reduce the risk of flooding from the Spittal Burn and surface water to residential properties in Castlemilk

Indicators:

- 500 residential properties
- £600,000 Annual Average Damages

Objective ID: 11020

Target area:



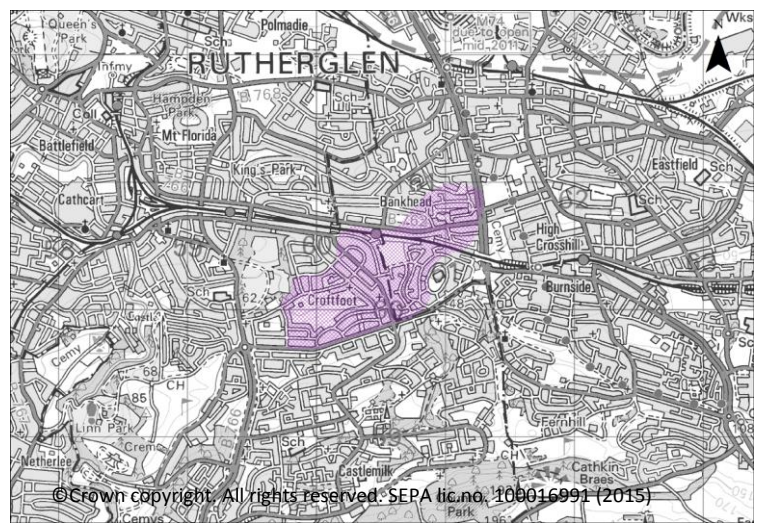
### Reduce the risk of river and surface water flooding to residential properties in Croftfoot

Indicators:

- 550 residential properties
- £880,000 Annual Average Damages

Objective ID: 11021

Target area:

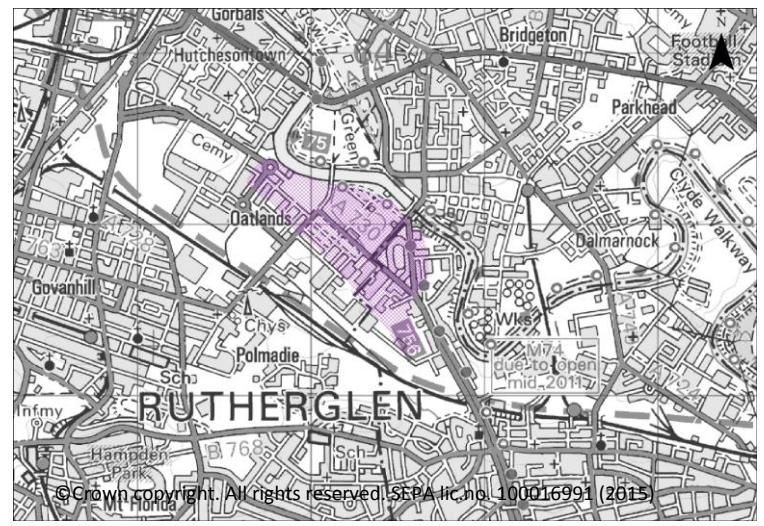


## Reduce the risk of flooding to residential properties and non-residential properties in Shawfield

Indicators:

- 180 residential properties
- 110 non-residential properties
- £440,000 Annual Average Damages

Target area:



Objective ID: 11022

Target area	Objective	ID	Indicators within PVA
Glasgow	Reduce the economic damages and number of people at risk of surface water flooding in Glasgow City	11007	* See note below
Kings Park, Glasgow	Reduce the economic damages and risk to people from surface water flooding in Kings Park	11097	* See note below
Overwood Drive and Aikenhead, Glasgow	Reduce the economic damages and risk to people from surface water flooding in Overwood Drive / Aikenhead	11100	* See note below
Croftfoot	Reduce the economic damages and risk to people from surface water flooding in Croftfoot	11107	* See note below
Muirbank	Reduce the economic damages and risk to people from surface water flooding in Muirbank	11123	* See note below
Castlemilk	Reduce the economic damages and risk to people from surface water flooding in Castlemilk	11129	* See note below
Applies across Clyde and Loch Lomond Local Plan District	Avoid an overall increase in flood risk	11127	<ul style="list-style-type: none"> <li>• 1,800 residential properties</li> <li>• £3.2 million Annual Average Damages</li> </ul>
Applies across Clyde and Loch Lomond Local Plan District	Reduce overall flood risk	11132	<ul style="list-style-type: none"> <li>• 1,800 residential properties</li> <li>• £3.2 million Annual Average Damages</li> </ul>
Applies across Clyde and Loch Lomond 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 11/14 there are 930 residential properties at risk and Annual Average Damages of £1.1 million.

## Actions to manage flooding in Potentially Vulnerable Area 11/14

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 Rutherglen Potentially Vulnerable Area.

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

<b>Action (ID):</b>	<b>FLOOD PROTECTION STUDY (110210005)</b>		
<b>Objective (ID):</b>	Reduce the economic damages and risk to people from surface water flooding in Croftfoot (11107) Reduce the risk of river and surface water flooding to residential properties in Croftfoot (11021)		
<b>Delivery lead:</b>	Glasgow City Council		
<b>Priority:</b>	National:	Within local authority:	
	<b>16 of 168</b>	<b>2 of 8</b>	
<b>Status:</b>	<b>Ongoing</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	<p>A flood protection study should be carried out to further investigate the following actions in detail, separately and in combination: construction of storage, modification of conveyance by upgrading a culverts and construction of an embankment along sections of the Cityford Burn / Spittal Burn.</p> <p>This study is linked to the Croftfoot surface water management plan which will help to identify the potential of actions , including sustainable drainage systems and property level protection. It is proposed that Glasgow City Council will carry out hydraulic studies in the Croftfoot and Spittal areas. These studies are being promoted via the City Deals project and are awaiting confirmation that funding will be approved.</p> <p>The Cathkin Road bypass project, which lies outwith the Target Area, involves attenuation and storage. It is being promoted via the City Deals and is awaiting confirmation that funding will be approved.</p>		
<b>Potential impacts</b>			
<b>Economic:</b>	There are 210 residential properties at risk of flooding in this location, with potential damages avoided of up to £33 million. The economic impact of natural flood management actions is difficult to define.		

<b>Economic:</b>	However, these actions can reduce flood risk for high likelihood events. In this location, it has been estimated that 60 residential and non-residential properties could potentially benefit from natural flood management actions.
<b>Social:</b>	A reduction in flood risk would have a positive benefit to the health and wellbeing of the community. In addition there are two community facilities, one educational building and two utilities which have been identified as potentially benefitting from this action. Natural flood management actions can restore and enhance natural environments and create opportunities for recreation and tourism.
<b>Environmental:</b>	Flood protection studies should consider the positive and negative impacts of proposed actions on the ecological quality of the environment. Natural flood management actions can have a positive impact by restoring and enhancing natural habitats. This study includes the Cityford Burn (water body ID 10930). The physical condition of this river is identified by river basin management planning to be at less than good status. Future works could improve the condition of the river or degrade it. Opportunities to improve the condition of the river should be considered by coordinating with river basin management planning. There are no international, national or local level environmental designations that are likely to be impacted by this action. There may be a loss of recreational land and natural and semi-natural habitats in the footprint of the storage areas and direct defences. There is the potential for creation of new wetland habitats. Downstream of the storage and culvert action there may be negative impacts on water quality through increased erosion and sedimentation. There are likely to be short term negative impacts on water quality during construction from increased sediment. There is the potential for slight positive impacts on water quality from the implementation of sustainable drainage systems in the area.

<b>Action (ID):</b>	<b>FLOOD PROTECTION STUDY (110200005)</b>		
<b>Objective (ID):</b>	Reduce the economic damages and risk to people from surface water flooding in Castlemilk (11129) Reduce the risk of flooding from the Spittal Burn and surface water to residential properties in Castlemilk (11020)		
<b>Delivery lead:</b>	Glasgow City Council and South Lanarkshire Council		
<b>Priority:</b>	National:		Within local authority:
	<b>19 of 168</b>		<b>4 of 8</b>
<b>Status:</b>	<b>Ongoing</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	A study is recommended to further investigate the feasibility of a flood protection scheme on the Cityford / Spittal Burn. The study should focus on identifying the most sustainable combination of actions for managing flooding in the area including, upstream storage, modification of conveyance by upgrading culverts and construction of an embankment along sections of the Cityford Burn / Spittal Burn. This study is linked to the Castlemilk and Croftfoot surface water management plans which will help to identify the potential of some of these actions, including sustainable drainage systems and the benefit of property level protection.		

Potential impacts	
<b>Economic:</b>	The flood protection study should consider how to reduce flooding to 250 residential properties and 30 non-residential properties in this location. The potential damages avoided are estimated to be up to £46 million. The economic impact of natural flood management actions is difficult to define. However, these actions can reduce flood risk for high likelihood events. In this location, it has been estimated that 150 residential and non-residential properties could potentially benefit from natural flood management actions.
<b>Social:</b>	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. There may be negative impacts through disturbance to the local community during the construction phase and changes in visual amenity and land use as a result of this action.
<b>Environmental:</b>	Flood protection studies should consider the positive and negative impacts of proposed actions on the ecological quality of the environment. Natural flood management actions can have a positive impact by restoring and enhancing natural habitats. This study includes the Cityford Burn (water body ID 10930). The physical condition of this river is identified by river basin management planning to be at less than good status. Future works could improve the condition of the river or degrade it. Opportunities to improve the condition of the river should be considered by coordinating with river basin management planning. There are no international, national or local level environmental designations that are likely to be impacted by this action. There may be a loss of recreational land and natural and semi-natural habitats in the footprint of the storage areas and footprint and vicinity of the defences. There is the potential for creation of new wetland habitats. Downstream of the storage and culvert action there may be negative impacts on water quality through increased erosion and sedimentation. There are likely to be short term negative impacts on water quality during construction from increased sediment. There is the potential for slight positive impacts on water quality from the implementation of sustainable drainage systems in the area.

<b>Action (ID):</b>	<b>FLOOD PROTECTION STUDY (110220005)</b>		
<b>Objective (ID):</b>	Reduce the risk of flooding to residential properties and non-residential properties in Shawfield (11022)		
<b>Delivery lead:</b>	Glasgow City Council		
<b>Priority:</b>	National:	Within local authority:	
	<b>41 of 168</b>	<b>6 of 8</b>	
<b>Status:</b>	<b>Ongoing</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	It is recommended that a review of the Clyde Gateway masterplan at Shawfield is carried out to assess if further work is required to assess the level of flood risk. It is recommended that this review is coordinated between Glasgow City Council and South Lanarkshire Council for Rutherglen / Shawfield areas.		

	If the review identifies further investigation of actions may be required, sustainable drainage systems and property level protection should be considered.
<b>Potential impacts</b>	
<b>Economic:</b>	This study should investigate how to reduce flooding to 140 residential properties and 60 non-residential properties in this location, with potential damages avoided of up to £9.7 million.
<b>Social:</b>	A reduction in flood risk would have a positive benefit to the health and wellbeing of the community. In addition there are two utilities which have been identified as potentially benefitting from this action.
<b>Environmental:</b>	Flood protection studies should consider the positive and negative impacts of proposed actions on the ecological quality of the environment.

<b>Action (ID):</b>	<b>SURFACE WATER PLAN/STUDY (110070018)</b>		
<b>Objective (ID):</b>	Reduce the economic damages and number of people at risk of surface water flooding in Glasgow City (11007)		
<b>Delivery lead:</b>	Glasgow City Council		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2028-2033</b>
<b>Description:</b>	The area must be covered by a strategy to manage and reduce surface water flood risk and identify the most sustainable actions to achieve the objectives. This strategy has been developed by the Metropolitan Glasgow Strategic Drainage Partnership. The detailed objectives and actions to manage and reduce surface water flood risk will be set out in the area specific surface water management plans described below.		

<b>Action (ID):</b>	<b>SURFACE WATER PLAN/STUDY (110970018)</b>		
<b>Objective (ID):</b>	Reduce the economic damages and risk to people from surface water flooding in Kings Park (11097)		
<b>Delivery lead:</b>	Glasgow City Council		
<b>Status:</b>	<b>Ongoing</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	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. The Metropolitan Glasgow Strategic Drainage Partnership will support the 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.		

<b>Action (ID):</b>	<b>SURFACE WATER PLAN/STUDY (111070018)</b>		
<b>Objective (ID):</b>	Reduce the economic damages and risk to people from surface water flooding in Croftfoot (11107)		
<b>Delivery lead:</b>	Glasgow City Council		
<b>Status:</b>	<b>Ongoing</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	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. The Metropolitan Glasgow Strategic Drainage Partnership will support the 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.		

<b>Action (ID):</b>	<b>SURFACE WATER PLAN/STUDY (111230018)</b>		
<b>Objective (ID):</b>	Reduce the economic damages and risk to people from surface water flooding in Muirbank (11123)		
<b>Delivery lead:</b>	South Lanarkshire Council		
<b>Status:</b>	<b>Ongoing</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>SURFACE WATER PLAN/STUDY (111290018)</b>		
<b>Objective (ID):</b>	Reduce the economic damages and risk to people from surface water flooding in Castlemilk (11129)		
<b>Delivery lead:</b>	Glasgow City Council		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	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. The Metropolitan Glasgow Strategic Drainage Partnership will support the 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.		



<b>Action (ID):</b>	<b>STRATEGIC MAPPING AND MODELLING (111320019)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Scottish Water		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>MAINTAIN FLOOD PROTECTION SCHEME (110210017)</b>		
<b>Objective (ID):</b>	Reduce the risk of river and surface water flooding to residential properties in Croftfoot (11021)		
<b>Delivery lead:</b>	Glasgow City Council		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	The Cityford Burn Culvert Flood Protection Scheme was completed in 2006 and entailed extending a culvert and creating an over ground storage channel. The scheme was designed to protect properties in Landemer Drive from fluvial flooding up to a 200 year flood. This scheme will be maintained, and will continue to manage flooding according to the design standard at the time of construction. Levels of flood risk are likely to increase over time as a consequence of climate change.		

<b>Action (ID):</b>	<b>FLOOD FORECASTING (111320009)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	SEPA		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>COMMUNITY FLOOD ACTION GROUPS (110210012)</b>		
<b>Objective (ID):</b>	Reduce the risk of river and surface water flooding to residential properties in Croftfoot (11021)		
<b>Delivery lead:</b>	Community		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	The local community set up the Croftfoot Action group, to raise awareness of flood risk in the area. It is recommended that this group continues it's activities.		

<b>Action (ID):</b>	<b>SELF HELP (111320011)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	—		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>AWARENESS RAISING (111320013)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Responsible authorities		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>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.</p> <p>From 2016 SEPA will engage with the community through local participation in national initiatives, including partnership working with the Safer Rutherglen group and Neighbourhood Watch Scotland.</p> <p>The South Lanarkshire Council winter awareness campaign, between October and March includes information on flooding.</p> <p>Local authorities will be undertaking additional awareness raising activities. Further details will be set out in the Local FRM Plan.</p>		

<b>Action (ID):</b>	<b>MAINTENANCE (111320007)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Local authorities, asset / land managers		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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.		

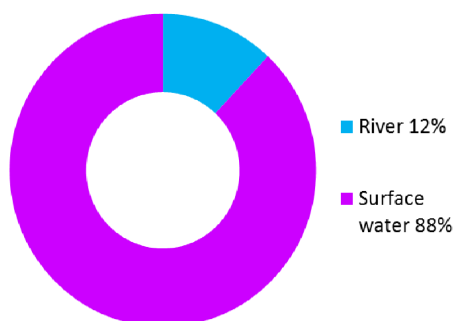
<b>Action (ID):</b>	<b>EMERGENCY PLANS/RESPONSE (111320014)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Category 1 and 2 Responders		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	Providing an emergency response to flooding 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.		

<b>Action (ID):</b>	<b>PLANNING POLICIES (111270001)</b>		
<b>Objective (ID):</b>	Avoid an overall increase in flood risk (11127) Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Planning authority		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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.		

## Glasgow City north (Potentially Vulnerable Area 11/15)

Local Plan District	Local authority	Main catchment
Clyde and Loch Lomond	Glasgow City Council, North Lanarkshire Council	East Glasgow

### Summary of flooding impacts



#### At risk of flooding

- 710 residential properties
- 410 non-residential properties
- £750,000 Annual Average Damages

(damages by flood source shown left)

Summary of flooding impacts

### 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.

Objectives

### Summary of actions to manage flooding

The actions below have been selected to manage flood risk.

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

Actions

## Glasgow City north (Potentially Vulnerable Area 11/15)

Local Plan District	Local authority	Main catchment
Clyde and Loch Lomond	Glasgow City Council, North Lanarkshire Council	East Glasgow

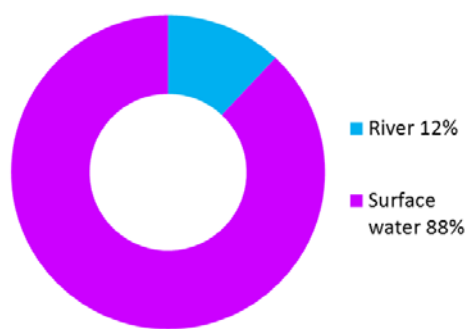
### Background

This Potentially Vulnerable Area is located in Glasgow City centre and is approximately 30km<sup>2</sup> (shown below). The area incorporates the Old Balornock, Millerston, Queenslie, Greenfield, Bridgeton, Calton and Dennistoun sections of the city.



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

There are approximately 710 residential properties and 410 non-residential properties at risk of flooding. The Annual Average Damages are approximately £750,000.



**Figure 1:** Annual Average Damages by flood source

### Summary of flooding impacts

Surface water flooding affects residential properties and main transport routes (notably; railway lines, M8, M80 and A74). The areas at highest risk from surface water flooding will require the preparation of surface water management plans.

River flooding is limited to small pockets of flooding to the west of Greenfield and in Glasgow Green. River flooding is most likely to occur in the areas where watercourses are restricted by a culvert or another structure.

Scottish Water and local authorities have completed a number of studies, including strategic and detailed assessments of the risk from surface water flooding and its interaction with river flooding, as well as considering mitigation actions. Many of these studies have been helped by the partnership working developed within the Metropolitan Glasgow Strategic Drainage Partnership. This has led to the implementation of schemes and works to protect properties from river and surface water flooding.

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.

Residential properties affected by surface water flooding experience the highest economic impact at approximately 60% of the damages.

Within this Potentially Vulnerable Area it is estimated that climate change will increase the number of residential properties at risk of flooding from approximately 710 to 1,000 and the number of non-residential properties from approximately 410 to 550.

The location of the impacts of flooding is shown in Figure 3. There are impacts throughout the area with the greatest concentrations in the city centre and north of the M8. The M8 itself is at risk of flooding within this area.

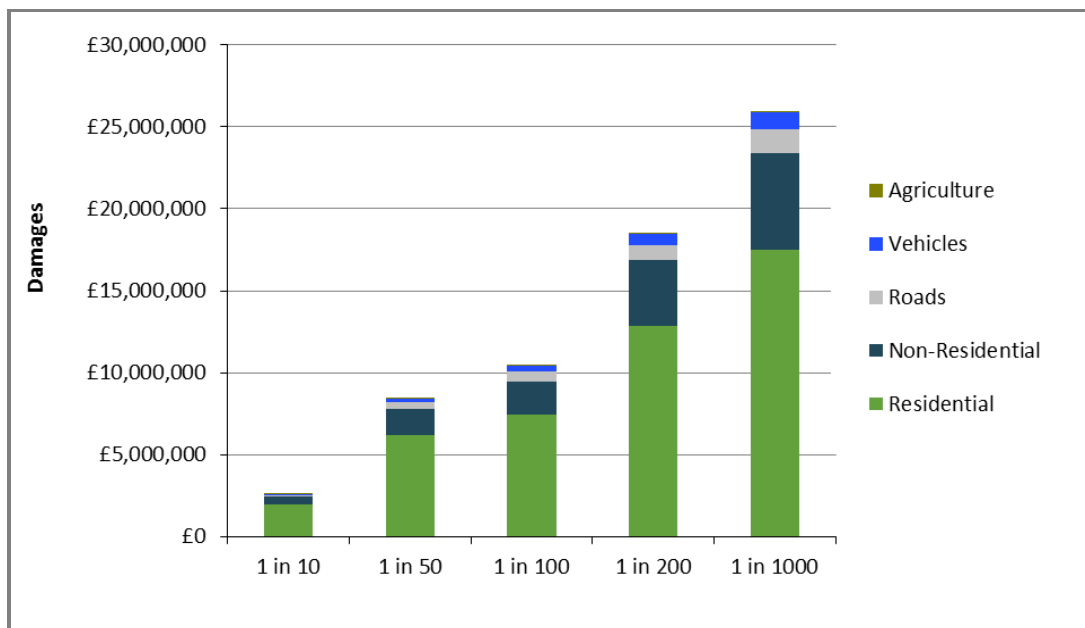
## **History of flooding**

Between the 10-12 December 1994 major flooding occurred in rivers and urban watercourses across the Glasgow and its surrounding areas. A slow-moving weather system delivered persistent rain over a 48 hour period across a wide geographical area. Previously recorded peak river flows were exceeded in all major catchments in the region.

In July and August 2002 flash floods affected the areas of Greenfield and Shettleston, which is just outside this Potentially Vulnerable Area. A total of 200 people were evacuated and a number of roads were badly affected by flooding in Sighthill, Springburn, as well as the main A82 and A8 roads and the M8 motorway. Flash floods were again reported on the 25 July 2013.

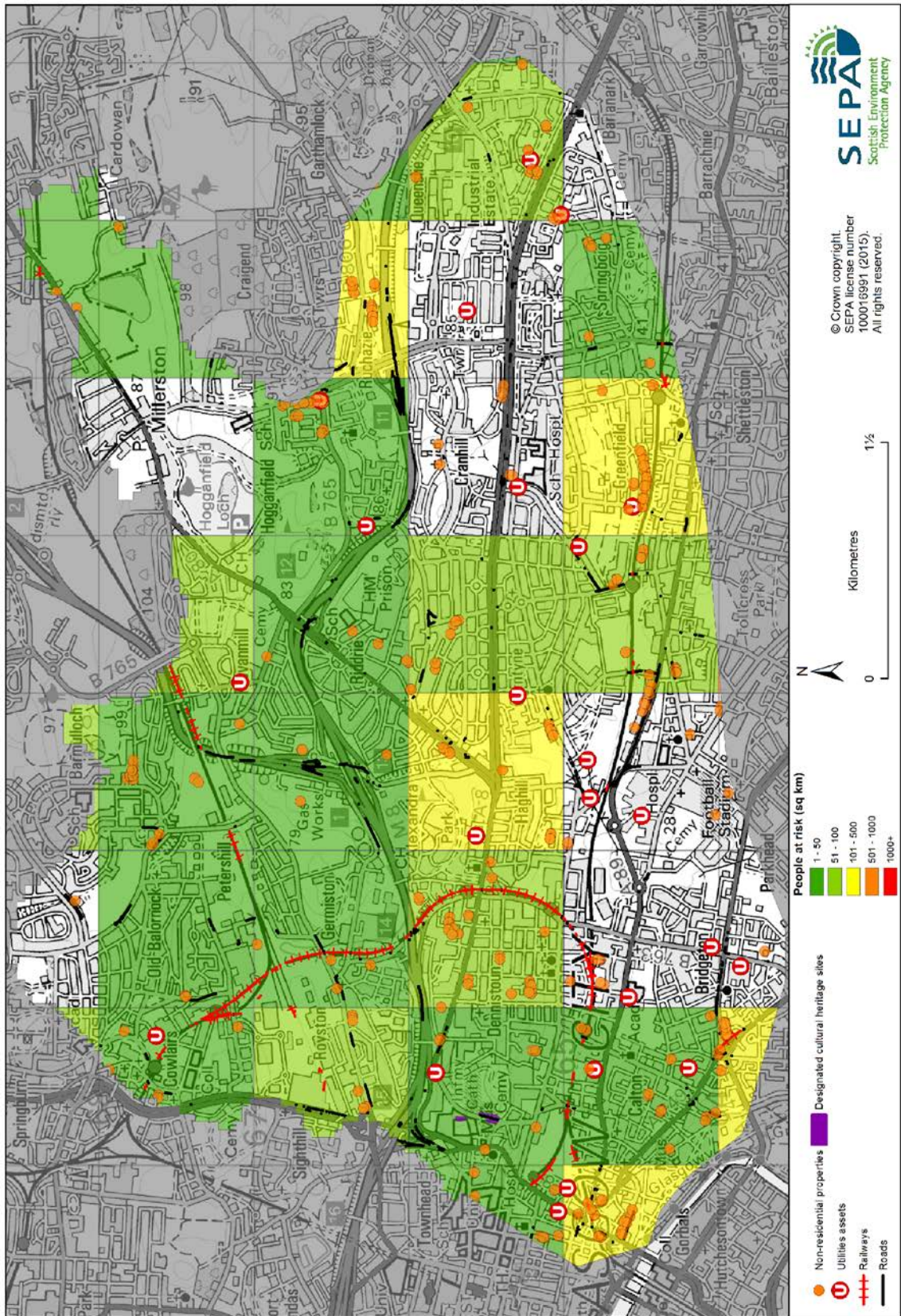
	1 in 10 High likelihood	1 in 200 Medium likelihood	1 in 1000 Low likelihood
Residential properties (total 49,000)	140	710	990
Non-residential properties (total 12,000)	120	410	540
People	320	1,600	2,200
Community facilities	0	0	0
Utilities assets	<10	20	30
Transport links-roads (km)	4.5 (of which 1.3 is motorway and <0.1 is A road)	10.2 (of which 3.2 is motorway and 0.3 is A road)	12.3 (of which 3.7 is motorway and 0.6 is A road)
Transport links-rail (km)	1.4	5.5	6.5
Transport links-airports	0	0	0
Environmental designated areas (km <sup>2</sup> )	0	0	0
Designated cultural heritage sites	6	6	7
Agricultural land (km <sup>2</sup> )	0	<0.1	<0.1

**Table 1:** Summary of flooding impacts<sup>1</sup>



**Figure 2:** Damages by flood likelihood

<sup>1</sup> Some receptors are counted more than once if flooded from multiple sources



**Figure 3: Impacts of flooding**



## Objectives to manage flooding in Potentially Vulnerable Area 11/15

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 Glasgow City north Potentially Vulnerable Area.

Target area	Objective	ID	Indicators within PVA
Glasgow	Reduce the economic damages and number of people at risk of surface water flooding in Glasgow City	11007	* See note below
Cockenzie Street, Glasgow	Reduce the economic damages and risk to people from surface water flooding in Cockenzie Street	11091	* See note below
East Springburn, Glasgow	Reduce the economic damages and risk to people from surface water flooding in East Springburn	11094	* See note below
Light Burn, Glasgow	Reduce the economic damages and risk to people from surface water flooding in Light Burn	11098	* See note below
Riddrie and Carntyne, Glasgow	Reduce the economic damages and risk to people from surface water flooding in Riddrie / Carntyne	11101	* See note below
Applies across Clyde and Loch Lomond Local Plan District	Avoid an overall increase in flood risk	11127	<ul style="list-style-type: none"> <li>• 710 residential properties</li> <li>• £750,000 Annual Average Damages</li> </ul>
Applies across Clyde and Loch Lomond Local Plan District	Reduce overall flood risk	11132	<ul style="list-style-type: none"> <li>• 710 residential properties</li> <li>• £750,000 Annual Average Damages</li> </ul>
Applies across Clyde and Loch Lomond 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 11/15 there are 660 residential properties at risk and Annual Average Damages of £660,000.

## Actions to manage flooding in Potentially Vulnerable Area 11/15

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 Glasgow City north Potentially Vulnerable Area.

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

<b>Action (ID):</b>	<b>SURFACE WATER PLAN/STUDY (110070018)</b>		
<b>Objective (ID):</b>	Reduce the economic damages and number of people at risk of surface water flooding in Glasgow City (11007)		
<b>Delivery lead:</b>	Glasgow City Council		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2028-2033</b>
<b>Description:</b>	The area must be covered by a strategy to manage and reduce surface water flood risk and identify the most sustainable actions to achieve the objectives. This strategy has been developed by the Metropolitan Glasgow Strategic Drainage Partnership. The detailed objectives and actions to manage and reduce surface water flood risk will be set out in the area specific surface water management plans described below.		

<b>Action (ID):</b>	<b>SURFACE WATER PLAN/STUDY (110910018)</b>		
<b>Objective (ID):</b>	Reduce the economic damages and risk to people from surface water flooding in Cockenzie Street (11091)		
<b>Delivery lead:</b>	Glasgow City Council		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	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. The Metropolitan Glasgow Strategic Drainage Partnership will support the 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.		

<b>Action (ID):</b>	<b>SURFACE WATER PLAN/STUDY (110940018)</b>		
<b>Objective (ID):</b>	Reduce the economic damages and risk to people from surface water flooding in East Springburn (11094)		
<b>Delivery lead:</b>	Glasgow City Council		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	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. The Metropolitan Glasgow Strategic Drainage Partnership will support the 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.		

<b>Action (ID):</b>	<b>SURFACE WATER PLAN/STUDY (110980018)</b>		
<b>Objective (ID):</b>	Reduce the economic damages and risk to people from surface water flooding in Light Burn (11098)		
<b>Delivery lead:</b>	Glasgow City Council		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2022-2027</b>
<b>Description:</b>	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. The Metropolitan Glasgow Strategic Drainage Partnership will support the 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.		

<b>Action (ID):</b>	<b>SURFACE WATER PLAN/STUDY (111010018)</b>		
<b>Objective (ID):</b>	Reduce the economic damages and risk to people from surface water flooding in Riddrie / Carntyne (11101)		
<b>Delivery lead:</b>	Glasgow City Council		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2022-2027</b>
<b>Description:</b>	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. The Metropolitan Glasgow Strategic Drainage Partnership will support the 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.		

<b>Action (ID):</b>	<b>STRATEGIC MAPPING AND MODELLING (111320019)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Scottish Water		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>FLOOD FORECASTING (111320009)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	SEPA		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>SELF HELP (111320011)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	—		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>AWARENESS RAISING (111320013)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Responsible authorities		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>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.</p> <p>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.</p>		

<b>Action (ID):</b>	<b>MAINTENANCE (111320007)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Local authorities, asset / land managers		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>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.</p>		

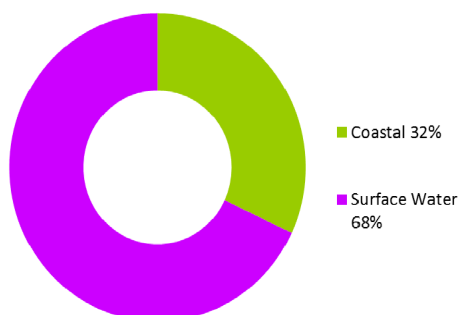
<b>Action (ID):</b>	<b>EMERGENCY PLANS/RESPONSE (111320014)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Category 1 and 2 Responders		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>Providing an emergency response to 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.</p>		

<b>Action (ID):</b>	<b>PLANNING POLICIES (111270001)</b>		
<b>Objective (ID):</b>	Avoid an overall increase in flood risk (11127) Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Planning authority		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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.		

## Glasgow City centre (Potentially Vulnerable Area 11/16)

Local Plan District	Local authority	Main catchment
Clyde and Loch Lomond	Glasgow City Council	River Clyde

### Summary of flooding impacts



#### At risk of flooding

- 420 residential properties
- 460 non-residential properties
- £550,000 Annual Average Damages

(damages by flood source shown left)

Summary of flooding impacts

### 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.

Objectives

### Summary of actions to manage flooding


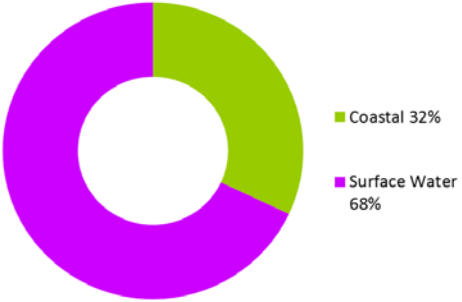
The actions below have been selected to manage flood risk.

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

Actions

# Glasgow City centre (Potentially Vulnerable Area 11/16)

Local Plan District	Local authority	Main catchment
Clyde and Loch Lomond	Glasgow City Council	River Clyde

Background							
<p>This Potentially Vulnerable Area is located in Glasgow City centre along the north of the River Clyde between Glasgow Bridge in the east and the riverside museum to the west (shown below). The area incorporates Yorkhill, Glasgow Central railway station, Townhead and is approximately 4km<sup>2</sup>.</p>  <p><small>© Crown copyright. SEPA licence number 100016991 (2015). All rights reserved.</small></p>	<p>The area has a risk of river, surface water and coastal flooding. The majority of damages are caused by surface water flooding.</p> <p>There are approximately 420 residential properties and 460 non-residential properties at risk of flooding. The Annual Average Damages are approximately £550,000.</p>  <table border="1"> <caption>Data for Figure 1: Annual Average Damages by flood source</caption> <thead> <tr> <th>Flood Source</th> <th>Percentage</th> </tr> </thead> <tbody> <tr> <td>Surface Water</td> <td>68%</td> </tr> <tr> <td>Coastal</td> <td>32%</td> </tr> </tbody> </table> <p><b>Figure 1: Annual Average Damages by flood source</b></p>	Flood Source	Percentage	Surface Water	68%	Coastal	32%
Flood Source	Percentage						
Surface Water	68%						
Coastal	32%						

## Summary of flooding impacts

Surface water flooding in the area impacts residential properties and there is also the potential for flooding to restrict access to many others. The areas at highest risk from surface water flooding will require the preparation of surface water management plans.

Scottish Water and local authorities have completed a number of studies in the area. These have included strategic and detailed assessments of surface water risk and its interaction with river flooding, as well as considering mitigation actions. Many of these studies have been helped by the partnership working developed within the Metropolitan Glasgow Strategic Drainage Partnership. This has led to the implementation of schemes and works to protect properties from river and surface water flooding.

The southern boundary of the Potentially Vulnerable Area fronts onto the River Clyde which is tidal over this entire reach. Coastal flooding is predicted to affect approximately 170 residential and 20 non-residential properties as well as sections of the road and rail network. Coastal flood risk is centred on the mouth of the River



Kelvin, in the vicinity of the Scottish Exhibition and Conference Centre, and sections of Lancefield and Anderston Quay as far as the Kingston (M8) Bridge.

The assessment of coastal flooding does not include local surge and wave impacts which have the potential to increase coastal flood risk. Severe weather conditions to the south and west of the Firth of Clyde can cause a surge that will run up the Firth as far as Glasgow. If a surge coincided with a high tide, the water level could rise above the quay walls in the city centre, increasing the identified risk.

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. Non-residential properties affected by surface water flooding experience the highest economic impact at approximately 40% of the damages.

Within this Potentially Vulnerable Area it is estimated that climate change will increase the number of residential properties at risk of flooding from approximately 420 to 680 and the number of non-residential properties from approximately 460 to 830.

The location of the impacts of flooding is shown in Figure 3. The M8 and M74 are at risk of flooding within this Potentially Vulnerable Area.

## **History of flooding**

There is a long history of flooding within this area. Many of the river floods which caused damages to properties and people occurred prior to the Clyde being canalised and widened to the south (1700's and 1800's), however the city was very different at this time.

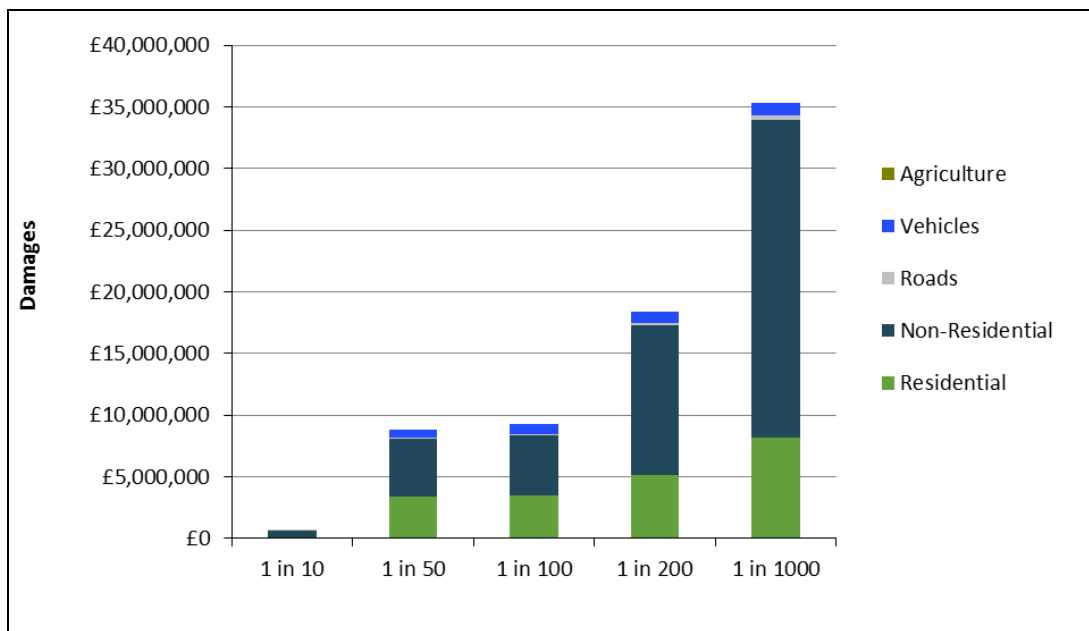
Between 10- 12 December 1994 major flooding occurred in rivers and urban watercourses across Glasgow and surrounding areas. A slow-moving weather system delivered persistent rain over a 48 hour period across a wide geographical area. Previously recorded peak river flows were exceeded in all major catchments in the region. The River Clyde is thought to have reached its highest level in 150 years, and the total cost of the damage reached in the region of £100 million. This flood had a magnitude of 50-100 year return period. There were 700 homes and many businesses affected in Strathclyde. This flood severely affected Glasgow City and completely inundated the grounds of the Scottish Exhibition and Conference Centre.

On 8 of August 1948 surface water flooding resulted in two deaths and transport disruption. Some homes were isolated by the flood waters and a telephone communication was affected.

There have been no coastal floods recorded within this Potentially Vulnerable Area; however, it is likely that many of the early river flood events could be attributed to tidal surges from the Clyde.

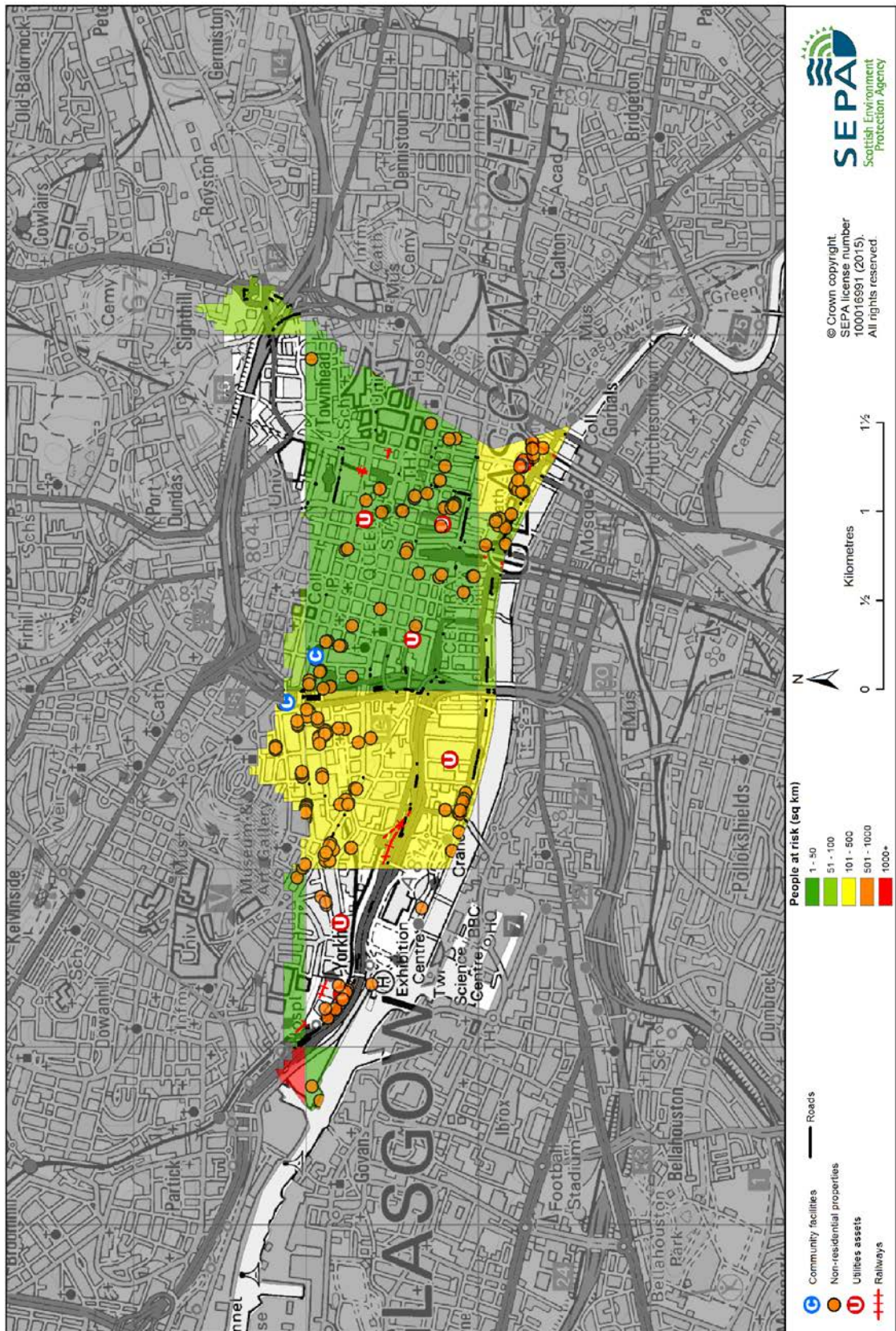
	1 in 10 High likelihood	1 in 200 Medium likelihood	1 in 1000 Low likelihood
Residential properties (total 10,000)	<10	420	720
Non-residential properties (total 10,000)	40	460	820
People	<10	920	1,600
Community facilities	0	<10 Includes: educational buildings and healthcare facilities	10 Includes: educational buildings, emergency services and healthcare facilities
Utilities assets	<10	<10	<10
Transport links-roads (km)	0.7 (of which 0.3 is motorway)	2.4 (of which 0.6 is motorway)	3.7 (of which 0.6 is motorway)
Transport links-rail (km)	0.4	1.2	1.7
Designated cultural heritage sites	0	20	39

**Table 1:** Summary of flooding impacts<sup>1</sup>



**Figure 2:** Damages by flood likelihood

<sup>1</sup> Some receptors are counted more than once if flooded from multiple sources



**Figure 3: Impacts of flooding**

## Objectives to manage flooding in Potentially Vulnerable Area 11/16

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 Glasgow City centre Potentially Vulnerable Area.

### Reduce the risk of coastal flooding to non-residential properties in the Exhibition Centre Quarter

Indicators:

- 10 non-residential properties
- £18,000 Annual Average Damages

Target area:



Objective ID: 11023

Target area	Objective	ID	Indicators within PVA
Glasgow	Reduce the economic damages and number of people at risk of surface water flooding in Glasgow City	11007	* See note below
Applies across Clyde and Loch Lomond Local Plan District	Avoid an overall increase in flood risk	11127	<ul style="list-style-type: none"> <li>• 420 residential properties</li> <li>• £550,000 Annual Average Damages</li> </ul>
Applies across Clyde and Loch Lomond Local Plan District	Reduce overall flood risk	11132	<ul style="list-style-type: none"> <li>• 420 residential properties</li> <li>• £550,000 Annual Average Damages</li> </ul>
Applies across Clyde and Loch Lomond 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 11/16 there are 240 residential properties at risk and Annual Average Damages of £370,000.

## Actions to manage flooding in Potentially Vulnerable Area 11/16

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 Glasgow City centre Potentially Vulnerable Area.

Selected actions					
Flood protection scheme/works	<i>Natural flood management works</i>	<i>New flood warning</i>	<i>Community flood action groups</i>	<i>Property level protection scheme</i>	Site protection plans
<i>Flood protection study</i>	<i>Natural flood management study</i>	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

<b>Action (ID):</b>	<b>FLOOD PROTECTION SCHEME/WORKS (110230006)</b>		
<b>Objective (ID):</b>	Reduce the economic damages and number of people at risk of surface water flooding in Glasgow City (11007)		
<b>Delivery lead:</b>	Scottish Water		
<b>Status:</b>	<b>Under development</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	Scottish Water have proposed a large combined sewer overflow interceptor for Yorkhill adjacent to the Heliport which will remove combined sewer spills from the River Kelvin. This will not reduce the risk of coastal flooding to the Exhibition Quarter.		
<b>Potential impacts</b>			
<b>Economic:</b>	This project is not principally designed to protect against flooding however it may help to reduce the impact of flooding in the local areas. As a consequence the flooding benefits have not been assessed.		
<b>Social:</b>	A reduction in flood risk would have a positive benefit to the health and wellbeing of the community.		
<b>Environmental:</b>	Flood protection works can have both positive and negative impacts on the ecological quality of the environment depending on how they are designed.		

<b>Action (ID):</b>	<b>SURFACE WATER PLAN/STUDY (110070018)</b>
<b>Objective (ID):</b>	Reduce the economic damages and number of people at risk of surface water flooding in Glasgow City (11007)
<b>Delivery lead:</b>	Glasgow City Council

<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2028-2033</b>
<b>Description:</b>	The area must be covered by a strategy to manage and reduce surface water flood risk and identify the most sustainable actions to achieve the objectives. This strategy has been developed by the Metropolitan Glasgow Strategic Drainage Partnership. The detailed objectives and actions to manage and reduce surface water flood risk will be set out in the area specific surface water management plans described below.		

<b>Action (ID):</b>	<b>STRATEGIC MAPPING AND MODELLING (111320019)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Scottish Water		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>MAINTAIN FLOOD PROTECTION SCHEME (110230017)</b>		
<b>Objective (ID):</b>	Reduce the risk of coastal flooding to non-residential properties in the Exhibition Centre Quarter (11023)		
<b>Delivery lead:</b>	Glasgow City Council		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	There are a number of sections of flood defence along the River Clyde which offer protection to properties in the area. These defences will be maintained, and will continue to manage flooding according to the design standard at the time of construction. Levels of flood risk are likely to increase over time as a consequence of climate change.		

<b>Action (ID):</b>	<b>MAINTAIN FLOOD WARNING (111320030)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	SEPA		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	Continue to maintain the Glasgow Quay Walls flood warning area which is part of the Firth of Clyde coastal flood warning scheme.		

<b>Action (ID):</b>	<b>FLOOD FORECASTING (111320009)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	SEPA		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>SELF HELP (111320011)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	—		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>AWARENESS RAISING (111320013)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Responsible authorities		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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.		



<b>Action (ID):</b>	<b>MAINTENANCE (111320007)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Glasgow City Council, asset / land managers		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>SITE PROTECTION PLANS (110230015)</b>		
<b>Objective (ID):</b>	Reduce the risk of coastal flooding to non-residential properties in the Exhibition Centre Quarter (11023)		
<b>Delivery lead:</b>	Glasgow City Council		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	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. A site protection plan for the Exhibition Centre should be developed; the multiple operators in the Centre should be involved in the process.		

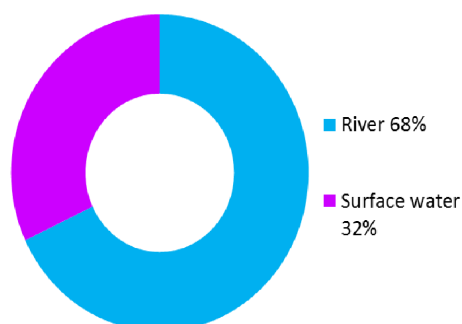
<b>Action (ID):</b>	<b>EMERGENCY PLANS/RESPONSE (111320014)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Category 1 and 2 Responders		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	Providing an emergency response to flooding 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.		

<b>Action (ID):</b>	<b>PLANNING POLICIES (111270001)</b>		
<b>Objective (ID):</b>	Avoid an overall increase in flood risk (11127) Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Planning authority		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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.		

## East of Glasgow (Potentially Vulnerable Area 11/17/1)

Local Plan District	Local authority	Main catchment
Clyde and Loch Lomond	Glasgow City Council, North Lanarkshire Council, South Lanarkshire Council	River Clyde

### Summary of flooding impacts



#### At risk of flooding

- 2,500 residential properties
- 650 non-residential properties
- £6.7 million Annual Average Damages

(damages by flood source shown left)

Summary of flooding impacts

### 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.

Objectives

### Summary of actions to manage flooding

The actions below have been selected to manage flood risk.

Flood protection scheme/works	<i>Natural flood management works</i>	<i>New flood warning</i>	Community flood action groups	<i>Property level protection scheme</i>	<i>Site protection plans</i>
Flood protection study	<i>Natural flood management study</i>	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

Actions

## East of Glasgow (Potentially Vulnerable Area 11/17/1)

Local Plan District	Local authority	Main catchment
Clyde and Loch Lomond	Glasgow City Council, North Lanarkshire Council, South Lanarkshire Council	River Clyde

### Background

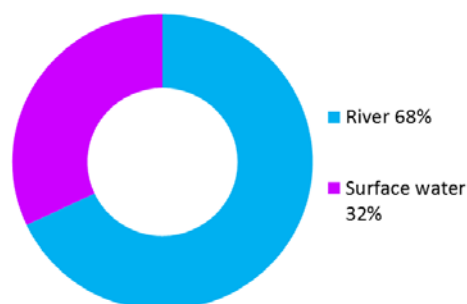
This Potentially Vulnerable Area covers the area south of Glasgow City centre down through Hamilton and Strathaven (shown below). It is approximately 160km<sup>2</sup>.



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

There are approximately 2,500 residential properties and 650 non-residential properties at risk of flooding. The Annual Average Damages are approximately £6.7 million.



**Figure 1:** Annual Average Damages by flood source

### Summary of flooding impacts

River flooding within the area is primarily attributed to the River Clyde and its tributaries. The River Clyde flows in a north westerly direction through the area from Dalsersf, through Hamilton and Uddingston to Rutherglen.

Residential and non-residential properties and utilities are at risk of flooding in Rutherglen and around Hamilton and Uddingston. There are also a number of transport routes impacted across the Potentially Vulnerable Area including railway lines and main roads (notably the A723, A724, A725, A74, A8, M74). Other notable areas at risk include Strathclyde Country Park (an area of protected land) and agricultural land to the north around Hamilton and Uddingston.

There are approximately 870 residential properties at risk of surface water flooding. Surface water flooding of residential and non-residential properties is also predicted in East Kilbride, Hamilton and Rutherglen. The areas at highest risk from surface water flooding will require the preparation of surface water management plans.

Scottish Water and local authorities have completed a number of studies, including strategic and detailed assessments of the risk from surface water flooding and its interaction with river flooding, as well as considering mitigation actions. Many of

these studies have been helped by the partnership working developed within the Metropolitan Glasgow Strategic Drainage Partnership. This has led to the implementation of schemes and works to protect properties from river and surface water flooding.

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. Residential properties affected by river flooding experience the highest economic impact at approximately 50% of the damages.

Within this Potentially Vulnerable Area it is estimated that climate change will increase the number of residential properties at risk of flooding from approximately 2,500 to 4,200 and the number of non-residential properties from approximately 650 to 970.

The location of the impacts of flooding is shown in Figure 3. The greatest concentration of risk is within Shettleston, Cambuslang and Hamilton with impacts to people, non-residential properties, utilities, roads and railways.

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 is one asset identified as being at risk of flooding.

## History of flooding

There is a long history of flooding within this Potentially Vulnerable Area. The river floods which caused the highest impact to properties and people are detailed below:

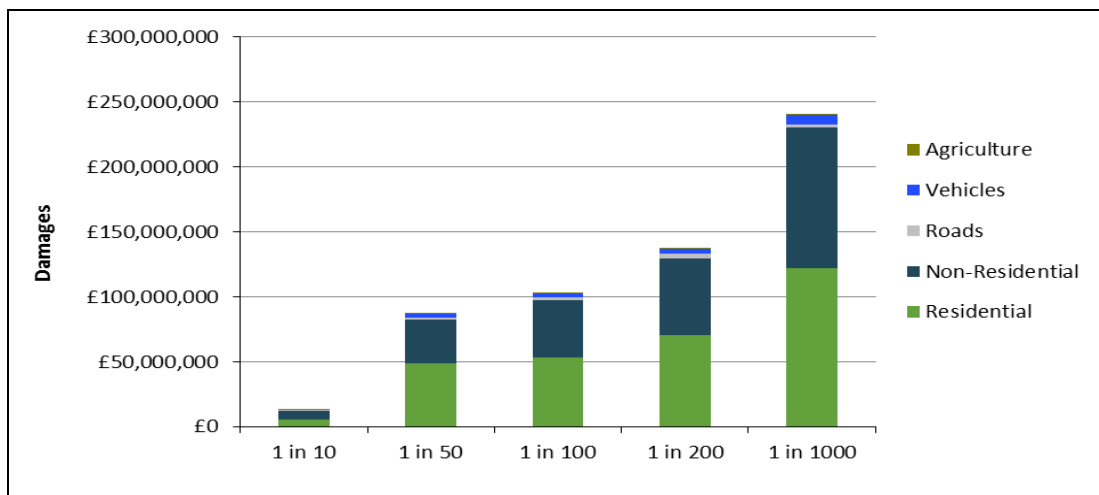
- South Lanarkshire, Larkhall, Netherburn – 21 July 2010. Flooded Hamilton driveways and roads; Rutherglen roads and bowling club; property in Cambuslang; East Kilbride including A749, Eaglesham Road as well as local access roads. Mixture of river and surface water flooding;
- South Lanarkshire – 30 and 31 July 2002. Flooding to property, gardens, roads and railway lines. Areas affected included Larkhall, Uddingston, Cambuslang, Hamilton, Halfway;
- East Kilbride – 30 and 31 July 2002, Stonehouse and Rutherglen flood included surface water, river and sewer flooding;
- South Lanarkshire – 1 December 1999. Properties and roads affected including the A749 Trunk Road. Areas affected included Hallside, Rutherglen, Cambuslang and East Kilbride;
- Strathaven – December 1999. Commercial properties, High Blantyre/Blantyre and Cathkin. River / surface water and sewer.
- South Lanarkshire – 16 October 1998. Properties were evacuated in Kenmar Road, Kenmar Terrace, Auchenraith Avenue and areas of Hamilton. Roads were flooded and there was a loss of electricity.
- South Lanarkshire – 27 October 1998. Properties were evacuated for five days.
- South Lanarkshire – 12 December 1994. 50-100 year return period. Areas affected include East Kilbride, Hamilton, Rutherglen and many other areas within South Lanarkshire Council (The 1994 flood is one of the main drivers for South Lanarkshire Council flooding programme).

Surface water floods which caused the highest damages to properties and people are detailed below:

- South Lanarkshire – 21 July 2010. Major road flooded (A749);
- Glasgow City – 30 July 2002. Return period of 100 years. There were 500 properties affected in Glasgow due to extreme rainfall which exceeded the drainage capacity and resulted in sewer flooding. Road and rail links were severely disrupted as a result, with estimated damages of £100m;
- North Lanarkshire – 30 May 2003. Torrential rain / hailstorm resulting in the flooding of roads.

	1 in 10 High likelihood	1 in 200 Medium likelihood	1 in 1000 Low likelihood
Residential properties (total 100,000)	200	2,500	3,900
Non-residential properties (total 9,000)	130	650	1,000
People	450	5,400	8,700
Community facilities	<10 Includes: educational buildings and emergency services	<10 Includes: educational buildings and emergency services	10 Includes: educational buildings and emergency services
Utilities assets	20	90	110
Transport links - roads (km)	10.7 (of which 1.2 is motorway and 2.2 is A road)	33.5 (of which 4.9 is motorway and 4.9 is A road)	46.0 (of which 8.9 is motorway and 5.7 is A road)
Transport links - rail (km)	2.4	12.2	15.4
Environmental designated areas (km <sup>2</sup> )	1.2	1.2	1.2
Designated cultural heritage sites	18	19	20
Agricultural land (km <sup>2</sup> )	1.9	2.8	3.3

**Table 1:** Summary of flooding impacts<sup>1</sup>



**Figure 2:** Damages by flood likelihood

<sup>1</sup> Some receptors are counted more than once if flooded from multiple sources

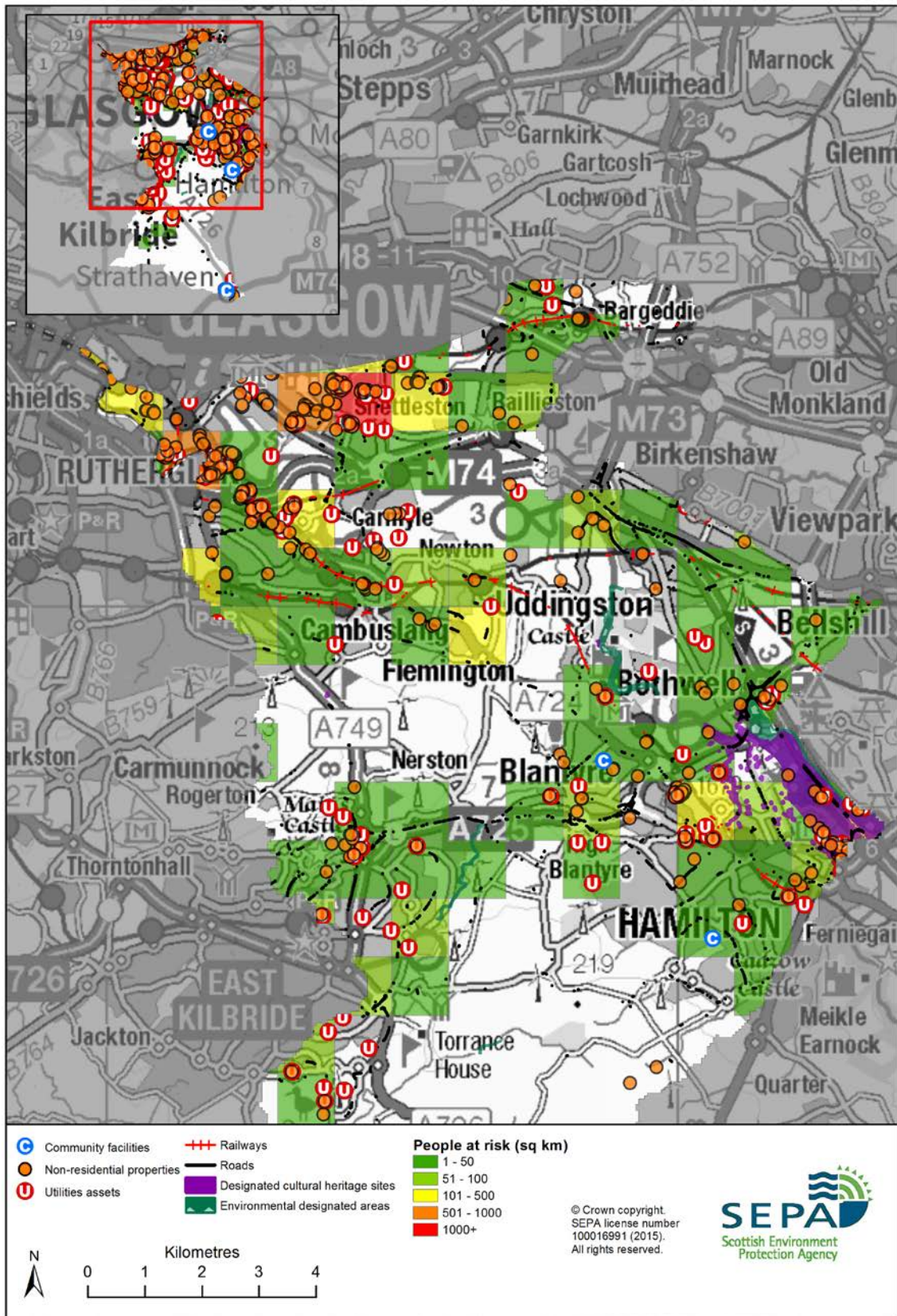


Figure 3: Impacts of flooding

## Objectives to manage flooding in Potentially Vulnerable Area 11/17/1

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 East of Glasgow Potentially Vulnerable Area.

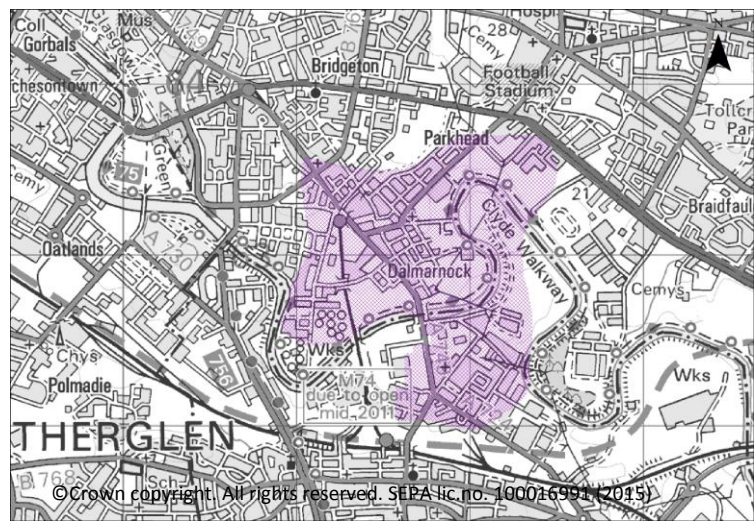
### Reduce the risk of river and surface water flooding to residential properties, non-residential properties, community facilities and transport routes in Dalmarnock

Indicators:

- 300 residential properties
- 130 non-residential properties
- £560,000 Annual Average Damages
- 0.6km of road

Objective ID: 11024

Target area:



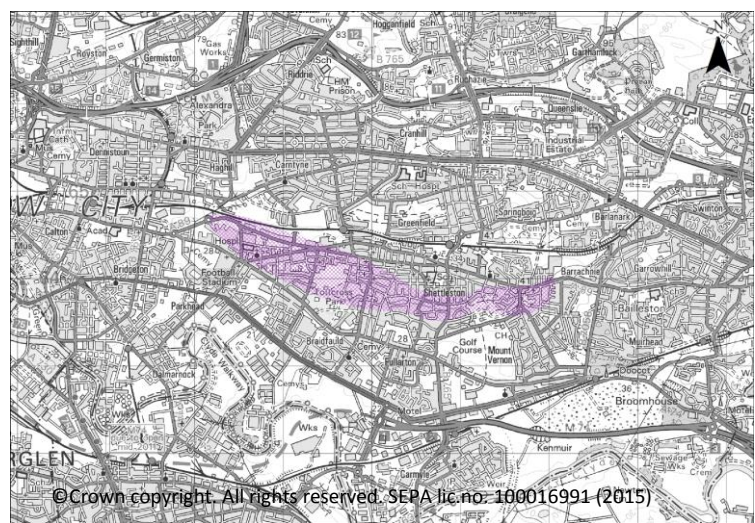
### Reduce the risk of flooding from the Tollcross Burn and Camlachie Burn to residential properties and non-residential properties in Shettleston

Indicators:

- 710 residential properties
- 70 non-residential properties
- £1.9 million Annual Average Damages

Objective ID: 11026

Target area:



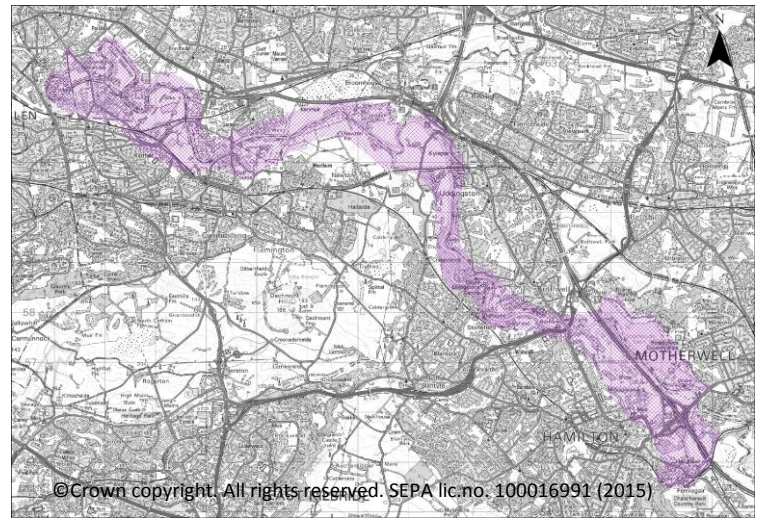


**Reduce the risk of flooding to residential properties, non-residential properties and transport routes along the River Clyde from Strathclyde Park to Shawfield**

Indicators:

Target area:

- 560 residential properties
- 240 non-residential properties
- £3.2 million Annual Average Damages
- 8.8km of road



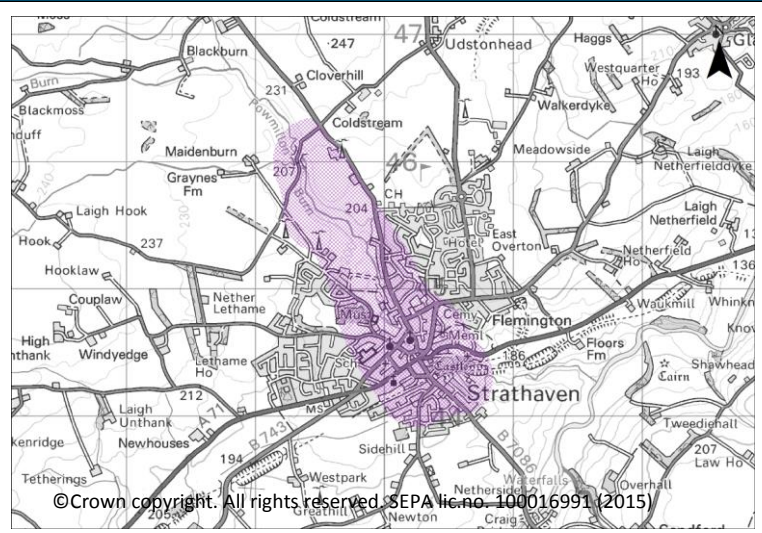
Objective ID: 11065

**Reduce the risk of river and surface water flooding to residential properties, non-residential properties, community facilities and transport routes in Strathaven**

Indicators:

Target area:

- 40 residential properties
- 40 non-residential properties
- £320,000 Annual Average Damages
- 1 emergency service
- 0.4km of road



Objective ID: 11071

Target area	Objective	ID	Indicators within PVA
Dalmarnock	Reduce the physical or disruption risk related to the transport network for rail.	11304	<ul style="list-style-type: none"> <li>• 110m of rail track at 3 locations</li> </ul>
East of Glasgow	Reduce the physical risk, or disruption risk, related to areas of the M8, M73, M74 at risk of flooding	11305	<ul style="list-style-type: none"> <li>• 20m of the M73 at 5 locations</li> <li>• 160m of the M74 at 22 locations</li> <li>• 380m of the M8 at 5 locations</li> </ul>
Glasgow	Reduce the economic damages and number of people at risk of surface water flooding in Glasgow City	11007	* See note below
Garrowhill and Baillieston, Glasgow	Reduce the economic damages and risk to people from surface water flooding in Garrowhill and Baillieston	11095	* See note below
Tollcross Burn catchment, Glasgow	Reduce the economic damages and risk to people from surface water flooding in the Tollcross Burn catchment	11104	* See note below
Motherwell and Wishaw	Reduce the economic damages and risk to people from surface water flooding in Motherwell and Wishaw	11113	* See note below
East Kilbride	Reduce the economic damages and risk to people from surface water flooding in East Kilbride	11119	* See note below
Eastfield	Reduce the economic damages and risk to people from surface water flooding in Eastfield	11120	* See note below
Halfway	Reduce the economic damages and risk to people from surface water flooding in Halfway	11121	* See note below
Hamilton	Reduce the economic damages and risk to people from surface water flooding in Hamilton	11122	* See note below
Applies across Clyde and Loch Lomond Local Plan District	Avoid an overall increase in flood risk	11127	<ul style="list-style-type: none"> <li>• 2,500 residential properties</li> <li>• £6.7 million Annual Average Damages</li> </ul>
Applies across Clyde and Loch Lomond Local Plan District	Reduce overall flood risk	11132	<ul style="list-style-type: none"> <li>• 2,500 residential properties</li> <li>• £6.7 million Annual Average Damages</li> </ul>
Applies across Clyde and Loch Lomond 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 11/17/1 there are 910 residential properties at risk and Annual Average Damages of £2.2 million.

## Actions to manage flooding in Potentially Vulnerable Area 11/17/1

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 East of Glasgow Potentially Vulnerable Area.

Selected actions					
Flood protection scheme/works	<i>Natural flood management works</i>	<i>New flood warning</i>	Community flood action groups	<i>Property level protection scheme</i>	<i>Site protection plans</i>
Flood protection study	<i>Natural flood management study</i>	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

<b>Action (ID):</b>	<b>FLOOD PROTECTION SCHEME/WORKS (110260006)</b>				
<b>Objective (ID):</b>	Reduce the risk of flooding from the Tollcross Burn and Camlachie Burn to residential properties and non-residential properties in Shettleston (11026)				
<b>Delivery lead:</b>	Glasgow City Council				
<b>Priority:</b>	National:		Within local authority:		
	<b>39 of 42</b>		<b>2 of 2</b>		
<b>Status:</b>	<b>Under development</b>	Indicative delivery:	<b>2016-2021</b>		
<b>Description:</b>	<p>It is recommended that the council look to progress the flood protection scheme proposed for the Camlachie Burn. The proposed work includes three elements of improvement works linked to the overall strategy to address existing network constraints in the area, which has the potential to contribute to substantial flooding within the wider catchment if not addressed.</p> <p>The work includes diversion of extreme flows and watercourse restoration to remove a substantial network constraint close to Biggar Street.</p> <p>The flood mapping for the Camlachie Burn should be revised to include all elements of the scheme to understand any remaining residual risk now and in the future.</p>				
<b>Potential impacts</b>					
<b>Economic:</b>	The proposed scheme may benefit 410 residential properties at risk of flooding in this location, damages avoided are estimated to be £990,000. The flood protection scheme has an estimated benefit cost ratio of 0.9.				
<b>Social:</b>	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 there are				

<b>Social:</b>	four 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 and changes in visual amenity and land use as a result of this action.
<b>Environmental:</b>	Flood protection schemes can have both positive and negative impacts on the ecological quality of the environment depending on how they are designed.

<b>Action (ID):</b>	<b>FLOOD PROTECTION SCHEME/WORKS (11304021)</b>		
<b>Objective (ID):</b>	Reduce the physical or disruption risk related to the transport network for rail. (11304)		
<b>Delivery lead:</b>	Network Rail		
<b>Status:</b>	<b>Under development</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	Network Rail will carry out civil engineering work which will reduce flood risk to identified sections of the rail network within this Potentially Vulnerable Area.		

<b>Action (ID):</b>	<b>FLOOD PROTECTION SCHEME/WORKS (11305021)</b>		
<b>Objective (ID):</b>	Reduce the physical risk, or disruption risk, related to areas of the M8, M73, M74 at risk of flooding (11305)		
<b>Delivery lead:</b>	Transport Scotland		
<b>Status:</b>	<b>Under development</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	Transport Scotland will carry out civil engineering work which will reduce flood risk to identified sections of the trunk road.		

<b>Action (ID):</b>	<b>FLOOD PROTECTION STUDY (110650005)</b>		
<b>Objective (ID):</b>	Reduce the risk of flooding to residential properties, non-residential properties and transport routes along the River Clyde from Strathclyde Park to Shawfield (11065)		
<b>Delivery lead:</b>	South Lanarkshire Council		
<b>Priority:</b>	National:	Within local authority:	
	<b>8 of 168</b>	<b>1 of 4</b>	
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	A study is recommended to further investigate the feasibility of a flood protection scheme along the lower River Clyde. The Clyde Gateway Masterplan should initially be reviewed and built upon for this study. The study should focus on establishing the most sustainable combination of actions including; improving the conveyance through a number of structures, the construction of a control structure on the Powburn with a pumping station to force		

	<p>water into the River Clyde, and the benefit of flood defences. The study should also assess the benefit of sustainable drainage systems and property level protection. A separate study of the upper River Clyde is also being carried out (ID 110680005) and should be considered when identifying actions. SEPA will review the output from this study for inclusion in the Flood Maps.</p>
<b>Potential impacts</b>	
<b>Economic:</b>	The flood protection study should consider how to reduce flood risk to 210 residential properties and 780 non-residential properties in this location, with potential damages avoided of up to £33.4 million.
<b>Social:</b>	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 there are nine utilities which have been identified as potentially benefitting from this action. There may be changes in visual amenity and land use as a result of this action.
<b>Environmental:</b>	Flood protection studies should consider the positive and negative impacts of proposed actions on the ecological quality of the environment. Natural flood management actions can have a positive impact by restoring and enhancing natural habitats. There is the potential for direct construction impacts to the Bothwell Castle Grounds and the Hamilton Low Parks both a Site of Special Scientific Interest. There is likely to be the loss of habitat and displacement of species in the vicinity of conveyance works; however, these may re-establish and return to the area. Downstream of these conveyance works there may be negative impacts on water quality through localised increased erosion and sedimentation on the River Clyde. Introduction of control structures on the river may impede fish passage. There is likely to be a loss of natural and semi-natural habitat in the footprint and vicinity of the defences. There is the potential for permanent, negative impacts from conveyance actions to Bothwell Bridge, Livingstone Memorial Bridge, Uddingston Railway viaduct, Haughhead Bridge, Dalmarnock Bridge, St Andrews Bridge and Kings Bridge, which are all listed structures. There is the potential for direct defences to have negative impacts on the setting of Hamilton Palace and Chatelherault protected gardens and designed landscapes in the Hamilton area, along with the Kylepark Heritage Conservation Area and the Uddingston railway viaduct listed structure.

<b>Action (ID):</b>	<b>FLOOD PROTECTION STUDY (110260005)</b>		
<b>Objective (ID):</b>	Reduce the risk of flooding from the Tollcross Burn and Camlachie Burn to residential properties and non-residential properties in Shettleston (11026)		
<b>Delivery lead:</b>	Glasgow City Council		
<b>Priority:</b>	National:		Within local authority:
	<b>11 of 168</b>		<b>1 of 8</b>
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>

<b>Description:</b>	<p>Glasgow City Council should progress the work to deculvert sections of the Tollcross Burn in Sandyhills Park. The work is being carried out in coordination with river basin management planning and should help to improve the condition of the river.</p> <p>A study is recommended to further investigate the flood benefit of the deculverting work and feasibility of a flood protection scheme on the Tollcross Burn focusing on, upstream storage, modification of conveyance by upgrading a culverts, sustainable drainage systems, modification of fluvial control structures by replacing existing trash screens and construction of a river wall. Other actions may also be considered to select the most sustainable combination of actions.</p>
<b>Potential impacts</b>	
<b>Economic:</b>	The economic impacts have not been defined at this stage.
<b>Social:</b>	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.
<b>Environmental:</b>	<p>Flood protection studies should consider the positive and negative impacts of proposed actions on the ecological quality of the environment. This study is proposed for the Tollcross Burn (water body ID 10048). The physical condition of this river is identified by river basin management planning to be at less than good status. Future works could improve the condition of the river or degrade it. Opportunities to improve the condition of the river should be considered by coordinating with river basin management planning. There are no international, national or local level environmental designations that are likely to be impacted by this action. There may be a loss of recreational land and natural and semi-natural habitats in the footprint of the storage areas and in the footprint and vicinity of the direct defences. There is the potential for creation of new wetland habitats. Downstream of the storage and culvert action there may be negative impacts on water quality through increased erosion and sedimentation. There is the potential for slight positive impacts on water quality from the implementation of sustainable drainage systems in the area.</p>

<b>Action (ID):</b>	<b>FLOOD PROTECTION STUDY (110710005)</b>		
<b>Objective (ID):</b>	Reduce the risk of river and surface water flooding to residential properties, non-residential properties, community facilities and transport routes in Strathaven (11071)		
<b>Delivery lead:</b>	South Lanarkshire Council		
<b>Priority:</b>	National: <b>40 of 168</b>	Within local authority: <b>2 of 4</b>	
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	A study is recommended to further investigate the feasibility of a flood protection scheme in Strathaven focusing on the benefit from storage from the Powmillon Burn, improving the conveyance through existing structures on the Powmillon Burn, modification of the existing weirs at Strathaven Park and the Old Mill and construction of flood defences along the Powmillon Burn within Strathaven.		

	Sustainable drainage systems should be assessed in any future flood study undertaken in the area. This study may also consider natural flood management, property level protection actions and other complementary actions.
Potential impacts	
<b>Economic:</b>	The flood protection study should consider how to reduce flood risk to 40 residential properties and 30 non-residential properties in this location, with potential damages avoided of up to £10 million. The economic impact of natural flood management actions is difficult to define, however, these actions can reduce flood risk for high likelihood events. In this location, it has been estimated that 60 residential and non-residential properties could potentially benefit from natural flood management actions.
<b>Social:</b>	A reduction in flood risk would have a positive benefit to the health and wellbeing of the community. In addition there are one emergency service and one utility which have been identified as potentially benefitting from this action. Natural flood management actions can restore and enhance natural environments and create opportunities for recreation and tourism. There may be changes in visual amenity and land use as a result of this action.
<b>Environmental:</b>	Flood protection studies should consider the positive and negative impacts of proposed actions on the ecological quality of the environment. Natural flood management actions can have a positive impact by restoring and enhancing natural habitats. Runoff control actions could have an impact on the Waukenwae Moss Site of Special Scientific Interest. To be in accord with the Flood Risk Management 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 Waukenwae Moss Special Area of Conservation. There will be a loss of existing habitat and displacement of species with storage; however, these will be replaced with new wetland habitat and species. Downstream of the conveyance works there may be negative impacts on water quality through localised increased erosion and sedimentation on the Powmillon Burn. Removal of control structures on the river may assist fish passage. There is likely to be a loss of semi-natural habitat in the footprint and vicinity of the defences. There is the potential for modification of conveyance to have negative impacts on the Strathaven Boo-Backed Bridge listed structure. There is the potential for direct defences to have negative impacts on a listed bridge and the setting of several listed buildings on Kirk Street and the setting of the Strathaven heritage conservation area.

<b>Action (ID):</b>	<b>SURFACE WATER PLAN/STUDY (110070018)</b>		
<b>Objective (ID):</b>	Reduce the economic damages and number of people at risk of surface water flooding in Glasgow City (11007)		
<b>Delivery lead:</b>	Glasgow City Council		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2028-2033</b>
<b>Description:</b>	The area must be covered by a strategy to manage and reduce surface water flood risk and identify the most sustainable actions to achieve the objectives. This strategy has been developed by the		

Metropolitan Glasgow Strategic Drainage Partnership. The detailed objectives and actions to manage and reduce surface water flood risk will be set out in the area specific surface water management plans described below.

<b>Action (ID):</b>	<b>SURFACE WATER PLAN/STUDY (110950018)</b>		
<b>Objective (ID):</b>	Reduce the economic damages and risk to people from surface water flooding in Garrowhill and Baillieston (11095)		
<b>Delivery lead:</b>	Glasgow City Council		
<b>Status:</b>	<b>Ongoing</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	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. The Metropolitan Glasgow Strategic Drainage Partnership will support the 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.		

<b>Action (ID):</b>	<b>SURFACE WATER PLAN/STUDY (111040018)</b>		
<b>Objective (ID):</b>	Reduce the economic damages and risk to people from surface water flooding in the Tollcross Burn catchment (11104)		
<b>Delivery lead:</b>	Glasgow City Council		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	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. The Metropolitan Glasgow Strategic Drainage Partnership will support the 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.		

<b>Action (ID):</b>	<b>SURFACE WATER PLAN/STUDY (111130018)</b>		
<b>Objective (ID):</b>	Reduce the economic damages and risk to people from surface water flooding in Motherwell and Wishaw (11113)		
<b>Delivery lead:</b>	North Lanarkshire Council		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2022-2027</b>
<b>Description:</b>	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. The Metropolitan Glasgow Strategic Drainage Partnership will support the process and improve knowledge and understanding of surface water flood risk and interactions with other sources of flooding e.g. with the sewer network and watercourses.		



<b>Action (ID):</b>	<b>SURFACE WATER PLAN/STUDY (111191018)</b>		
<b>Objective (ID):</b>	Reduce the economic damages and risk to people from surface water flooding in East Kilbride (11119)		
<b>Delivery lead:</b>	South Lanarkshire Council		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>SURFACE WATER PLAN/STUDY (111191019)</b>		
<b>Objective (ID):</b>	Reduce the economic damages and risk to people from surface water flooding in East Kilbride (11119)		
<b>Delivery lead:</b>	Scottish Water in partnership with South Lanarkshire Council		
<b>Status:</b>	<b>Ongoing</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	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 and watercourses.		

<b>Action (ID):</b>	<b>SURFACE WATER PLAN/STUDY (111200018)</b>		
<b>Objective (ID):</b>	Reduce the economic damages and risk to people from surface water flooding in Eastfield (11120)		
<b>Delivery lead:</b>	South Lanarkshire Council		
<b>Status:</b>	<b>Ongoing</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>SURFACE WATER PLAN/STUDY (111210018)</b>		
<b>Objective (ID):</b>	Reduce the economic damages and risk to people from surface water flooding in Halfway (11121)		
<b>Delivery lead:</b>	South Lanarkshire Council		
<b>Status:</b>	<b>Ongoing</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>SURFACE WATER PLAN/STUDY (111220018)</b>		
<b>Objective (ID):</b>	Reduce the economic damages and risk to people from surface water flooding in Hamilton (11122)		
<b>Delivery lead:</b>	South Lanarkshire Council		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>STRATEGIC MAPPING AND MODELLING (111320016)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	SEPA		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	SEPA will seek to incorporate additional surface water data into the flood maps to improve understanding of flood risk. Approximately 2,200km <sup>2</sup> 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.		

<b>Action (ID):</b>	<b>STRATEGIC MAPPING AND MODELLING (111320019)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Scottish Water		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>MAINTAIN FLOOD PROTECTION SCHEME (110240017)</b>		
<b>Objective (ID):</b>	Reduce the risk of river and surface water flooding to residential properties, non-residential properties, community facilities and transport routes in Dalmarnock (11024)		
<b>Delivery lead:</b>	Glasgow City Council		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	The Dalmarnock Flood Bund Flood Protection Scheme consists of a flood embankment adjacent to the River Clyde at Downiebrae Road. It protects properties in the area against a 200 year flood. This scheme will be maintained, and will continue to manage flooding according to the design standard at the time of construction. Levels of flood risk are likely to increase over time as a consequence of climate change.		

<b>Action (ID):</b>	<b>MAINTAIN FLOOD PROTECTION SCHEME (110650017)</b>		
<b>Objective (ID):</b>	Reduce the risk of flooding to residential properties, non-residential properties and transport routes along the River Clyde from Strathclyde Park to Shawfield (11065)		
<b>Delivery lead:</b>	South Lanarkshire Council		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	The Dalmarnock Flood Bund Flood Protection Scheme consists of a flood embankment adjacent to the River Clyde at Downiebrae Road. It protects properties in the area against a 200 year flood. These defences will be maintained, and will continue to manage flooding according to the design standard at the time of construction. Levels of flood risk are likely to increase over time as a consequence of climate change.		

<b>Action (ID):</b>	<b>MAINTAIN FLOOD WARNING (111320030)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	SEPA		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	Continue to maintain the Cambuslang Road and Morrison Park, Carmyle, Dalbeth, Dalmarnock Bridge, Hamilton Services and the Watersports Centre at Strathclyde Loch flood warning areas which are part of the River Clyde flood warning scheme.		

<b>Action (ID):</b>	<b>FLOOD FORECASTING (111320009)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	SEPA		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>COMMUNITY FLOOD ACTION GROUPS (110240012)</b>		
<b>Objective (ID):</b>	Reduce the risk of river and surface water flooding to residential properties, non-residential properties, community facilities and transport routes in Dalmarnock (11024)		
<b>Delivery lead:</b>	Community		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	The local community set up the Clyde River Users group, to raise awareness of flood risk in the area. The group should continue its activities.		

<b>Action (ID):</b>	<b>SELF HELP (111320011)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	—		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>AWARENESS RAISING (111320013)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Responsible authorities		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>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.</p> <p>From 2016 SEPA will engage with the community and promote Floodline. This will be achieved through SEPA led education events. The South Lanarkshire Council winter awareness campaign, between October and March includes information on flooding.</p> <p>Local authorities will be undertaking additional awareness raising activities. Further details will be set out in the Local FRM Plan.</p>		

<b>Action (ID):</b>	<b>MAINTENANCE (111320007)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Local authorities, asset / land managers		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>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.</p>		

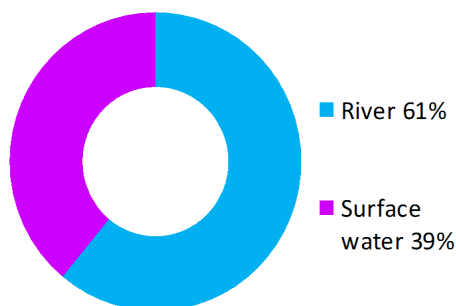
<b>Action (ID):</b>	<b>EMERGENCY PLANS/RESPONSE (111320014)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Category 1 and 2 Responders		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>Providing an emergency response to 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.</p>		

<b>Action (ID):</b>	<b>PLANNING POLICIES (111270001)</b>		
<b>Objective (ID):</b>	Avoid an overall increase in flood risk (11127) Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Planning authority		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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.		

## Clyde catchment - Motherwell to Lesmahagow (Potentially Vulnerable Area 11/17/2)

Local Plan District	Local authority	Main catchment
Clyde and Loch Lomond	North Lanarkshire Council, South Lanarkshire Council	River Clyde

### Summary of flooding impacts



#### At risk of flooding

- 420 residential properties
- 210 non-residential properties
- £1.1 million Annual Average Damages

(damages by flood source shown left)

Summary of flooding impacts

### 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.

Objectives

### Summary of actions to manage flooding

The actions below have been selected to manage flood risk.

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

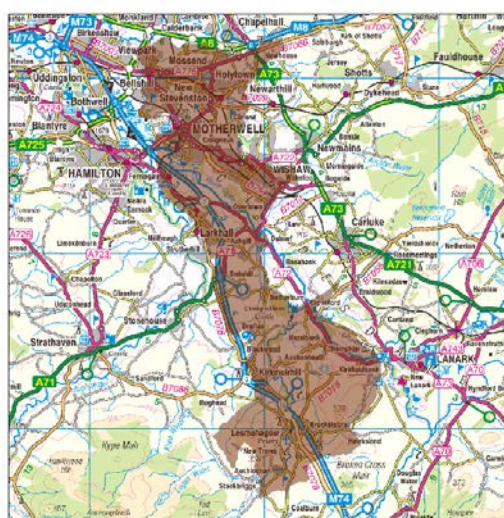
Actions

# Clyde catchment – Motherwell to Lesmahagow (Potentially Vulnerable Area 11/17/2)

Local Plan District	Local authority	Main catchment
Clyde and Loch Lomond	North Lanarkshire Council, South Lanarkshire Council	River Clyde

## Background

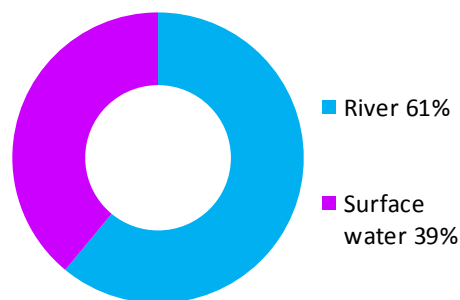
This Potentially Vulnerable Area extends from Mossend and Holytown in the north towards Kirkmuirhill and Lesmahagow. It is approximately 140km<sup>2</sup> (shown below).



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

There are approximately 420 residential properties and 210 non-residential properties at risk of flooding. The Annual Average Damages are approximately £1.1 million.



**Figure 1: Annual Average Damages by flood source**

## Summary of flooding impacts

River flooding is primarily from the River Clyde and its tributaries. The River Clyde flows through the Potentially Vulnerable Area from Dalsersf, through Overtown towards Hamilton in a generally north westerly direction.

The majority of the risk from river flooding is to non-residential properties, whilst there are residential properties and agricultural land at risk of flooding to the south of Motherwell. The road network is also impacted with notable sections of the A71, A72, A723 and the M74 at risk.

Surface water flooding has the largest impact in terms of the number of properties, with 320 properties at risk. However, this flooding is typically shallow, therefore, the potential damages to each property is less than from river flooding. In the south, local road networks around the town of Kirkmuirhill are at risk. The areas at highest risk from surface water flooding will require the preparation of surface water management plans.



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. Residential properties affected by river flooding experience the highest economic impact at approximately 35% of the damages.

Within this Potentially Vulnerable Area it is estimated that climate change will increase the number of residential properties at risk of flooding from approximately 420 to 820 and the number of non-residential properties from approximately 210 to 250.

The location of the impacts of flooding is shown in Figure 3. The greatest concentration of risk is in Motherwell, with impacts to properties, people and infrastructure. Sections of the M74 are also at risk of flooding including at Larkhall.

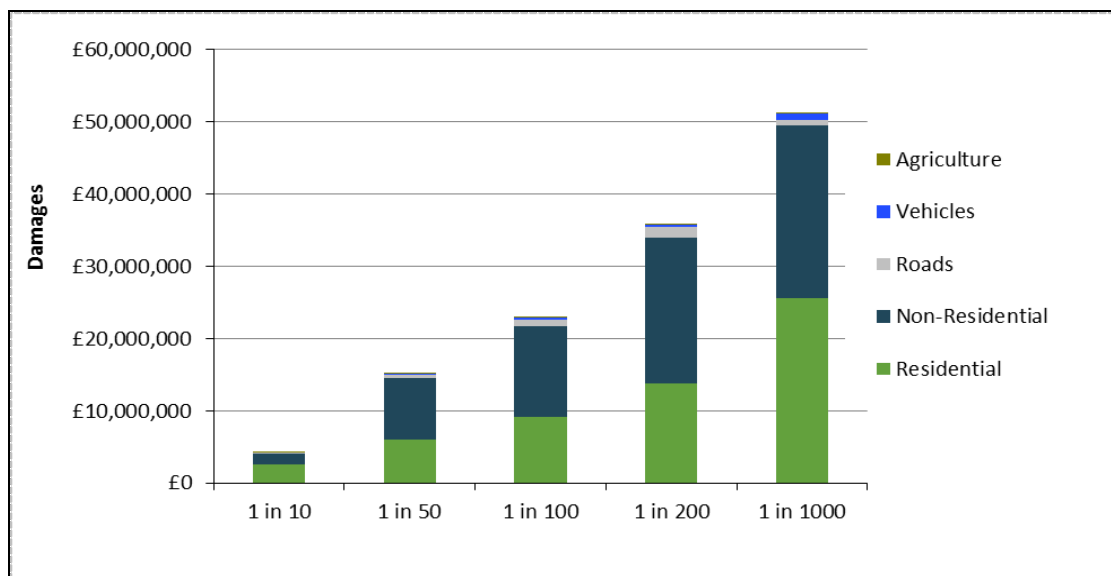
## History of flooding

There have been numerous incidents of flooding within this Potentially Vulnerable Area. The floods which caused the highest impact to properties and people are detailed below:

- In 1994 the River Clyde was identified to have reached its highest level in 150 years, covering an area of 50km and resulting in damages estimated at £100million;
- South Lanarkshire – 27 October 1998. Properties were evacuated for five days;
- North Lanarkshire – 30 May 2003. Torrential rain / hailstorm resulting in the flooding of roads and community facilities;
- In May 2003 surface water flooding caused flooding in Wishaw and Overton;
- In 2008 there are several records of sewer flooding which resulted in road closures within North Lanarkshire.

	1 in 10 High likelihood	1 in 200 Medium likelihood	1 in 1000 Low likelihood
Residential properties (total 47,000)	80	420	730
Non-residential properties (total 3,600)	120	210	230
People	170	1,100	1,700
Community facilities	0	<10 Educational buildings	<10 Educational buildings
Utilities assets	<10	30	40
Transport links-roads (km)	5.2 (of which 1.5 is motorway and 0.1 is A road)	14.6 (of which 3.8 is motorway and 0.6 is A road)	19.0 (of which 5.0 is motorway and 0.8 is A road)
Transport links-rail (km)	1.6	6.7	8.9
Environmental designated areas (km <sup>2</sup> )	0.4	0.4	0.4
Designated cultural heritage sites	15	16	17
Agricultural land (km <sup>2</sup> )	2.2	2.9	3.3

**Table 1:** Summary of flooding impacts<sup>1</sup>



**Figure 2:** Damages by flood likelihood

<sup>1</sup> Some receptors are counted more than once if flooded from multiple sources

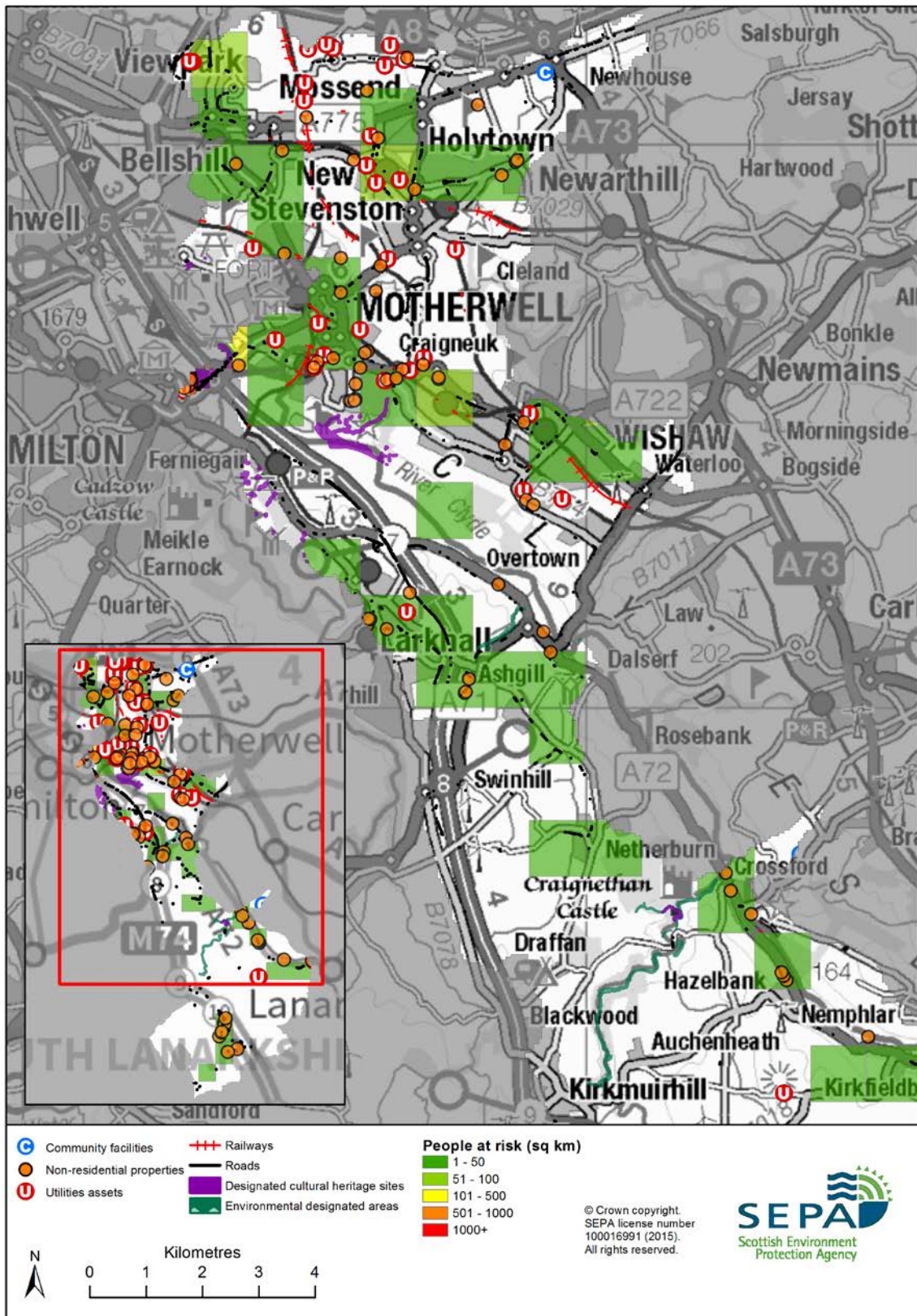


Figure 3: Impacts of flooding

## Objectives to manage flooding in Potentially Vulnerable Area 11/17/2

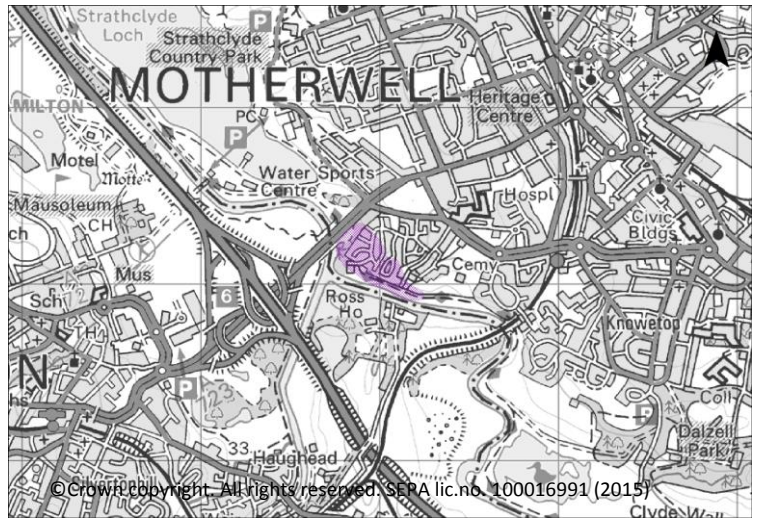
Objectives provide a common goal and shared ambition for managing floods. These objectives have been set by SEPA and agreed with flood risk management authorities following consultation. They were identified through an assessment of the underlying evidence of the causes and impacts of flooding. Target 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 Clyde catchment - Motherwell to Lesmahagow Potentially Vulnerable Area.

### Reduce the risk of river flooding to residential properties in Greenacres

Indicators:

- 60 residential properties
- £47,000 Annual Average Damages

Target area:



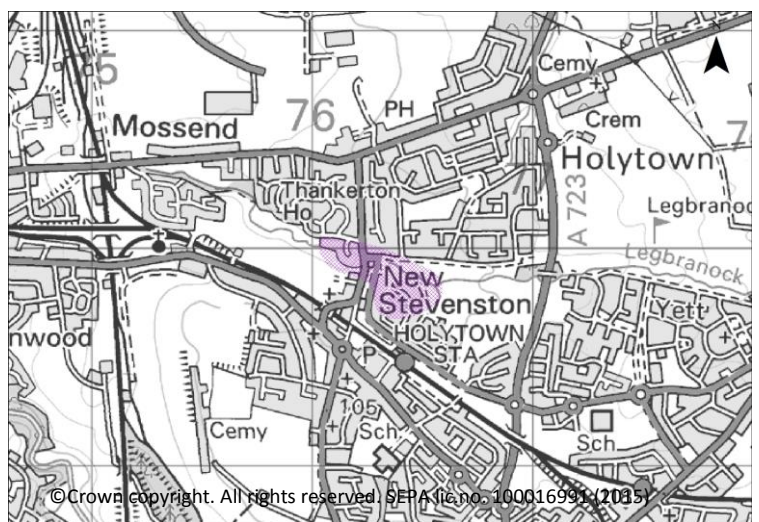
Objective ID: 11037

### Reduce the risk of flooding to residential properties in Holytown

Indicators:

- <10 non-residential properties
- £8,600 Annual Average Damages

Target area:



Objective ID: 11038

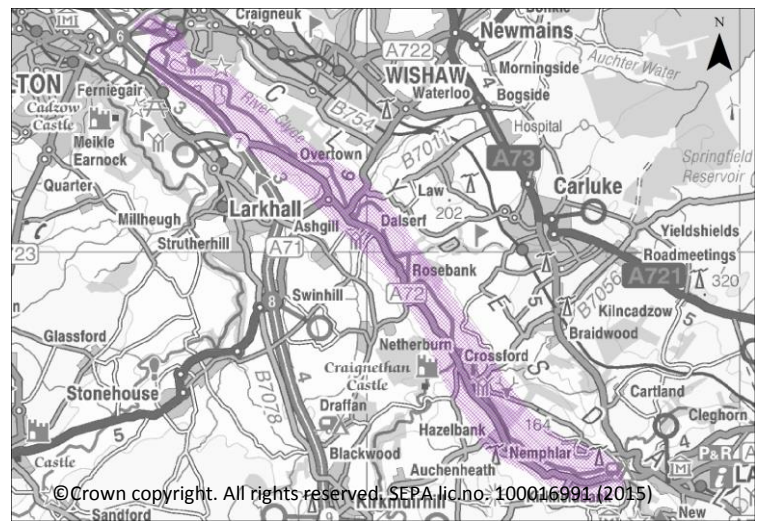
**Reduce the risk of flooding to residential properties, non-residential properties and transport routes along the River Clyde, upstream of Strathclyde Park**

Indicators:

Target area:

- 160 residential properties
- 20 non-residential properties
- £570,000 Annual Average Damages
- 2.0km of road

Objective ID: 11068



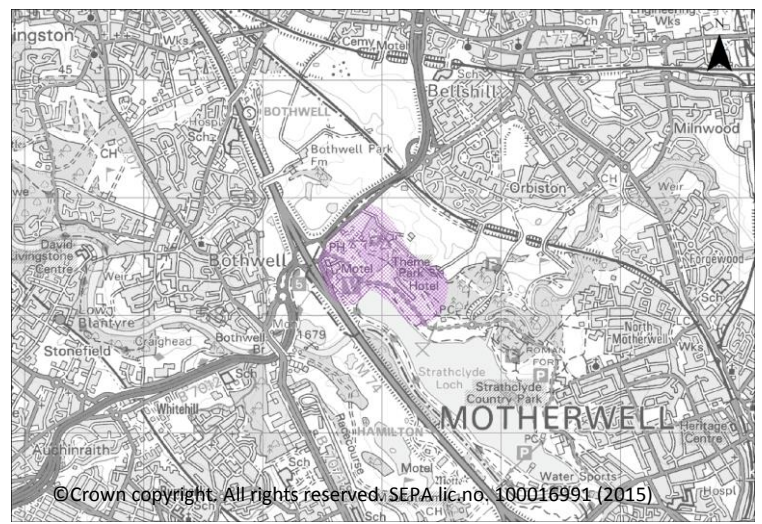
**Reduce the risk of river flooding to non-residential properties in Bothwellhaugh**

Indicators:

Target area:

- <10 non-residential properties
- £16,000 Annual Average Damages

Objective ID: 11203



Target area	Objective	ID	Indicators within PVA
Clyde Catchment – Motherwell to Lesmahagow	Reduce the physical risk, or disruption risk, related to areas of the M74 at risk of flooding	11306	<ul style="list-style-type: none"> <li>• 340m of the M74 at 15 locations</li> </ul>
Motherwell and Wishaw	Reduce the economic damages and risk to people from surface water flooding in Motherwell and Wishaw	11113	* See note below
Applies across Clyde and Loch Lomond Local Plan District	Avoid an overall increase in flood risk	11127	<ul style="list-style-type: none"> <li>• 420 residential properties</li> <li>• £1.1 million Annual Average Damages</li> </ul>
Applies across Clyde and Loch Lomond Local Plan District	Reduce overall flood risk	11132	<ul style="list-style-type: none"> <li>• 420 residential properties</li> <li>• £1.1 million Annual Average Damages</li> </ul>
Applies across Clyde and Loch Lomond 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 11/17/2 there are 280 residential properties at risk and Annual Average Damages of £440,000.

## Actions to manage flooding in Potentially Vulnerable Area 11/17/2

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 Clyde catchment - Motherwell to Lesmahagow Potentially Vulnerable Area.

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

<b>Action (ID):</b>	<b>FLOOD PROTECTION SCHEME/WORKS (11306021)</b>		
<b>Objective (ID):</b>	Reduce the physical risk, or disruption risk, related to areas of the M74 at risk of flooding (11306)		
<b>Delivery lead:</b>	Transport Scotland		
<b>Status:</b>	<b>Under development</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	Transport Scotland will carry out civil engineering work which will reduce flood risk to identified sections of the trunk road.		

<b>Action (ID):</b>	<b>FLOOD PROTECTION STUDY (110680005)</b>		
<b>Objective (ID):</b>	Reduce the risk of flooding to residential properties, non-residential properties and transport routes along the River Clyde, upstream of Strathclyde Park (11068)		
<b>Delivery lead:</b>	South Lanarkshire Council		
<b>Priority:</b>	National: <b>88 of 168</b>	Within local authority: <b>3 of 4</b>	
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	A study is recommended to further investigate the feasibility of a flood protection scheme on the upper River Clyde (upstream of Strathclyde Park) focusing on, improving the conveyance of a number of existing structures and the benefit of flood defences at various locations along the upper River Clyde. This should also assess the benefit of sustainable drainage systems and property		

	<p>level protection.</p> <p>A separate study of the lower River Clyde is also being carried out (action 110650005) and should be considered when selecting the most sustainable combination of actions.</p> <p>SEPA will review the output from this study for inclusion in the Flood Maps.</p>
<b>Potential impacts</b>	
<b>Economic:</b>	The flood protection study should consider how to reduce flood risk to 40 residential properties and 10 non-residential properties in this location, with potential damages avoided of up to £4.4 million.
<b>Social:</b>	A reduction in flood risk would have a positive benefit to the health and wellbeing of the community. There may be changes in visual amenity and land use as a result of this action.
<b>Environmental:</b>	Flood protection studies should consider the positive and negative impacts of proposed actions on the ecological quality of the environment. There is the potential for direct negative construction impacts to the Milton Lockhart Wood Site of Special Scientific Interest. There is likely to be the loss of habitat and displacement of species in the vicinity of the conveyance works; however, these may re-establish and return to the area. Downstream of these conveyance works there may be negative impacts on water quality through localised increased erosion and sedimentation on the River Clyde. There is likely to be a loss of natural and semi-natural habitat in the direct footprint and vicinity of the defences. There is the potential for permanent, negative impacts to several bridges which are listed structures on the River Clyde from conveyance actions. There is the potential for direct defences to have negative impacts on Garrion and Mauldslie listed bridges and the setting of several listed buildings on the river.

<b>Action (ID):</b>	<b>FLOOD PROTECTION STUDY (110380005)</b>		
<b>Objective (ID):</b>	Reduce the risk of flooding to residential properties in Holytown (11038)		
<b>Delivery lead:</b>	North Lanarkshire Council		
<b>Priority:</b>	National:		Within local authority:
	<b>101 of 168</b>		<b>2 of 4</b>
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	<p>A study is recommended to further investigate surface water flood risk in Holytown. The identified risk from strategic mapping does not correspond with the flooding history in this area. Therefore a detailed study should be carried out to assess the flow paths and potential flood risk.</p> <p>Review of the study will establish the level of risk and if further stages are required to examine actions to manage flooding.</p> <p>The flood mapping from the study should be used to revise SEPA's strategic mapping.</p>		
<b>Potential impacts</b>			
<b>Economic:</b>	Current strategic modelling identifies 80 residential properties and 20 non-residential properties at risk of flooding. The study should look to revise these values and identify a potential benefit from any works.		



<b>Social:</b>	A reduction in flood risk would have a positive benefit to the health and wellbeing of the community.
<b>Environmental:</b>	Flood protection studies should consider the positive and negative impacts of proposed actions on the ecological quality of the environment.

<b>Action (ID):</b>	<b>FLOOD PROTECTION STUDY (110370005)</b>		
<b>Objective (ID):</b>	Reduce the risk of river flooding to residential properties in Greenacres (11037)		
<b>Delivery lead:</b>	North Lanarkshire Council		
<b>Priority:</b>	National:	Within local authority:	
	<b>146 of 168</b>	<b>4 of 4</b>	
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	A study is recommended to further investigate the feasibility of flood protection work in Greenacres, focusing on direct defences and sustainable drainage systems. Property level protection should also be considered to reduce residual risk. Other actions may also be considered to select the most sustainable combination of actions.		
<b>Potential impacts</b>			
<b>Economic:</b>	The flood protection study should consider how to reduce flood risk to 60 residential properties at risk of flooding in this location, with potential damages avoided of up to £780,000.		
<b>Social:</b>	A reduction in flood risk would have a positive benefit to the health and wellbeing of the community.		
<b>Environmental:</b>	Flood protection studies should consider the positive and negative impacts of proposed actions on the ecological quality of the environment. There is the potential for indirect impacts during works to the Hamilton Low Parks Site of Special Scientific Interest, through increased sedimentation and reduced water quality. There is likely to be a loss of natural and semi-natural habitat in the footprint and vicinity of the defences. There is the potential for direct defences to have negative impacts on the views from Hamilton Palace protected gardens and designed landscapes across the River Clyde.		

<b>Action (ID):</b>	<b>SURFACE WATER PLAN/STUDY (111131018)</b>		
<b>Objective (ID):</b>	Reduce the economic damages and risk to people from surface water flooding in Motherwell and Wishaw (11113)		
<b>Delivery lead:</b>	North Lanarkshire Council		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2022-2027</b>
<b>Description:</b>	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. The Metropolitan Glasgow Strategic Drainage Partnership will support the process and improve knowledge and understanding of surface water flood risk and interactions with other sources of		

	flooding e.g. with the sewer network and watercourses.
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<b>Action (ID):</b>	<b>STRATEGIC MAPPING AND MODELLING (111320019)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Scottish Water		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>FLOOD FORECASTING (111320009)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	SEPA		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>SELF HELP (111320011)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	—		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>AWARENESS RAISING (111320013)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Responsible authorities		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>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.</p> <p>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.</p> <p>The South Lanarkshire Council winter awareness campaign, between October and March includes information on flooding.</p> <p>Local authorities will be undertaking additional awareness raising activities. Further details will be set out in the Local FRM Plan.</p>		

<b>Action (ID):</b>	<b>MAINTENANCE (111320007)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Local authorities, asset / land managers		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>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.</p>		

<b>Action (ID):</b>	<b>SITE PROTECTION PLANS (112030015)</b>		
<b>Objective (ID):</b>	Reduce the risk of river flooding to non-residential properties in Bothwellhaugh (11203)		
<b>Delivery lead:</b>	North Lanarkshire Council		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	<p>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.</p> <p>A site protection plan should be developed for the Caravan Park and hotels in Bothwellhaugh adjacent to M&amp;D's theme park.</p>		

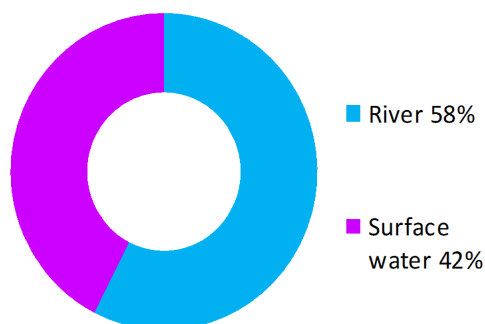
<b>Action (ID):</b>	<b>EMERGENCY PLANS/RESPONSE (111320014)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Category 1 and 2 Responders		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>Providing an emergency response to 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.</p>		

<b>Action (ID):</b>	<b>PLANNING POLICIES (111270001)</b>		
<b>Objective (ID):</b>	Avoid an overall increase in flood risk (11127) Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Planning authority		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>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.</p>		

## Coatbridge and Airdrie (Potentially Vulnerable Area 11/17/3)

Local Plan District	Local authority	Main catchment
Clyde and Loch Lomond	Falkirk Council, North Lanarkshire Council, West Lothian Council	North Calder Water

### Summary of flooding impacts



#### At risk of flooding

- 470 residential properties
- 150 non-residential properties
- £900,000 Annual Average Damages

(damages by flood source shown left)

Summary of flooding impacts

### 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.

Objectives

### Summary of actions to manage flooding

The actions below have been selected to manage flood risk.

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

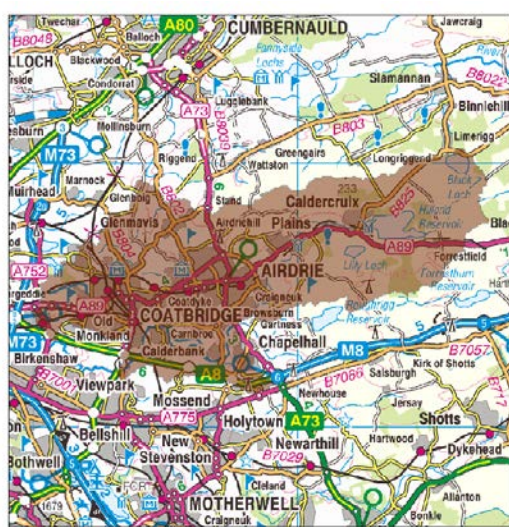
Actions

# Coatbridge and Airdrie (Potentially Vulnerable Area 11/17/3)

Local Plan District	Local authority	Main catchment
Clyde and Loch Lomond	Falkirk Council, North Lanarkshire Council, West Lothian Council	North Calder Water

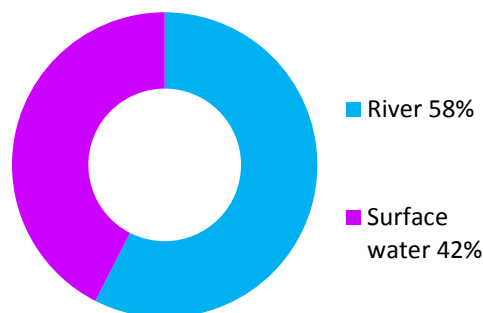
## Background

This Potentially Vulnerable Area is situated in North Lanarkshire around Coatbridge and Airdrie (shown below). It is approximately 80km<sup>2</sup>.



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

There are approximately 470 residential properties and 150 non-residential properties at risk of flooding. The Annual Average Damages are approximately £900,000.



**Figure 1: Annual Average Damages by flood source**

## Summary of flooding impacts

River flooding is primarily attributed to the Luggie Burn and the North Calder Water with the majority of the risk being to residential properties. The transport network is also at risk of flooding including section of railway lines and roads (notably the A752, A8, A73 and A89).

In Coatbridge the South/ Luggie Burn, a tributary of the River Clyde, is predicted to cause flooding to residential and non-residential properties as well as utilities.

Surface water flooding has the largest impact in terms of the number of properties at risk of flooding, with 310 properties at risk. However this flooding is typically shallow therefore the potential damages to each property is less than that from river flooding. Given the urban nature of the area, interaction between river and surface water flooding is likely to occur throughout. The areas at highest risk from surface water flooding will require the preparation of surface water management plans.

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.

Residential properties affected by river flooding experience the highest economic impact at approximately 40% of the damages

Within this Potentially Vulnerable Area it is estimated that climate change will increase the number of residential properties at risk of flooding from approximately 470 to 800 and the number of non-residential properties from approximately 150 to 230.

The location of the impacts of flooding is shown in Figure 3. The greatest concentrated of risk is around Coatbridge and Airdrie with impacts to people, properties, utilities and transport links.

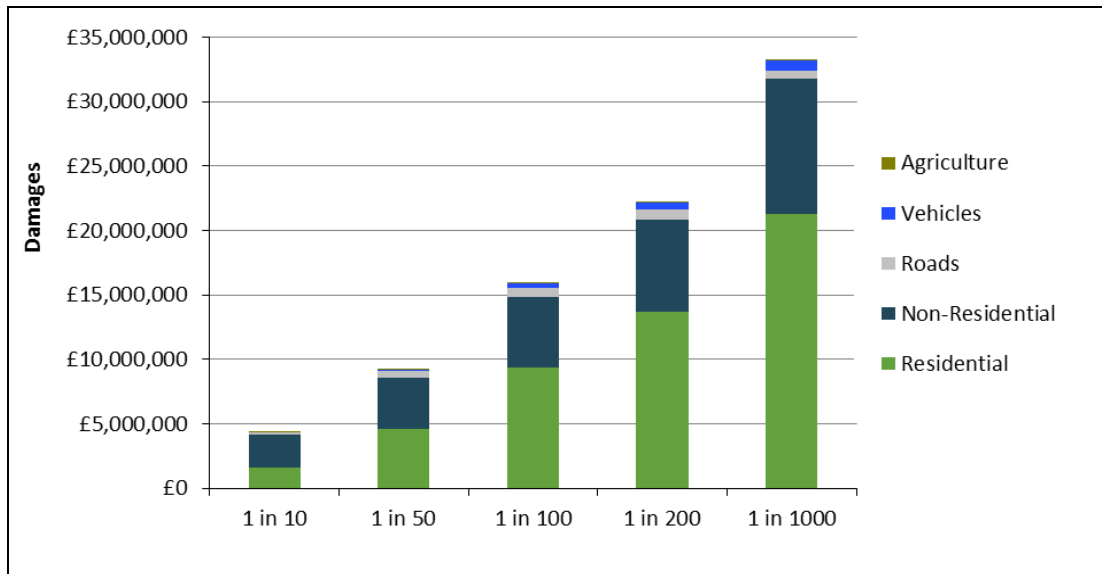
## **History of flooding**

There have been a large number of reported incidents of flooding within this Potentially Vulnerable Area. The floods causing the largest impact to properties and people are detailed below:

- In 30 May 2003 torrential rain / hailstorm caused flooding of roads and community facilities in North Lanarkshire;
- In 2008 there are several records of sewer flooding which resulted in road closures within North Lanarkshire;
- In December 1994 blocked culvert caused flooding in Coatbridge, Glenboig, Airdrie and Caldercruix;
- In 2004 and 2009 sewer flooding caused flooding of properties, roads and gardens;
- In 2001 there were reports of surface water flooding across North Lanarkshire.

	1 in 10 High likelihood	1 in 200 Medium likelihood	1 in 1000 Low likelihood
Residential properties (total 39,000)	80	470	720
Non-residential properties (total 2,800)	60	150	210
People	180	1,000	1,600
Community facilities	0	0	0
Utilities assets	<10	20	80
Transport links-roads (km)	3.8 (including 0.1 of A road)	8.9 including 0.4 of A road)	10.8 including 0.5 of A road)
Transport links-rail (km)	1.7	6.5	7.9
Environmental designated areas (km <sup>2</sup> )	0	0	0
Designated cultural heritage sites	2	3	3
Agricultural land (km <sup>2</sup> )	0.9	1.0	1.1

**Table 1:** Summary of flooding impacts<sup>1</sup>



**Figure 2:** Damages by flood likelihood

<sup>1</sup> Some receptors are counted more than once if flooded from multiple sources



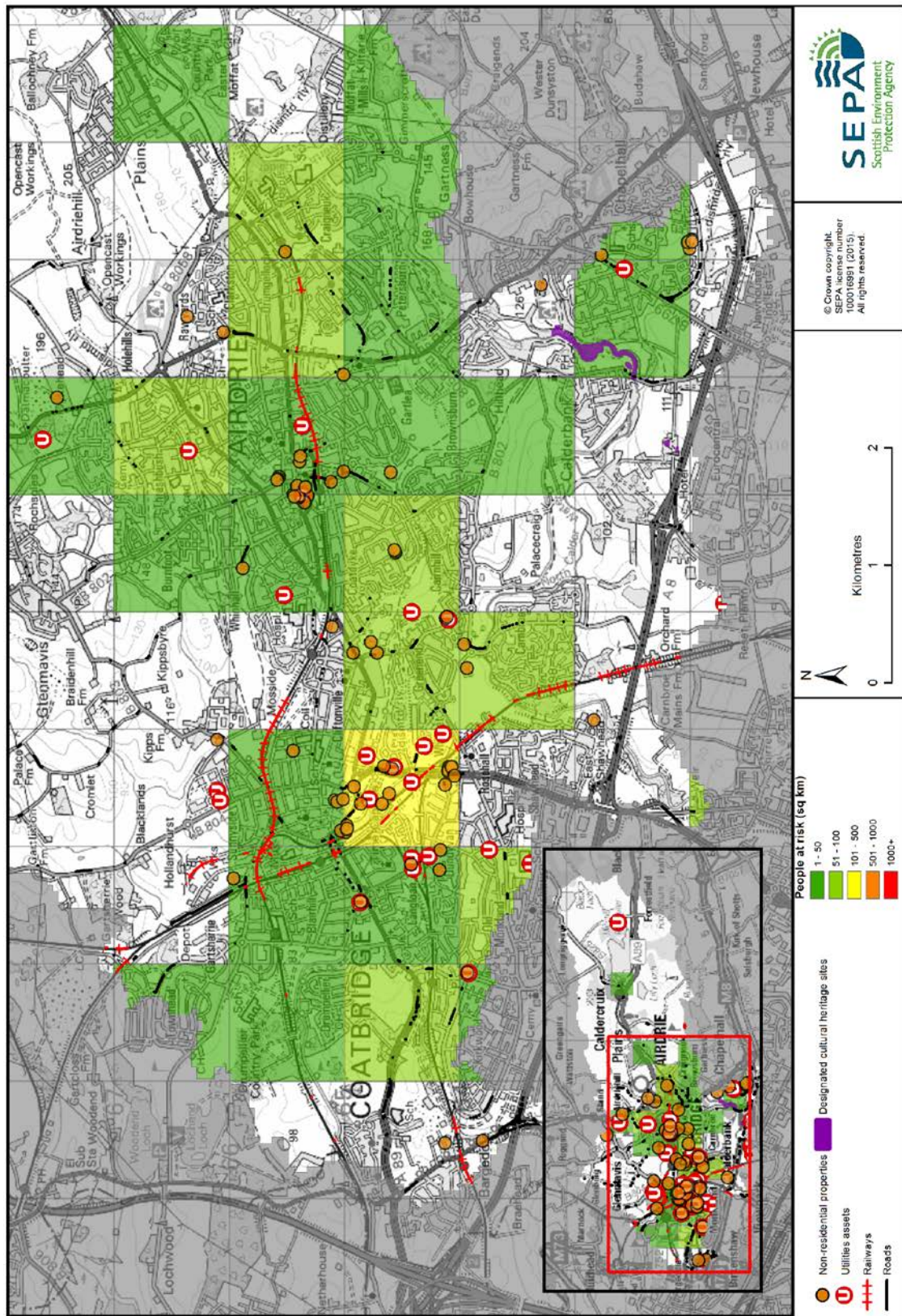


Figure 3: Impacts of flooding

## Objectives to manage flooding in Potentially Vulnerable Area 11/17/3

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 Coatbridge and Airdrie Potentially Vulnerable Area.

Target area	Objective	ID	Indicators within PVA
Coatbridge and Airdrie	Reduce the economic damages and risk to people from surface water flooding in Coatbridge and Airdrie	11110	* See note below
Applies across Clyde and Loch Lomond Local Plan District	Avoid an overall increase in flood risk	11127	<ul style="list-style-type: none"> <li>• 470 residential properties</li> <li>• £900,000 Annual Average Damages</li> </ul>
Applies across Clyde and Loch Lomond Local Plan District	Reduce overall flood risk	11132	<ul style="list-style-type: none"> <li>• 470 residential properties</li> <li>• £900,000 Annual Average Damages</li> </ul>
Applies across Clyde and Loch Lomond 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 11/17/3 there are 310 residential properties at risk and Annual Average Damages of £410,000.

## Actions to manage flooding in Potentially Vulnerable Area 11/17/3

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 Coatbridge and Airdrie Potentially Vulnerable Area.

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

<b>Action (ID):</b>	<b>SURFACE WATER PLAN/STUDY (111101018)</b>		
<b>Objective (ID):</b>	Reduce the economic damages and risk to people from surface water flooding in Coatbridge and Airdrie (11110)		
<b>Delivery lead:</b>	North Lanarkshire Council		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	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. The Metropolitan Glasgow Strategic Drainage Partnership will support the process and improve knowledge and understanding of surface water flood risk and interactions with other sources of flooding e.g. with the sewer network and watercourses.		

<b>Action (ID):</b>	<b>STRATEGIC MAPPING AND MODELLING (111320019)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Scottish Water		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>FLOOD FORECASTING (111320009)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	SEPA		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>SELF HELP (111320011)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	—		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>AWARENESS RAISING (111320013)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Responsible authorities		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>MAINTENANCE (111320007)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Local authorities, asset / land managers		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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.		

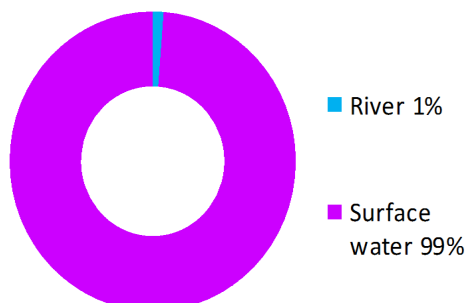
<b>Action (ID):</b>	<b>EMERGENCY PLANS/RESPONSE (111320014)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Category 1 and 2 Responders		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	Providing an emergency response to flooding 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.		

<b>Action (ID):</b>	<b>PLANNING POLICIES (111270001)</b>		
<b>Objective (ID):</b>	Avoid an overall increase in flood risk (11127) Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Planning authority		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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.		

## Coatbridge/Viewpark (Potentially Vulnerable Area 11/18)

Local Plan District	Local authority	Main catchment
Clyde and Loch Lomond	North Lanarkshire Council	North Calder Water

### Summary of flooding impacts



#### At risk of flooding

- 50 residential properties
- <10 non-residential properties
- £43,000 Annual Average Damages

(damages by flood source shown left)

Summary of flooding impacts

### 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.

Objectives

### Summary of actions to manage flooding

The actions below have been selected to manage flood risk.

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

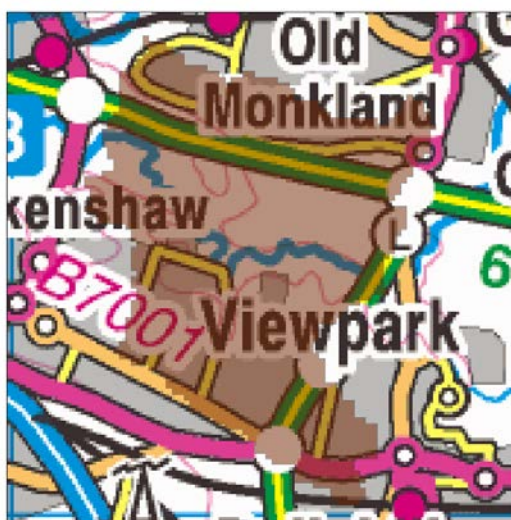
Actions

## Coatbridge/Viewpark (Potentially Vulnerable Area 11/18)

Local Plan District	Local authority	Main catchment
Clyde and Loch Lomond	North Lanarkshire Council	North Calder Water

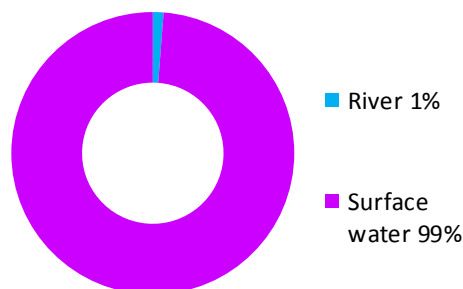
### Background

This Potentially Vulnerable Area is located to the east of Glasgow, within the North Calder Water catchment and is 7km<sup>2</sup> (shown below). Kirkwood and Kirkshaw residential areas are in the north of the area, while Viewpark and Righead Industrial Estate is in the south.



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

There are approximately 50 residential properties at risk of flooding. The Annual Average Damages are approximately £43,000.



**Figure 1:** Annual Average Damages by flood source

### Summary of flooding impacts

Almost all flood risk in this area comes from surface water flooding. Residential properties, as well as a number of local roads, are likely to be affected by surface water flooding within Viewpark. In Kirkshaw, a number of roads (including the A8) and residential properties are at risk of surface water flooding. There is also surface water flooding predicted in Righead industrial estate. Businesses in the estate are likely to experience restricted access and disruption due to flooded roads and yards. The areas at highest risk from surface water flooding will require the preparation of surface water management plans.

River flooding will mainly impact woodland and agricultural land in this area with a small section of the A8 also predicted to be impacted. The predicted flooding arises from possible capacity constraints imposed by a culverted section of the Luggie Burn which flows through Coatbridge and into the North Calder Water.

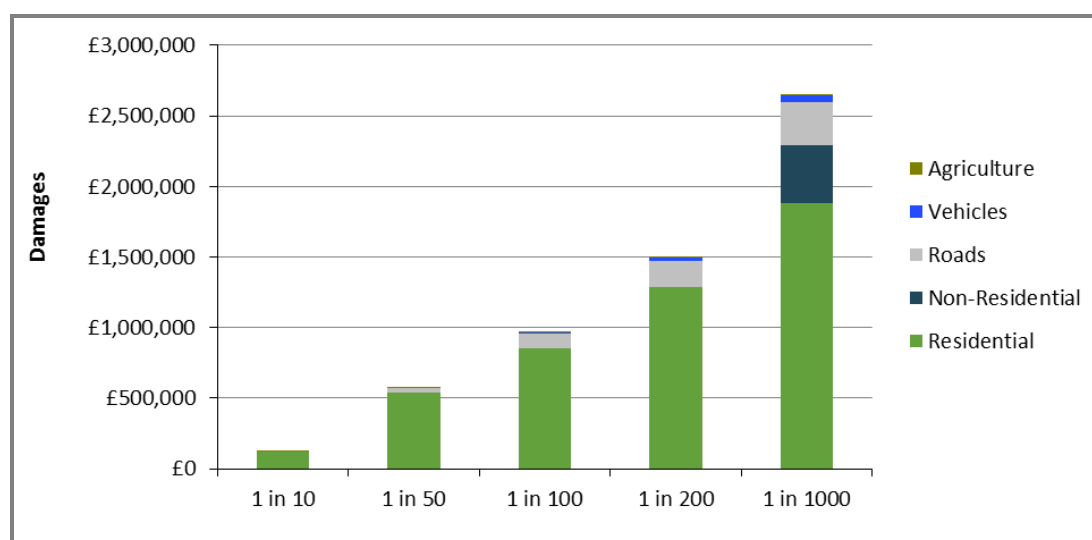
The risk of flooding to people and property, as well as to community facilities, utilities, the transport network, designated sites and agricultural land is summarised in Table 1. The damages associated with floods of different likelihood are shown in Figure 2. Residential properties affected by surface water flooding experience the highest economic impact at approximately 90% of the damages.

Within this Potentially Vulnerable Area it is estimated that climate change will increase the number of residential properties at risk of flooding from approximately 50 to 80.

The location of the impacts of flooding is shown in Figure 3. There are impacts to people and properties predominately in the west of the area with short sections of the A8 and A725 at risk of flooding.

	1 in 10 High likelihood	1 in 200 Medium likelihood	1 in 1000 Low likelihood
Residential properties (total 5,000)	<10	50	80
Non-residential properties (total 500)	<10	<10	10
People	20	120	170
Community facilities	0	0	0
Utilities assets	<10	<10	10
Transport links-roads (km)	0.5 (of which 0.1 is A road)	1.8 (of which 0.7 is A road)	2.2 (of which 0.9 is A road)
Environmental designated areas (km <sup>2</sup> )	0	0	0
Designated cultural heritage sites	0	0	0
Agricultural land (Km <sup>2</sup> )	<0.1	<0.1	<0.1

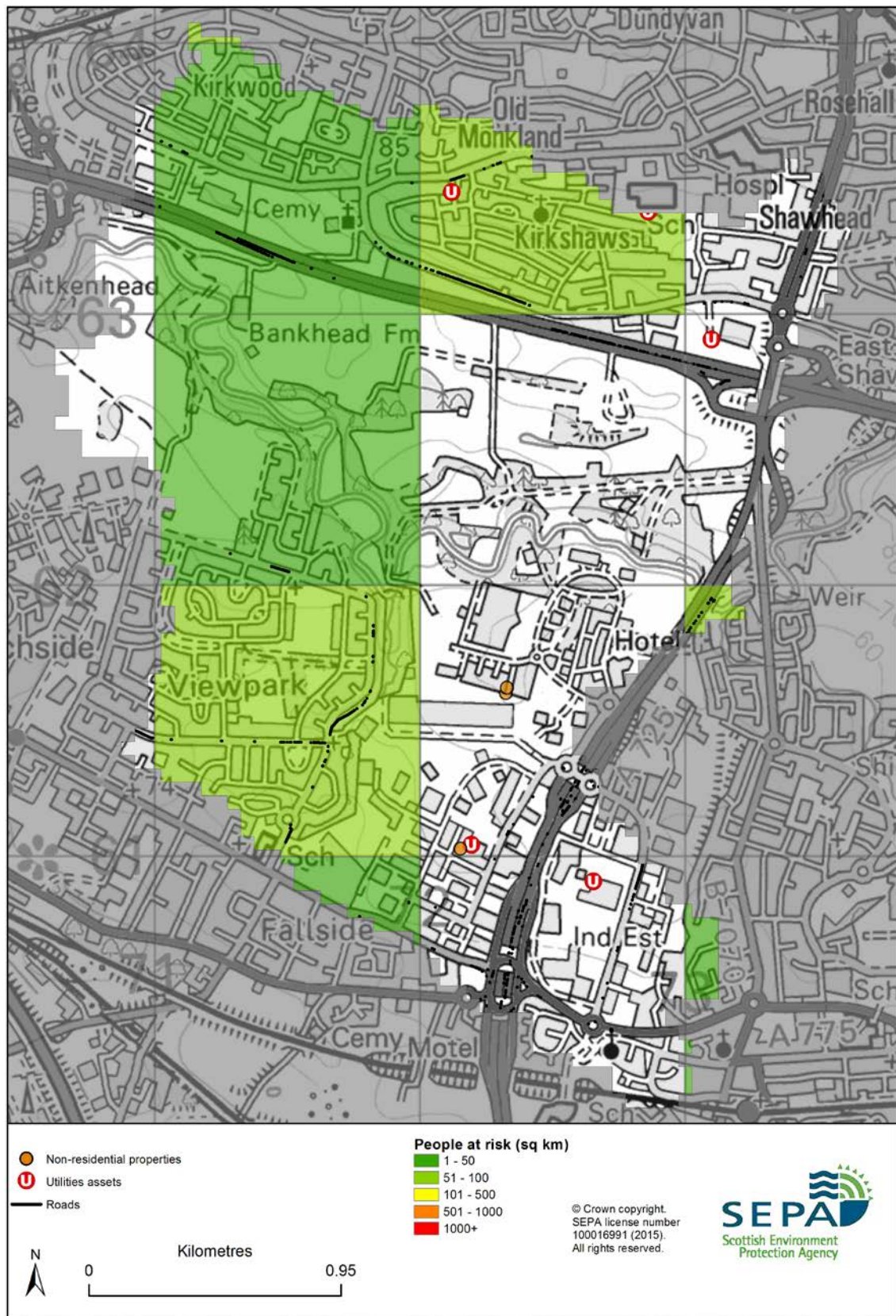
**Table 1:** Summary of flooding impacts<sup>1</sup>



**Figure 2:** Damages by flood likelihood

<sup>1</sup> Some receptors are counted more than once if flooded from multiple sources





**Figure 3: Impacts of flooding**

## History of flooding

There have been reported incidents of flooding within this Potentially Vulnerable Area. These have not been directly related to river or surface water flooding. Rather, they have been caused by capacity exceedance of drainage systems, sewers and other artificial structures. All records are in the location of Kirkwood and Kirkshaw in Coatbridge and the floods have had only minor impacts on the surrounding area.

## Objectives to manage flooding in Potentially Vulnerable Area 11/18

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 Coatbridge/Viewpark Potentially Vulnerable Area.

Target area	Objective	ID	Indicators within PVA
Applies across Clyde and Loch Lomond Local Plan District	Avoid an overall increase in flood risk	11127	<ul style="list-style-type: none"> <li>• 50 residential properties</li> <li>• £43,000 Annual Average Damages</li> </ul>
Applies across Clyde and Loch Lomond Local Plan District	Reduce overall flood risk	11132	<ul style="list-style-type: none"> <li>• 50 residential properties</li> <li>• £43,000 Annual Average Damages</li> </ul>
Applies across Clyde and Loch Lomond 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 11/18

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 Coatbridge/Viewpark Potentially Vulnerable Area.

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

<b>Action (ID):</b>	<b>STRATEGIC MAPPING AND MODELLING (111320019)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Scottish Water		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>FLOOD FORECASTING (111320009)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	SEPA		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>SELF HELP (111320011)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	—		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>AWARENESS RAISING (111320013)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Responsible authorities		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>MAINTENANCE (111320007)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	North Lanarkshire Council, asset / land managers		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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.		

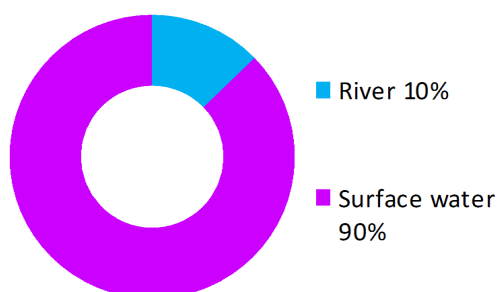
<b>Action (ID):</b>	<b>EMERGENCY PLANS/RESPONSE (111320014)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Category 1 and 2 Responders		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>Providing an emergency response to 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.</p>		

<b>Action (ID):</b>	<b>PLANNING POLICIES (111270001)</b>		
<b>Objective (ID):</b>	Avoid an overall increase in flood risk (11127) Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Planning authority		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>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.</p>		

## North of Wishaw (Potentially Vulnerable Area 11/19)

Local Plan District	Local authority	Main catchment
Clyde and Loch Lomond	North Lanarkshire Council	South Calder Water

### Summary of flooding impacts



#### At risk of flooding

- 30 residential properties
- <10 non-residential properties
- £50,000 Annual Average Damages

(damages by flood source shown left)

Summary of flooding impacts

### 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.

Objectives

### Summary of actions to manage flooding

The actions below have been selected to manage flood risk.

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

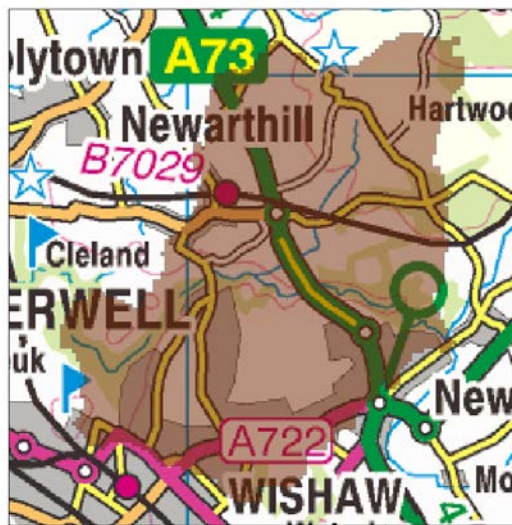
Actions

## North of Wishaw (Potentially Vulnerable Area 11/19)

Local Plan District	Local authority	Main catchment
Clyde and Loch Lomond	North Lanarkshire Council	South Calder Water

### Background

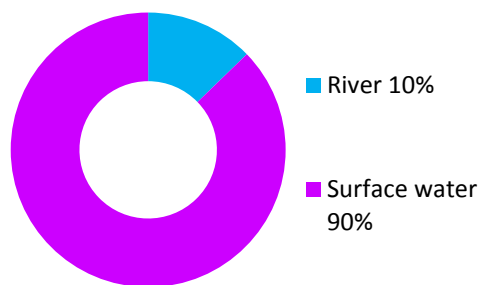
This Potentially Vulnerable Area is located to the south east of Glasgow within the South Calder Water catchment and is approximately 20km<sup>2</sup> (shown below). The town of Wishaw is in the south west.



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

There are approximately 30 residential properties at risk of flooding. The Annual Average Damages are approximately £50,000.



**Figure 1:** Annual Average Damages by flood source

### Summary of flooding impacts

The primary risk in this area is from surface water flooding, predominantly to the east of Wishaw where flooding may affect residential properties, roads (notably the A73) and utilities. The areas at highest risk from surface water flooding will require the preparation of surface water management plans.

The South Calder Water, a tributary of the River Clyde, flows in a westerly direction across the Potentially Vulnerable Area, north of Newmains and Wishaw. There is a small risk to properties from river flooding.

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. Surface water damages may be under-represented in Figure 2 due to limitations in the available modelling. Damages to residential properties provide the highest contribution to economic damages.

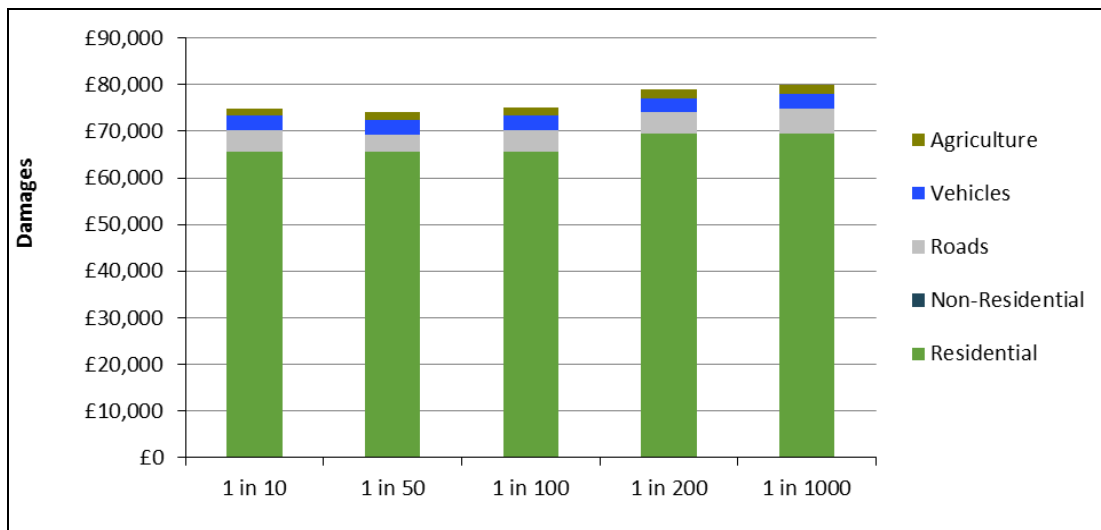
Within this Potentially Vulnerable Area it is estimated that climate change will increase the number of residential properties at risk of flooding from approximately 30 to 40.

The location of the impacts of flooding is shown in Figure 3. Almost all impacts are within Wishaw with flooding to properties and small sections of road.



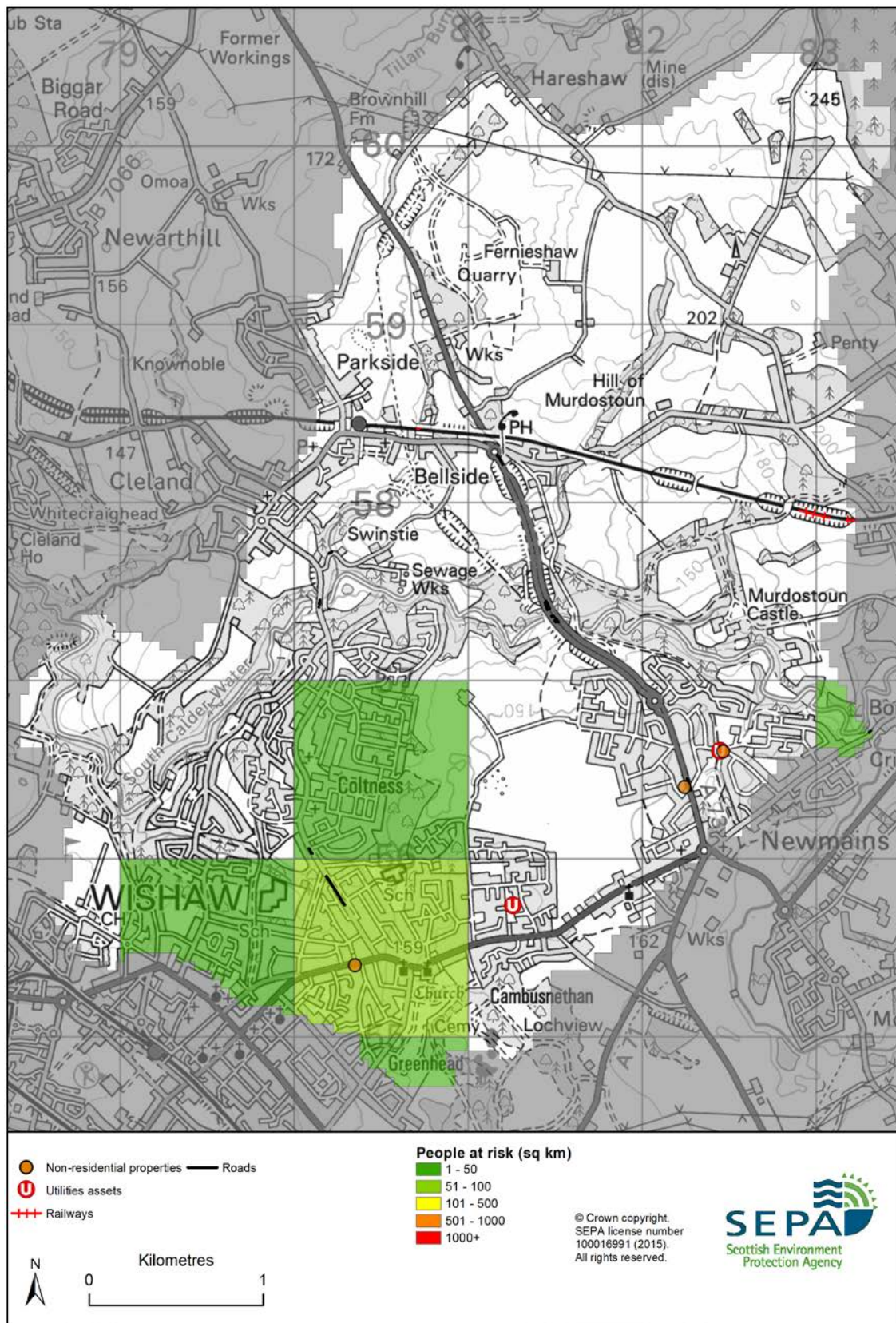
	1 in 10 High Likelihood	1 in 200 Medium Likelihood	1 in 1000 Low Likelihood
Residential properties (total 8,600)	<10	30	40
Non-residential properties (total 310)	<10	<10	<10
People	<10	70	90
Community facilities	0	0	0
Utilities assets	<10	<10	<10
Transport links - roads (km)	0.4 (of which 0.2 is A road)	0.5 (of which 0.3 is A road)	0.5 (of which 0.3 is A road)
Transport links - rail (km)	0.2	0.2	0.2
Environmental designated areas (km <sup>2</sup> )	0	0	0
Designated cultural heritage sites	0	0	0
Agricultural land (km <sup>2</sup> )	<0.1	<0.1	<0.1

**Table 1:** Summary of flooding impacts<sup>1</sup>



**Figure 2:** Damages by flood likelihood

<sup>1</sup> Some receptors are counted more than once if flooded from multiple sources



**Figure 3: Impacts of flooding**

## History of flooding

The majority of reported incidents have been due to surface water flooding. These are predominantly concentrated in Wishaw, in the southern section of this area. The flood which caused the highest damages to properties and people in North Lanarkshire occurred on the 30 May 2003. This flood caused widespread disruption throughout the town, affecting roads, schools and properties. Other less damaging surface water floods have occurred in Wishaw between 1998 and 2009, affecting properties, businesses and roads.

## Objectives to manage flooding in Potentially Vulnerable Area 11/19

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 North of Wishaw Potentially Vulnerable Area.

Target area	Objective	ID	Indicators within PVA
Motherwell and Wishaw	Reduce the economic damages and risk to people from surface water flooding in Motherwell and Wishaw	11113	* See note below
Applies across Clyde and Loch Lomond Local Plan District	Avoid an overall increase in flood risk	11127	<ul style="list-style-type: none"> <li>• 30 residential properties</li> <li>• £50,000 Annual Average Damages</li> </ul>
Applies across Clyde and Loch Lomond Local Plan District	Reduce overall flood risk	11132	<ul style="list-style-type: none"> <li>• 30 residential properties</li> <li>• £50,000 Annual Average Damages</li> </ul>
Applies across Clyde and Loch Lomond 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 11/19 there are 30 residential properties at risk and Annual Average Damages of £40,000.

## Actions to manage flooding in Potentially Vulnerable Area 11/19

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 North of Wishaw Potentially Vulnerable Area.

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

<b>Action (ID):</b>	<b>SURFACE WATER PLAN/STUDY (111132018)</b>		
<b>Objective (ID):</b>	Reduce the economic damages and risk to people from surface water flooding in Motherwell and Wishaw (11113)		
<b>Delivery lead:</b>	North Lanarkshire Council		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2022-2027</b>
<b>Description:</b>	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. The Metropolitan Glasgow Strategic Drainage Partnership will support the process and improve knowledge and understanding of surface water flood risk and interactions with other sources of flooding e.g. with the sewer network and watercourses.		

<b>Action (ID):</b>	<b>STRATEGIC MAPPING AND MODELLING (111320016)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	SEPA		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	SEPA will seek to incorporate additional surface water data into the flood maps to improve understanding of flood risk. Approximately 2,200km <sup>2</sup> 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.		

<b>Action (ID):</b>	<b>STRATEGIC MAPPING AND MODELLING (111320019)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Scottish Water		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>FLOOD FORECASTING (111320009)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	SEPA		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>SELF HELP (111320011)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	—		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>AWARENESS RAISING (111320013)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Responsible authorities		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>MAINTENANCE (111320007)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	North Lanarkshire Council, asset / land managers		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>EMERGENCY PLANS/RESPONSE (111320014)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Category 1 and 2 Responders		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>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.</p>		

<b>Action (ID):</b>	<b>PLANNING POLICIES (111270001)</b>		
<b>Objective (ID):</b>	Avoid an overall increase in flood risk (11127) Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Planning authority		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>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.</p>		



## Shotts (Potentially Vulnerable Area 11/20)

Local Plan District	Local authority	Main catchment
Clyde and Loch Lomond	North Lanarkshire Council, West Lothian Council	South Calder Water

### Summary of flooding impacts



#### At risk of flooding

- <10 residential properties
- <10 non-residential properties
- £7,200 Annual Average Damages

(damages by flood source shown left)

Summary of flooding impacts

### 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.

Objectives

### Summary of actions to manage flooding

The actions below have been selected to manage flood risk.

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

Actions

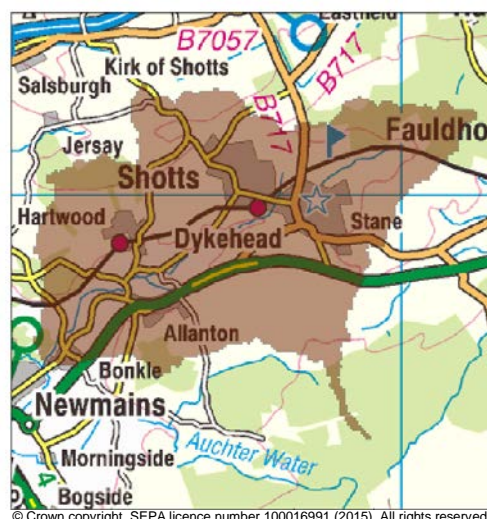
## Shotts (Potentially Vulnerable Area 11/20)

Local Plan District	Local authority	Main catchment
Clyde and Loch Lomond	North Lanarkshire Council, West Lothian Council	South Calder Water

### Background

The Potentially Vulnerable Area is located to the east of Glasgow, is approximately 30km<sup>2</sup> and incorporates the urban areas of Dykehead and Shotts (shown below).

There are less than 10 residential and non-residential properties at risk of flooding. The Annual Average Damages are approximately £7,200. All damages in this Potentially Vulnerable Area are caused by river flooding.



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### Summary of flooding impacts

The numbers provided in the assessment of flood risk do not include local impacts from groundwater. In this area there are known drainage problems in the village of Allanton due to groundwater rebound from the cessation of mining activities, with the water table close to or above ground level. Iron rich water breaks out at various locations to the south or within the village resulting in problems for land drainage. A number of houses currently have pumps installed within the surface of the soil to prevent flooding of the sub-structure.

The South Calder Water, a tributary of the River Clyde, is the main watercourse in area. It flows in a south-westerly direction through Shotts and past Allanton and Bonkle. The land surrounding the South Calder Water between Bonkle and Shotts is largely rural with extensive flood plains. River flooding is predicted to affect a small number of properties in Calderhead, Shotts where the South Calder Water is culverted underneath the B717 Burnbrae Road for approximately 350m. Historically, this culvert has been the cause of flooding due to blockages. A river restoration scheme is being undertaken to alleviate the problem by opening this culverted section to restore the South Calder to its natural state.

There were no residential properties assessed at risk of surface water flooding within the area however this does not correspond with the known flood history. In Allanbank and Bonkle there are small sections of roads at risk of surface water flooding. The A71 has also been identified to have a small risk of surface water flooding.

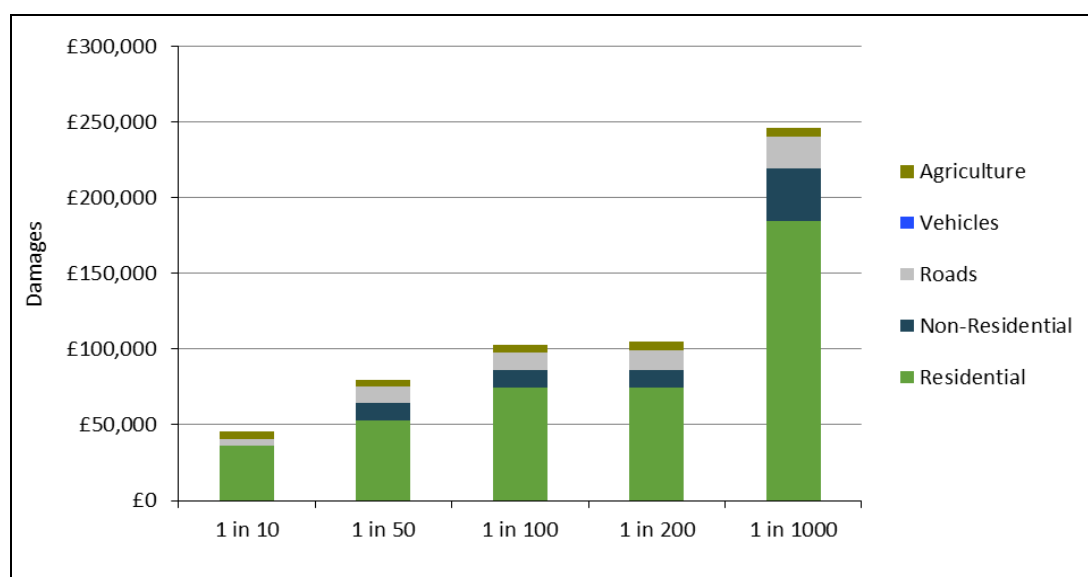
Within this Potentially Vulnerable Area it is estimated that climate change will increase the number of residential properties at risk of flooding from fewer than ten to 20.

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.

The location of the impacts of flooding is shown in Figure 3.

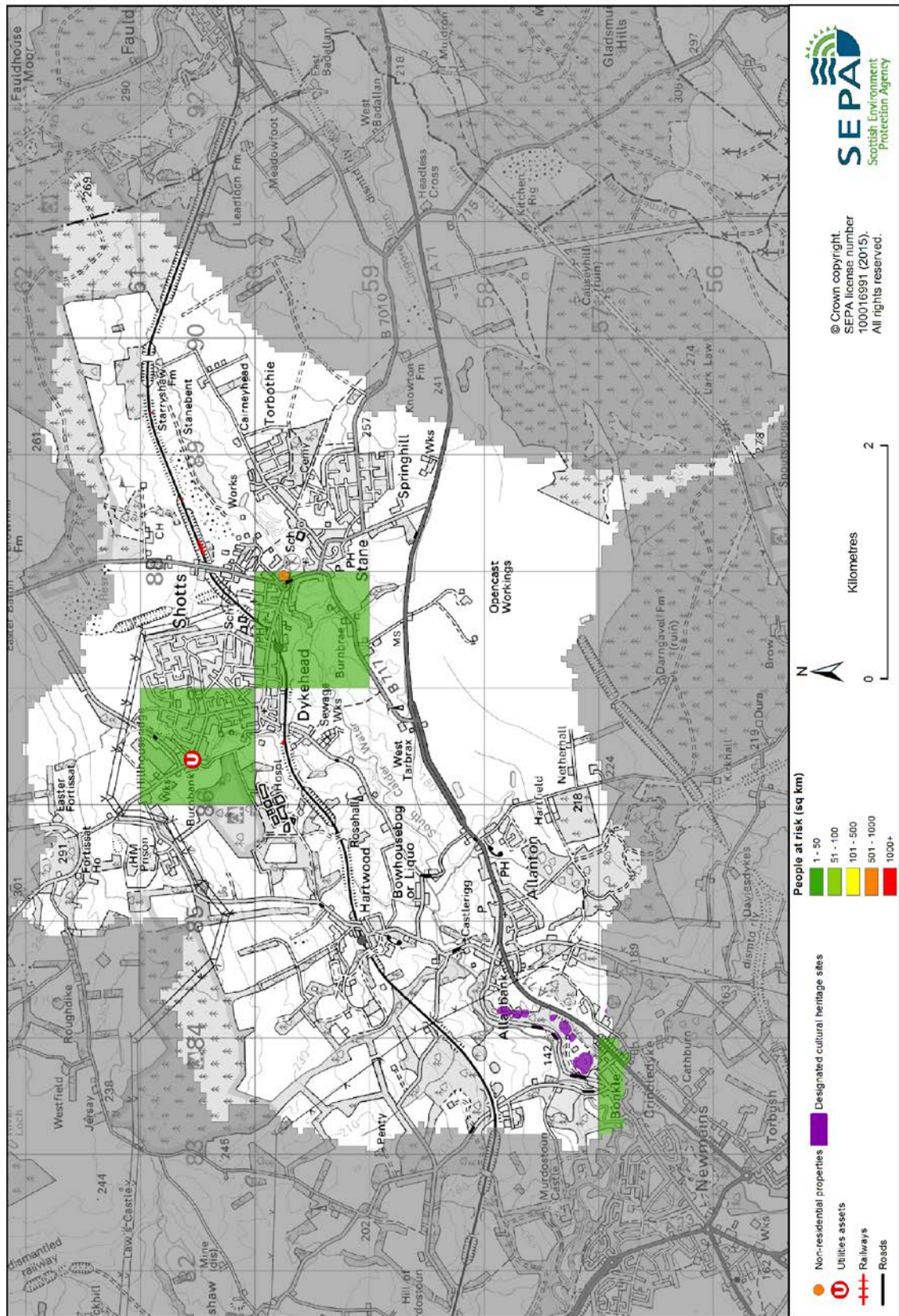
	1 in 10 High Likelihood	1 in 200 Medium Likelihood	1 in 1000 Low Likelihood
Residential properties (total 4,600)	<10	<10	20
Non-residential properties (total 240)	<10	<10	<10
People	<10	<10	30
Community facilities	0	0	0
Utilities assets	<10	<10	<10
Transport links - roads (km)	0.3 (of which <0.1 is A road)	0.7 (of which <0.1 is A road)	0.8 (of which <0.1 is A road)
Transport links - rail (km)	0.2	0.2	0.2
Environmental designated areas (km <sup>2</sup> )	0	0	0
Designated cultural heritage sites	2	2	2
Agricultural land (km <sup>2</sup> )	0.2	0.3	0.3

**Table 1:** Summary of flooding impacts<sup>1</sup>



**Figure 2:** Damages by flood likelihood

<sup>1</sup> Some receptors are counted more than once if flooded from multiple sources



**Figure 3: Impacts of flooding**

## History of flooding

There are records of river and surface water flooding, between the areas of Hartwood, Stane and Shotts. These floods have not had any major impacts and are relatively infrequent.

There are known drainage problems in the village of Allanton due to minewater rebound from the cessation of mining activities, with the groundwater table close to or above ground level. This problem has been mainly affecting residential gardens in the area. The residents association has also expressed concerns about waterlogged gardens and poor horticultural conditions. The council continues to deal with high deposition rates of ochre sediment precipitated in drains and ditches.

## Objectives to manage flooding in Potentially Vulnerable Area 11/20

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 Shotts Potentially Vulnerable Area.

Target area	Objective	ID	Indicators within PVA
Applies across Clyde and Loch Lomond Local Plan District	Avoid an overall increase in flood risk	11127	<ul style="list-style-type: none"> <li>• &lt;10 residential properties</li> <li>• £7,200 Annual Average Damages</li> </ul>
Applies across Clyde and Loch Lomond Local Plan District	Reduce overall flood risk	11132	<ul style="list-style-type: none"> <li>• &lt;10 residential properties</li> <li>• £7,200 Annual Average Damages</li> </ul>
Applies across Clyde and Loch Lomond 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 11/20

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 Shotts Potentially Vulnerable Area.

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

<b>Action (ID):</b>	<b>STRATEGIC MAPPING AND MODELLING (111320016)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	SEPA		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	SEPA will seek to incorporate additional surface water data into the flood maps to improve understanding of flood risk. Approximately 2,200km <sup>2</sup> 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.		

<b>Action (ID):</b>	<b>STRATEGIC MAPPING AND MODELLING (111320019)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Scottish Water		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>FLOOD FORECASTING (111320009)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	SEPA		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>SELF HELP (111320011)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	—		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>AWARENESS RAISING (111320013)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Responsible authorities		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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.		



<b>Action (ID):</b>	<b>MAINTENANCE (111320007)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Local authorities, asset / land managers		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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.		

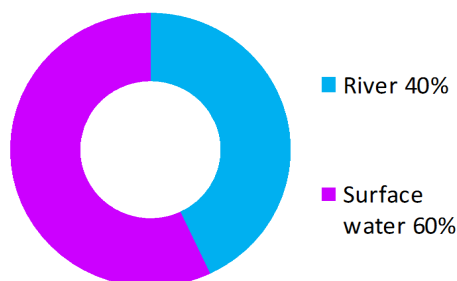
<b>Action (ID):</b>	<b>EMERGENCY PLANS/RESPONSE (111320014)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Category 1 and 2 Responders		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	Providing an emergency response to flooding 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.		

<b>Action (ID):</b>	<b>PLANNING POLICIES (111270001)</b>		
<b>Objective (ID):</b>	Avoid an overall increase in flood risk (11127) Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Planning authority		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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.		

## Kilmacolm (Candidate Potentially Vulnerable Area 11/21c)

Local Plan District	Local authority	Main catchment
Clyde and Loch Lomond	Inverclyde Council, Renfrewshire Council	Gryfe Water

### Summary of flooding impacts



#### At risk of flooding

- 30 residential properties
- 40 non-residential properties
- £96,000 Annual Average Damages

(damages by flood source shown left)

Summary of flooding impacts

### 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.

Objectives

### Summary of actions to manage flooding

The actions below have been selected to manage flood risk.

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

Actions

# Kilmacolm (Candidate Potentially Vulnerable Area 11/21c)

Local Plan District	Local authority	Main catchment
Clyde and Loch Lomond	Inverclyde Council, Renfrewshire Council	Gryfe Water

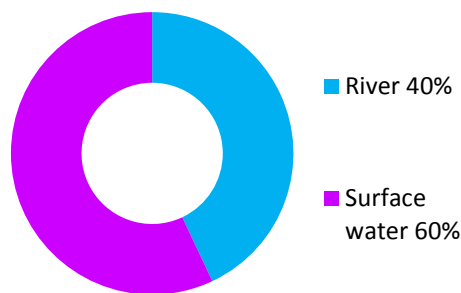
## Background

This candidate Potentially Vulnerable Area covers Kilmacolm and the land to the west (shown below). The Gryfe Water and the Green Water flow through this area. It is approximately 60km<sup>2</sup>.



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

There are approximately 30 residential properties and 40 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

This area was not originally identified as a Potentially Vulnerable Area in 2011. However, updated information on flood risk from the new hazard maps identified that this area should be regarded as a candidate Potentially Vulnerable Area due to the risk to people and properties.

The main risk to residential properties is from the Gryfe Water and the Green Water. These rivers both originate in the north west of the area and flow towards Kilmacolm, with the confluence of the two rivers to the south of the town. The Gryfe Water originates at the Gryfe Reservoir which could offer some attenuation of flows, depending on the management of the reservoir.

There are isolated patches of surface water flooding distributed across the area which impact residential properties and some sections of main road including the B786 and B788.

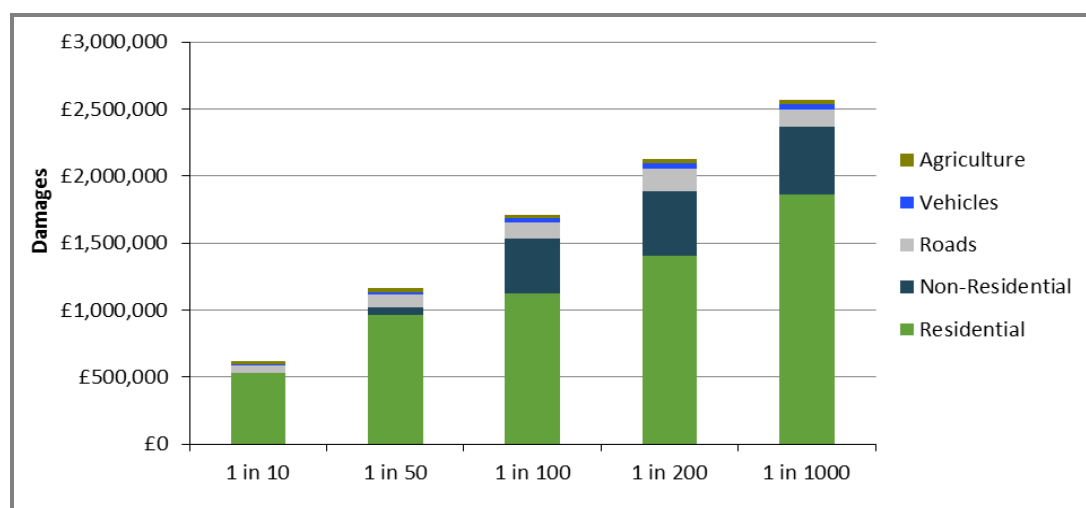
The risk of flooding to people and property, as well as to community facilities, utilities, the transport network, designated sites and agricultural land is summarised in Table 1. The damages associated with floods of different likelihood are shown in Figure 2. For this area the highest damages are to residential properties followed by damages to non-residential properties.

Within this candidate Potentially Vulnerable Area it is estimated that climate change will increase the number of residential properties at risk of flooding from approximately 30 to 50.

The location of the impacts of flooding is shown in Figure 3. Most of flooding impacts are within Kilmacolm.

	1 in 10 High likelihood	1 in 200 Medium likelihood	1 in 1000 Low likelihood
Residential properties (total 2,000)	10	30	40
Non-residential properties (total 260)	<10	40	40
People	30	70	100
Community facilities	<10 Educational buildings	<10 Includes: educational buildings and healthcare facilities	<10 Includes: educational buildings and healthcare facilities
Utilities assets	0	0	0
Transport links - roads (km)	0.7	1.6	2.0
Transport links - rail (km)	0	0	0
Environmental designated areas (km <sup>2</sup> )	2.0	2.0	2.0
Designated cultural heritage sites	6	6	6
Agricultural land (km <sup>2</sup> )	1.1	1.4	1.4

**Table 1:** Summary of flooding impacts<sup>1</sup>



**Figure 2:** Damages by flood likelihood

<sup>1</sup> Some receptors are counted more than once if flooded from multiple sources

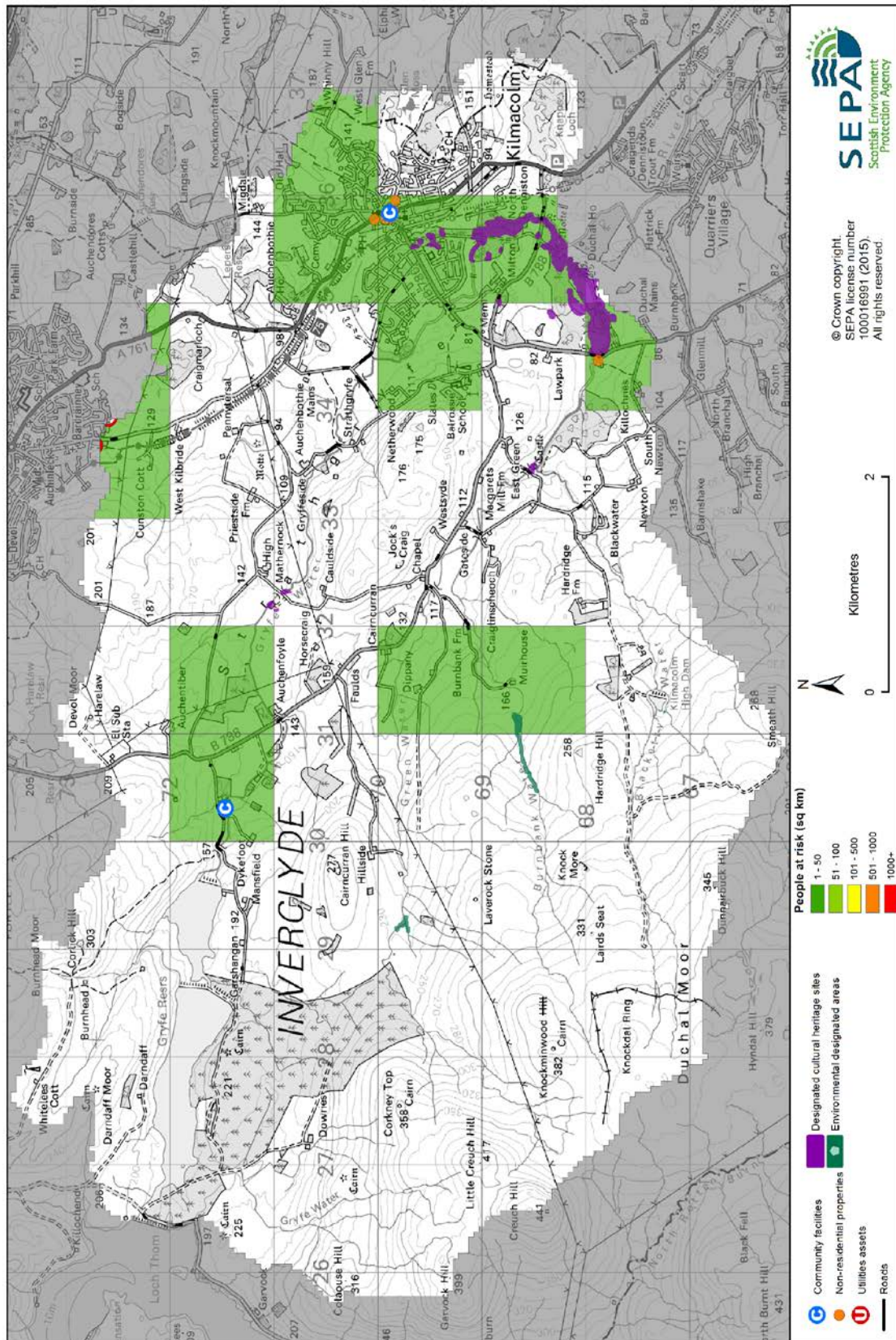


Figure 3: Impacts of flooding

## History of flooding

Glenmosston Burn is known to overtop its banks along Gowkhouse Road resulting in flooding of properties on Glencairn Road. There are limited reports of flooding in this area. Flooding in February 1998 in Strathgryfe was reported when the River Gryfe flooded the surrounding land with up to 18 inches of water.

## Objectives to manage flooding in Potentially Vulnerable Area 11/21c

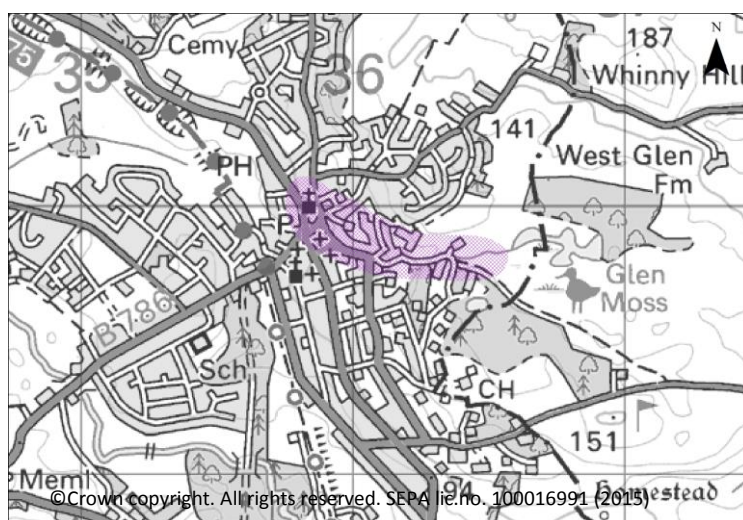
Objectives provide a common goal and shared ambition for managing floods. These objectives have been set by SEPA and agreed with flood risk management authorities following consultation. They were identified through an assessment of the underlying evidence of the causes and impacts of flooding. Target 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 Kilmacolm Candidate Potentially Vulnerable Area.

### Reduce the risk of flooding from the Glenmosston Burn to residential properties and non-residential properties in Kilmacolm

Indicators:

Target area:

- £170,000 Annual Average Damages
- Historic record of flooding to residential properties and main transport links



Objective ID: 11034

Target area	Objective	ID	Indicators within PVA
Applies across Clyde and Loch Lomond Local Plan District	Avoid an overall increase in flood risk	11127	<ul style="list-style-type: none"> <li>• 30 residential properties</li> <li>• £96,000 Annual Average Damages</li> </ul>
Applies across Clyde and Loch Lomond Local Plan District	Reduce overall flood risk	11132	<ul style="list-style-type: none"> <li>• 30 residential properties</li> <li>• £96,000 Annual Average Damages</li> </ul>
Applies across Clyde and Loch Lomond 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 11/21c

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 Kilmacolm Candidate Potentially Vulnerable Area.

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

<b>Action (ID):</b>	<b>FLOOD PROTECTION SCHEME/WORKS (110340006)</b>				
<b>Objective (ID):</b>	Reduce the risk of flooding from the Glenmosston Burn to residential properties and non-residential properties in Kilmacolm (11034)				
<b>Delivery lead:</b>	Inverclyde Council				
<b>Priority:</b>	National:		Within local authority:		
	<b>3 of 42</b>		<b>1 of 4</b>		
<b>Status:</b>	<b>Under development</b>	Indicative delivery:	<b>2016-2021</b>		
<b>Description:</b>	<p>It is recommended that the council look to progress the flood protection scheme proposed for the Glenmosston Burn. The works include upgrading a culvert at Market Place and a new overflow pipe at Gowkhouse Road.</p> <p>A separate natural flood management study is being carried out in the area which may identify additional actions that could be included within the flood protection scheme.</p>				
<b>Potential impacts</b>					
<b>Economic:</b>	The scheme will reduce flooding to trunk roads and properties with a potential economic benefit of £5.1 million. The flood protection scheme has an estimated benefit cost ratio of 10.2.				
<b>Social:</b>	A reduction in flood risk would have a positive benefit to the health and wellbeing of the community.				
<b>Environmental:</b>	Flood protection schemes can have both positive and negative impacts on the ecological quality of the environment depending on how they are designed. There is the potential for temporary construction impacts to the Glen Moss Site of Special Scientific Interest. There is likely to be a loss of habitat and displacement of species in the vicinity of these works; however, these may re-establish and return to the area. Downstream of these conveyance				



<b>Environmental:</b>	works there may be negative impacts on water quality through localised increased erosion and sedimentation.
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<b>Action (ID):</b>	<b>NEW FLOOD WARNING (111320010)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	SEPA		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>post 2021</b>
<b>Description:</b>	The area under consideration includes properties affected by flooding from the River Gryfe. A review of the flood risk in this location is required to assess the potential for flood warning delivery and subsequent to that appropriate timescales for delivery.		

<b>Action (ID):</b>	<b>NATURAL FLOOD MANAGEMENT STUDY (110340003)</b>		
<b>Objective (ID):</b>	Reduce the risk of flooding from the Glenmosston Burn to residential properties and non-residential properties in Kilmacolm (11034)		
<b>Delivery lead:</b>	Inverclyde Council		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	A natural flood management study should be carried out to further investigate the potential benefit for floodplain restoration at Glen Moss in Kilmacolm. These actions should help complement the protection that will be offered by the Glenmosston Burn works, by holding more water in the upper catchment. A scoping study is to be carried out by Inverclyde Council to inform future direction of the natural flood management study. The council should look to engage with land owners early in the process to establish the potential for any works.		

<b>Potential impacts</b>	
<b>Economic:</b>	The economic impact of natural flood management actions is difficult to define. However, these actions can reduce flood risk for high likelihood events.
<b>Social:</b>	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.
<b>Environmental:</b>	Natural flood management actions can have a positive impact on the ecological quality of the environment by restoring and enhancing natural habitats. There is the potential for permanent impacts to the Glen Moss Site of Special Scientific Interest as the existing ecosystems in the area for restoration may be impacted through a potential change in vegetation, management and local hydrology. There may, however, be improvements in biodiversity and water quality through this action.

<b>Action (ID):</b>	<b>STRATEGIC MAPPING AND MODELLING (111320019)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Scottish Water		
<b>Status:</b>	<b>Not started</b>	Indicative delivery:	<b>2016-2021</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>FLOOD FORECASTING (111320009)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	SEPA		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>SELF HELP (111320011)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	—		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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.		

<b>Action (ID):</b>	<b>AWARENESS RAISING (111320013)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Responsible authorities		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>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.</p> <p>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.</p>		

<b>Action (ID):</b>	<b>MAINTENANCE (111320007)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Inverclyde Council, asset / land managers		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>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.</p>		

<b>Action (ID):</b>	<b>EMERGENCY PLANS/RESPONSE (111320014)</b>		
<b>Objective (ID):</b>	Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Category 1 and 2 Responders		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	<p>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.</p>		

<b>Action (ID):</b>	<b>PLANNING POLICIES (111270001)</b>		
<b>Objective (ID):</b>	Avoid an overall increase in flood risk (11127) Reduce overall flood risk (11132)		
<b>Delivery lead:</b>	Planning authority		
<b>Status:</b>	<b>Existing</b>	Indicative delivery:	<b>Ongoing</b>
<b>Description:</b>	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

## Clyde and Loch Lomond 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

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## 3.1 Introduction

In the Clyde and Loch Lomond Local Plan District, river flooding is reported across three 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 <sup>1</sup>	Annual Average Damages	Local Authority
<b>River catchments</b>			
River Clyde catchment group	9,600	£22 million	Dumfries and Galloway Council, East Ayrshire Council, East Dunbartonshire Council, East Renfrewshire Council, Falkirk Council, Glasgow City Council, Inverclyde Council, North Ayrshire Council, North Lanarkshire Council, Renfrewshire Council, Scottish Borders Council, South Lanarkshire Council, Stirling Council, West Dunbartonshire Council, West Lothian Council.
River Leven (Dunbartonshire) catchment group	1,100	£4.2 million	Argyll and Bute Council, Stirling Council, West Dunbartonshire Council.
Firth of Clyde catchment group	920	£1.8 million	Argyll and Bute Council, Inverclyde Council, North Ayrshire Council.
<b>Coastal flooding</b>			
Clyde and Loch Lomond coastal area	4,900	£19 million	Argyll and Bute Council, Glasgow City Council, Inverclyde Council, Renfrewshire Council, North Ayrshire Council, South Lanarkshire Council, West Dunbartonshire Council
<b>Surface water flooding</b>			
Clyde and Loch Lomond Local Plan District	19,000	£20 million	Argyll and Bute Council, Dumfries and Galloway Council, East Ayrshire Council, East Dunbartonshire Council, East Renfrewshire Council, Falkirk Council, Glasgow City Council, Inverclyde Council, North Ayrshire Council, North Lanarkshire Council, Renfrewshire Council, Scottish Borders Council, South Lanarkshire Council, Stirling Council, West Dunbartonshire Council, West Lothian Council.

**Table 1:** Summary of flood risk from various sources within the Clyde and Loch Lomond Local Plan District

<sup>1</sup> Total number of residential and non-residential properties at risk of flooding.

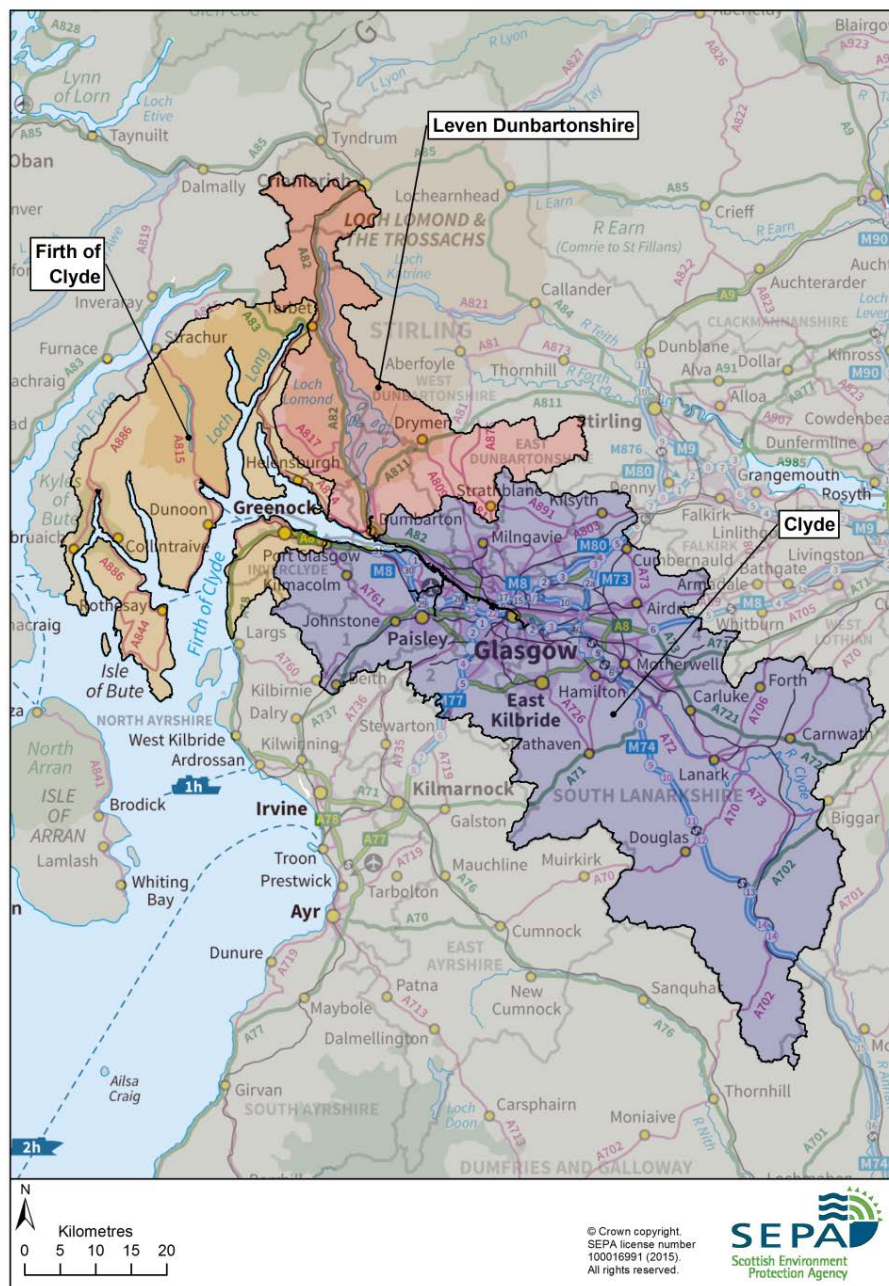
## 3.2 River flooding

### Clyde and Loch Lomond 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 Clyde and Loch Lomond Local Plan District, river flooding is reported across three distinct river catchments, shown below.



**Figure 1:** River catchments within the Clyde and Loch Lomond Local Plan District

## River flooding

### River Clyde catchment group

#### Catchment overview

The Clyde catchment group is located within the Clyde and Loch Lomond Local Plan District covering an area of over 3,000km<sup>2</sup>. The catchment is over 86% rural and almost 14% urban with a population of approximately 1.7 million people.

This river catchment group contains 15 local authorities: Dumfries and Galloway Council, East Ayrshire Council, East Dunbartonshire Council, East Renfrewshire Council, Falkirk Council, Glasgow City Council, Inverclyde Council, North Ayrshire Council, North Lanarkshire Council, Renfrewshire Council, Scottish Borders Council, South Lanarkshire Council, Stirling Council, West Dunbartonshire Council and West Lothian Council.

The catchment group is largely dominated by the River Clyde which is formed by the confluence of two streams in the far south of the catchment (the Daer Water and the Portrail Water). From here, it flows mostly in a north-westerly direction before continuing into Glasgow and finally flowing into the Firth of Clyde. The north west of the area is dominated by three main river catchments: the White Cart Water, the Black Cart Water (which join to become the River Cart shortly before flowing into the Firth of Clyde) and the Gryfe Water. The River Kelvin dominates the north east and its origin is Kelvinhead, to the east of Kilsyth. The River Kelvin flows past Kirkintilloch and Bersden before heading south into Glasgow and discharging into the River Clyde near Yorkhill.

The average annual rainfall for the Clyde catchment group is average for Scotland, ranging between 1,269mm and 1,726mm in the upper parts of the catchment and 1,124mm and 1,717mm in the lower reaches.

#### Flood risk in the catchment

Within the Clyde catchment group approximately 7,800 residential properties are predicted to be at risk of river flooding, 95% of which are located within a Potentially Vulnerable Area. Approximately 1,800 non-residential properties are predicted to be at risk of river flooding, 96% of which are located within a Potentially Vulnerable Area. There are 16 Potentially Vulnerable Areas and one candidate Potentially Vulnerable Area at risk of flooding in this catchment group. One of these (11/01) is also partially in the Leven catchment group. (Figure 1):

- Loch Lomond and Vale of Leven (11/01)
- Kilsyth to Bearsden – north of Glasgow City (11/04)
- Yoker catchment – Clydebank to Partick (11/05)
- Clyde south – Port Glasgow to Inchinnan (11/09)
- Bishopton (11/10)
- Gryfe catchment – Bridge of Weir to Houston (11/11)
- Black Cart Water catchment – Lochwinnoch to Johnstone (11/12)
- White Cart Water catchment (11/13)
- Rutherglen (11/14)
- Glasgow City north (11/15)
- East of Glasgow (11/17/1)
- Clyde catchment – Motherwell to Lesmahagow (11/17/2)
- Coatbridge and Airdrie (11/17/3)



- Coatbridge/Viewpark (11/18)
- North of Wishaw (11/19)
- Shotts (11/20)
- Kilmacolm (11/21c)

One of the Potentially Vulnerable Areas (11/17) has been split into three sections to aid reporting of the risks.

### Main areas at risk

The main areas with a risk of river flooding can be seen in Table 1 which 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
Glasgow City	3,500	£9.8 million
Paisley and Johnstone	1,600	£2.7million
Rutherglen	650	£2.5 million
Kirkintilloch	570	£740,000
Clydebank	290	£720,000
Giffnock and Thornliebank	270	£1.6 million
Coatbridge and Airdrie	210	£440,000
Cambuslang	190	£600,000
Hamilton	180	£980,000
Barrhead	150	£340,000

**Table 1:** Main areas at risk of river flooding

### Economic activity and infrastructure at risk

The Annual Average Damages caused by river flooding in the Clyde catchment group are approximately £22 million. This accounts for approximately 33% of the estimated Annual Average Damages from all flooding sources within the Local Plan District. The damages are distributed as follows:

- 60% residential properties (£13 million)
- 29% non-residential properties (£6.4 million)
- 5% emergency services (£1.1 million)
- 3% vehicles (£650,000)
- 2% roads (£350,000)
- 1% agriculture (£180,000).

Figure 2 shows the Annual Average Damages throughout the catchment group.

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

	Number at risk	Further detail
<b>Community facilities</b>	10	Includes: educational buildings, emergency services and healthcare facilities
<b>Utility assets</b>	110	Includes: electricity sub stations, telecommunications, oil refining and distribution, gas regulating and mineral and fuel extraction sites.
<b>Roads (km)</b>	32.7	Primary roads and Motorways include: A725 at Bothwell A726 at Renfrew, Paisley and Strathaven A737 at Kilbarchan M74 at Motherwell  A-Roads include: A752 between Bargeddie and Aitkenhead in Coatbridge A723 between Motherwell and Hamilton A736 north-west of Neilston in Barrhead A8 east of Inchinnan A760 Lochwinnoch
<b>Railway routes (km)</b>	16.5km	Notably: Glasgow City to Whifflet in Coatbridge Carstairs to Glasgow City Elvanfoot to Carstairs Bearsden to Milngavie Glasgow City to Ayr between Kilbirnie and Johnstone Railway line at Neilson
<b>Airports</b>	1	
<b>Agricultural land (km<sup>2</sup>)</b>	92	

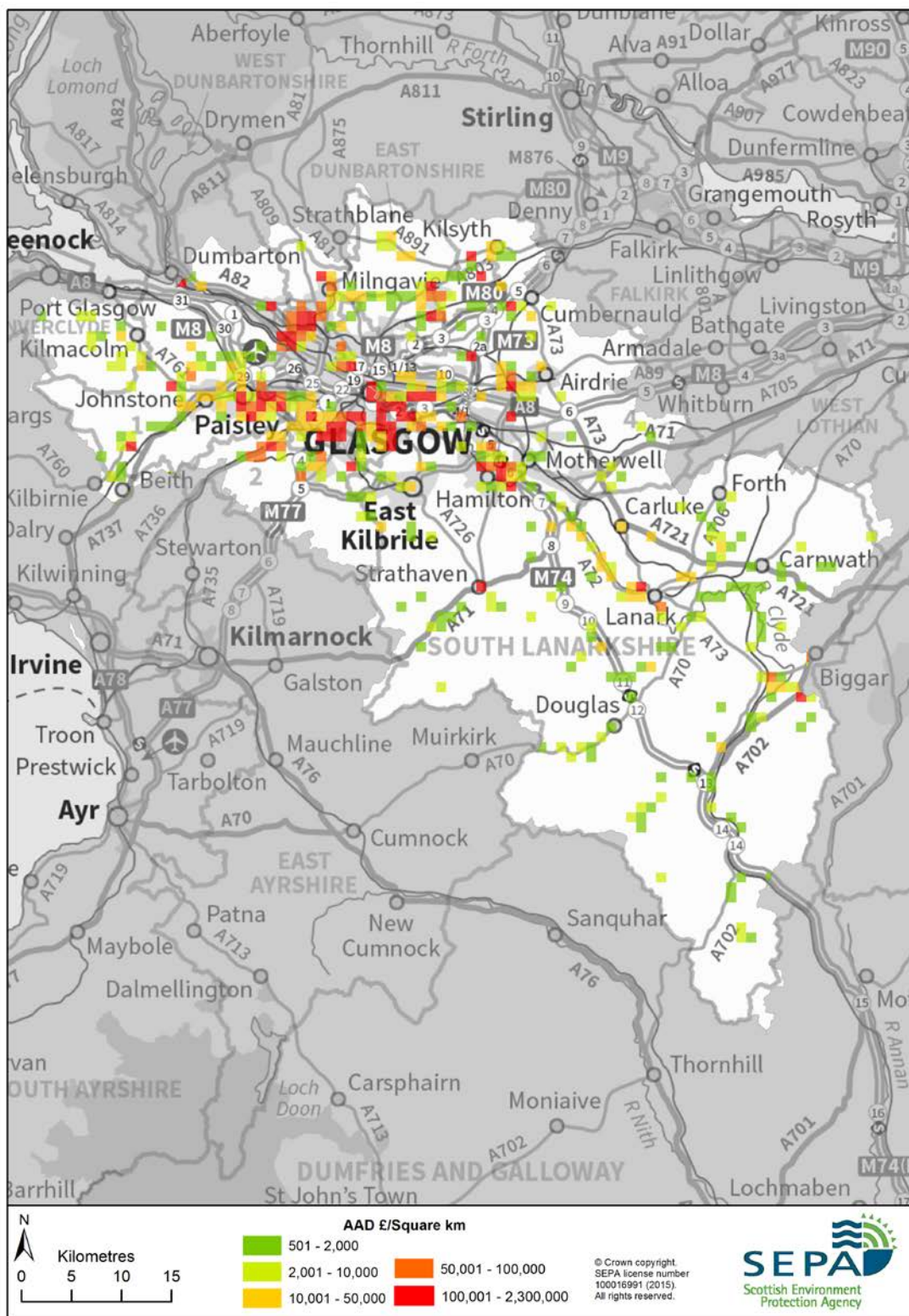
**Table 2:** Infrastructure and agricultural land at risk of river flooding

### Designated environmental and cultural heritage sites at risk

Within the catchment group there are approximately 108 designated cultural heritage sites at risk of river flooding. These sites include; scheduled monuments, gardens and designed landscapes, battlefield sites, World Heritage sites and listed buildings.

There are approximately 12km<sup>2</sup> of environmental designated area at risk of river flooding within the Clyde catchment group. The majority of these are Sites of Special Scientific Interest (9km<sup>2</sup>), with smaller areas of Special Areas of Conservation (1km<sup>2</sup>) and Special Protected Areas (2km<sup>2</sup>).





**Figure 2: Annual Average Damages from river flooding**

## History of flooding

This area has a long history of flooding with many of these floods impacting large numbers of people and properties. The most significant modern day flooding occurred between 10 and 12 December 1994, caused by prolonged heavy rainfall over a 48 hour period. Previous peak river flows were exceeded in all major catchments. In Glasgow over 700 residential properties and many non-residential properties flooded, with major transport disruptions (roads and rail) and three fatalities. The flood peaks of the White Cart Water and Black Cart Water, and their associated tributaries, coincided resulting in flows backing up along the main channels, causing flooding within Paisley. There was also flooding on the White Cart Water in 1984 affecting over 500 properties. More recently in December 2013 flooding from the River Clyde impacted properties and roads.

Recent flooding in this area has often been caused by linked river and surface water flooding with many areas impacted by regular flooding. The north west of Glasgow was affected on 21 October 2013 and on 30 and 31 July 2002, when storms led to 500 properties flooding, businesses being damaged and transport on major roads and railways severely disrupted

The earliest flooding recorded in the area was in 738 AD when the Clyde burst its banks. There were also a number of significant events identified in the 1700s and 1800s, which caused destruction of properties and bridges and resulted in a number of fatalities.

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

## 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 chapter of this document.

### Flood protection schemes

Given the historic risk of flooding within the catchment group a large number of flood protection schemes have been completed. East Dunbartonshire Council, Glasgow City Council, North Lanarkshire Council, Renfrewshire Council and South Lanarkshire Council have all completed schemes and flood mitigation works within this area. Many of these schemes aim to reduce the impact of both river and surface water due to the linked sources of flooding in this area.

In North Lanarkshire, Broadwood Loch Balancing Pond (previously known as Mosswater Pond) provides flood risk reduction benefit to the north western area of Cumbernauld.

The flood protection schemes completed by East Dunbartonshire Council in this area are:

- Lennoxton Flood Protection Scheme (1963) included channel improvements, new culverts and a new outfall on the Rannie Burn.
- The River Kelvin Flood Protection Scheme (1998) benefits Kirkintilloch, Balmore and Torrance. It involved the construction of embankments and retaining walls, diversion of services, channel improvements, new culverts, floodgates and pumps.
- The River Kelvin (Glazerbank Lennoxton) Flood Protection Scheme (2000) involved the construction of retaining walls and flood banks along the Glazer Water in Lennoxton,
- In Service Street, Lennoxton a new screen and flood defence wall were installed to manage overland flows. Maintenance, to include removal of debris at screen and inspection of flood wall, is carried out annually by East Dunbartonshire Council.
- Colquhoun Park Flood Alleviation Scheme (2015), Creation of a wetland area to reduce flooding in Bearsden.

The flood protection schemes completed by Glasgow City Council in this area are:

- White Cart Water Flood Protection Scheme, which included construction of flood storage areas upstream in East Renfrewshire and defences along parts of the river and tributary corridors. This scheme also benefits East Renfrewshire Council and Renfrewshire Council.
- Brock Burn / Lavern Water flood defence, which is a series of on-line flood defences.
- Camlachie Burn Overflow involved the construction of an overflow pipe.

The flood protection schemes completed by South Lanarkshire Council in this area are:

- Cityford Burn Culvert Flood Protection Scheme (2006), included culvert and embankments in Rutherglen.
- Dalmarnock Flood Bund Flood Protection Scheme (1999), included embankments in Rutherglen.
- Backmuir Road (culvert bypass) Flood Protection Scheme (2007), included culvert and embankments in Hamilton.
- Kenmar Terrace Culvert Flood Protection Scheme (2005) included culvert and embankments in Hamilton.
- Clydesmill Stage 1 and 2 Flood Protection Scheme (2001), included embankments in Cambuslang.
- Meadowbank Flood Bund Flood Protection Scheme, included a flood bund in Uddingston.
- Golf Gardens Flood Protection Scheme (2006), included a culvert upgrade in Larkhall.

The flood protection schemes completed by Renfrewshire Council in this area are:

- The flood protection scheme on the River Gryfe at Crosslee Park, Crosslee

- The flood protection scheme on the Black Cart Water at Collier Street / Rankine Street, Johnstone
- Flood protection scheme on the Espedair Burn at Moredun Playing Fields

Renfrewshire Council also has a flood protection scheme under construction at Renfrew, including embankments, land raising, the installation of two demountable flood barriers, construction of a pumping station and partial infilling of a tidal dock in the Clyde. Scheme construction is anticipated to be complete in early 2016.

### River flood warning schemes

SEPA operates 17 river flood warning schemes in the Clyde catchment group. Flood Warnings are issued when river flooding is forecast for these areas. The river flood warning schemes in this catchment are shown in Figures 3 and 4 and Table 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. 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 May 2014
Alyth Crescent (Thornliebank)	White Cart Water	158	20%
Cambuslang Road and Morrision Park (Glasgow)	River Clyde	162	28%
Carmyle (Glasgow)	River Clyde	47	43%
Cleveden Park (Glasgow)	River Kelvin	128	15%
Crossford	River Clyde	48	31%
Dalbeth (Glasgow)	River Clyde	0	N/A
Dalmarnock Bridge (Rutherglen, Glasgow)	River Clyde	1,046	11%
Dalserf	River Clyde	12	58%
Goyle Bridge (Kirkintilloch)	River Kelvin	4	0%
Hamilton Services (Hamilton)	River Clyde	3	33%
Kelvinbridge Underground (Glasgow)	River Kelvin	92	5%
Pollok (Glasgow)	White Cart Water	115	17%
Pollok Country Park (Glasgow)	White Cart Water	10	40%
Pollokshaws (Glasgow)	White Cart Water	139	60%
Rosebank	River Clyde	15	47%
Shawlands, Langside and Cathcart (Glasgow)	White Cart Water	4	100%
Watersports Centre at Strathclyde Loch (Motherwell)	River Clyde	86	100%

**Table 3:** Flood warning areas

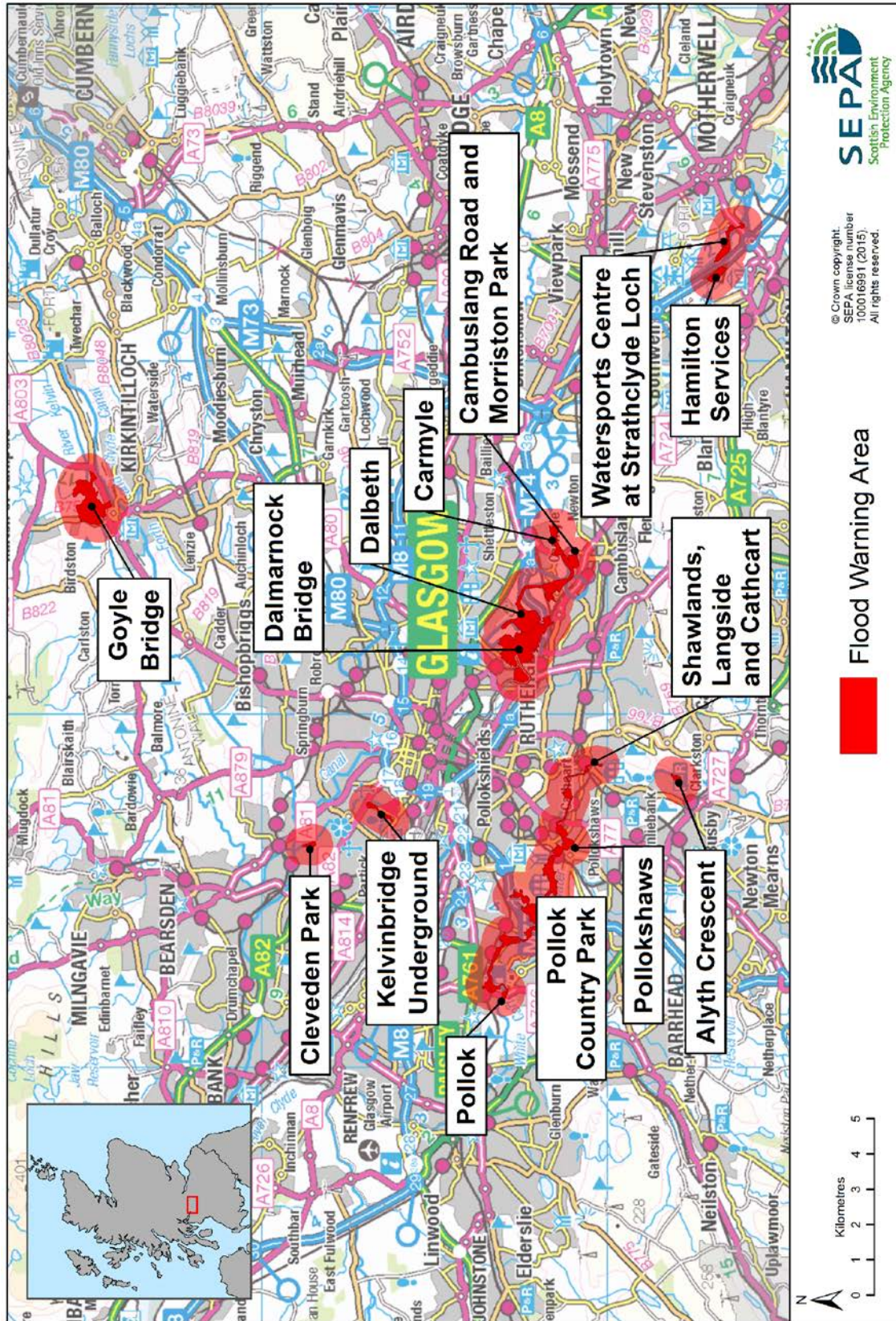
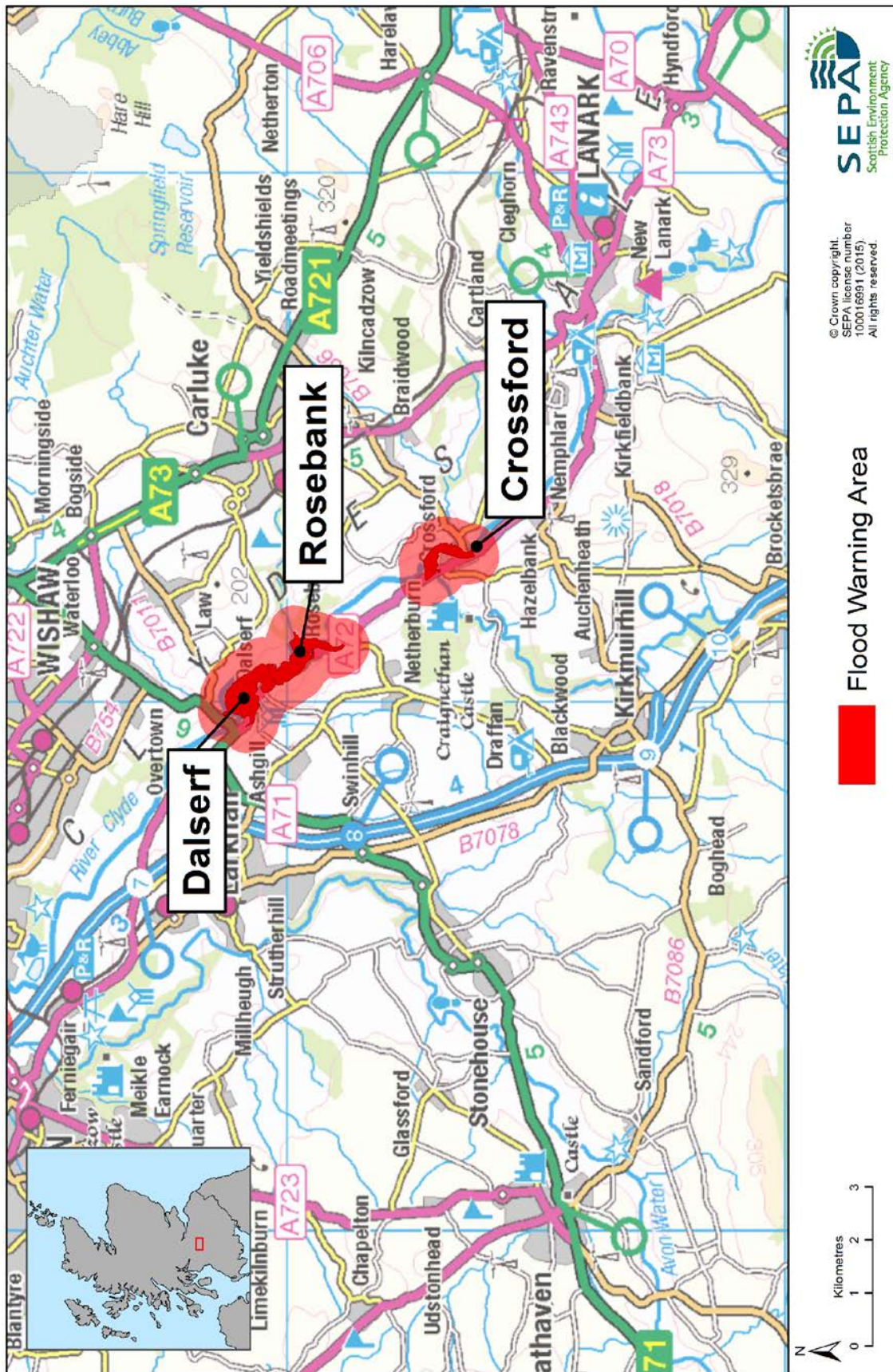


Figure 3: Flood warning areas – Clyde North





**Figure 4:** Flood warning areas – Clyde South

## Climate change and future flood risk

The 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 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 Clyde basin may increase by 44%<sup>1</sup>. This would potentially increase the number of residential properties at risk of river flooding from approximately 7,800 to 12,000 and the number of non-residential properties from approximately 1,800 to 2,900.

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 of this document.

### Runoff reduction

The assessment identifies a very large area with high potential for runoff reduction in the northern part of the River Kelvin catchment. Further areas with high potential for runoff reduction are scattered throughout the catchment group, with large areas of medium potential in the south of the White Cart Water catchment and between Milngavie and Dumbarton.

### Floodplain storage

Areas identified with the greatest potential for floodplain storage are in the vicinity of existing lochs and reservoirs. Some of these are impounding reservoirs and therefore subject to control regimes which regulate their levels and may restrict their suitability to provide additional flood storage. Potential floodplain storage areas are also identified along the Mouse Water, which contributes to flood damages in Lanark. An area with medium potential for additional storage exists along the River Kelvin, near Balmore Haughs

### Sediment management

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

The River Clyde shows signs of alternating between lengths of high deposition and high erosion. Several of the River Clyde tributaries also present similar areas of unbalance. Incorporating sediment management measures in these areas may help to reduce the significant damages relating to the rivers in this catchment group.

## River flooding River Leven (Dunbartonshire) catchment group

### Catchment overview

The Leven catchment group is within the Clyde and Loch Lomond Local Plan District and covers over 830km<sup>2</sup>. The catchment group is over 97% rural and almost 3% urban, with an approximate population of 58,000.

This river catchment group contains three local authorities; Argyll and Bute Council, Stirling Council and West Dunbartonshire Council.

The majority of the catchment group is within the Loch Lomond and the Trossachs National Park. This area is dominated by Loch Lomond and has high and steep mountains to either side of it. The maximum elevation is on Ben More in the north, at 1,029m. In the south of the catchment group are towns along the Vale of Leven including Alexandria and Dumbarton, which have hills either side to elevations of approximately 300m, falling to sea level. In the east are the Campsie Fells, with elevations of over 500m and some steep sloping hillsides.

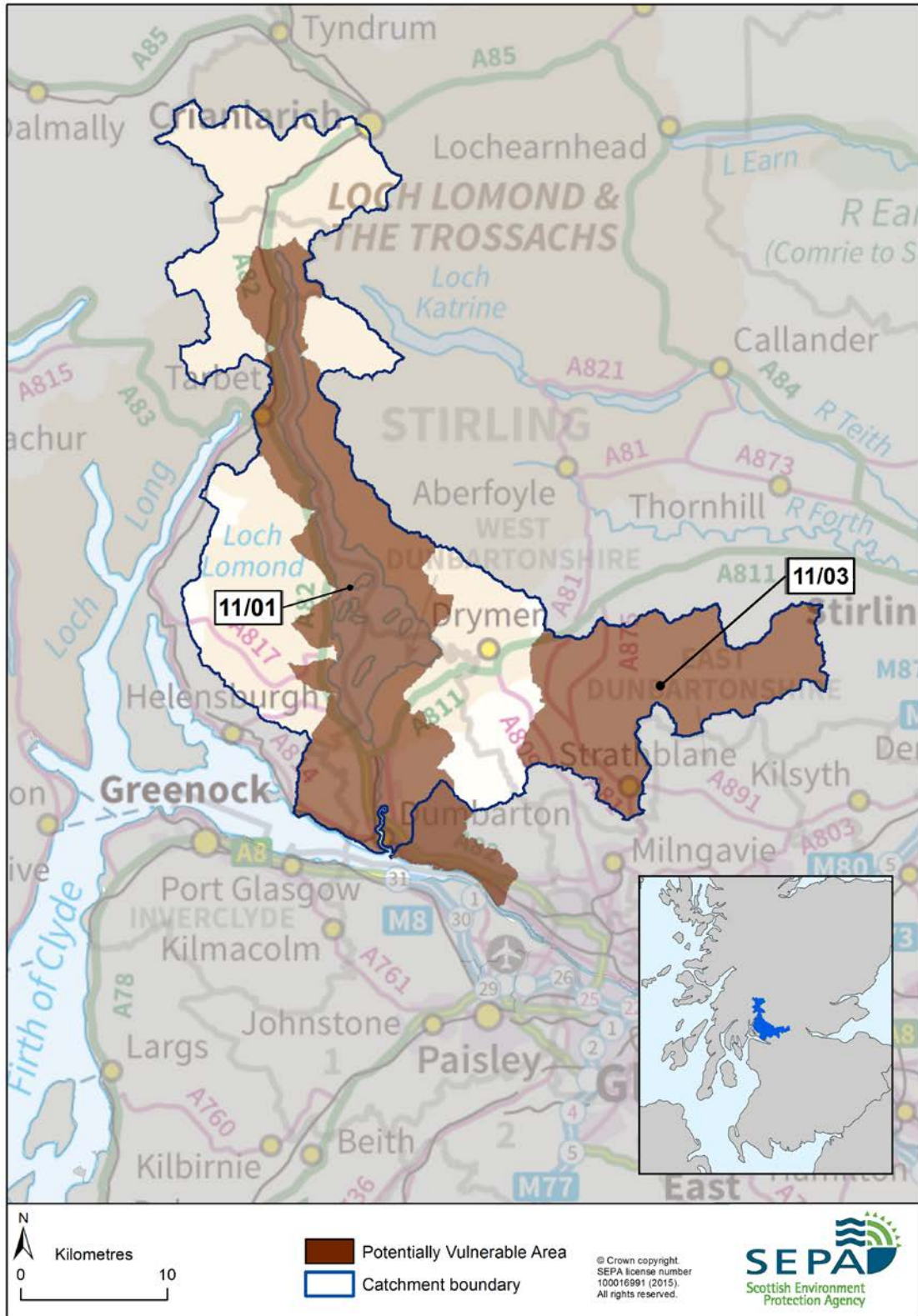
The River Leven flows south from Loch Lomond through Alexandria and Dumbarton before entering the Firth of Clyde. The River Falloch flows into Loch Lomond from the Highlands in the north. Loch Lomond is located in the centre of the catchment group and stretches for almost 36km. A number of tributaries discharge to Loch Lomond including the Arklet Water, Endrick Water, Douglas Water, Luss Water, Finlas Water and the Fruin Water.

The average annual rainfall for this area is given as 2,015mm, which is high for Scotland.

### Flood risk in the catchment

There are approximately 990 residential properties predicted to be at risk of river flooding in this area, 98% of which are located within a Potentially Vulnerable Area. Approximately 160 non-residential properties are predicted to be at risk of river flooding in this area, 86% of which are located within a Potentially Vulnerable Area. There are two Potentially Vulnerable Areas in this catchment as shown in Figure 1:

- Loch Lomond and Vale of Leven (11/01)
- Strathblane (11/03).



**Figure 1:** River catchment for the Leven catchment group

## Main areas at risk

The main areas at risk of river flooding can be seen in Table 1, which 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. The two principal areas at risk are Alexandria and Balloch and Dumbarton.

	Residential and non-residential properties at risk of river flooding	Annual Average Damages
Alexandria and Balloch	610	£2.4 million
Dumbarton	360	£1.3 million
Strathblane	30	£90,000
Geilston	10	£23,000

**Table 1:** Main areas at risk of river flooding

## Economic activity and infrastructure at risk

The Annual Average Damages caused by river flooding in the Leven catchment group are approximately £4.2 million. This accounts for approximately 7% of the estimated Annual Average Damages from all flooding sources within the Local Plan District. The damages are distributed as follows:

- 52% residential properties (£2.2 million)
- 38% non-residential properties (£1.6 million)
- 5% emergency services (£210,000)
- 3% vehicles (£130,000)
- 2% roads (£76,000)
- <1% agriculture (£27,000).

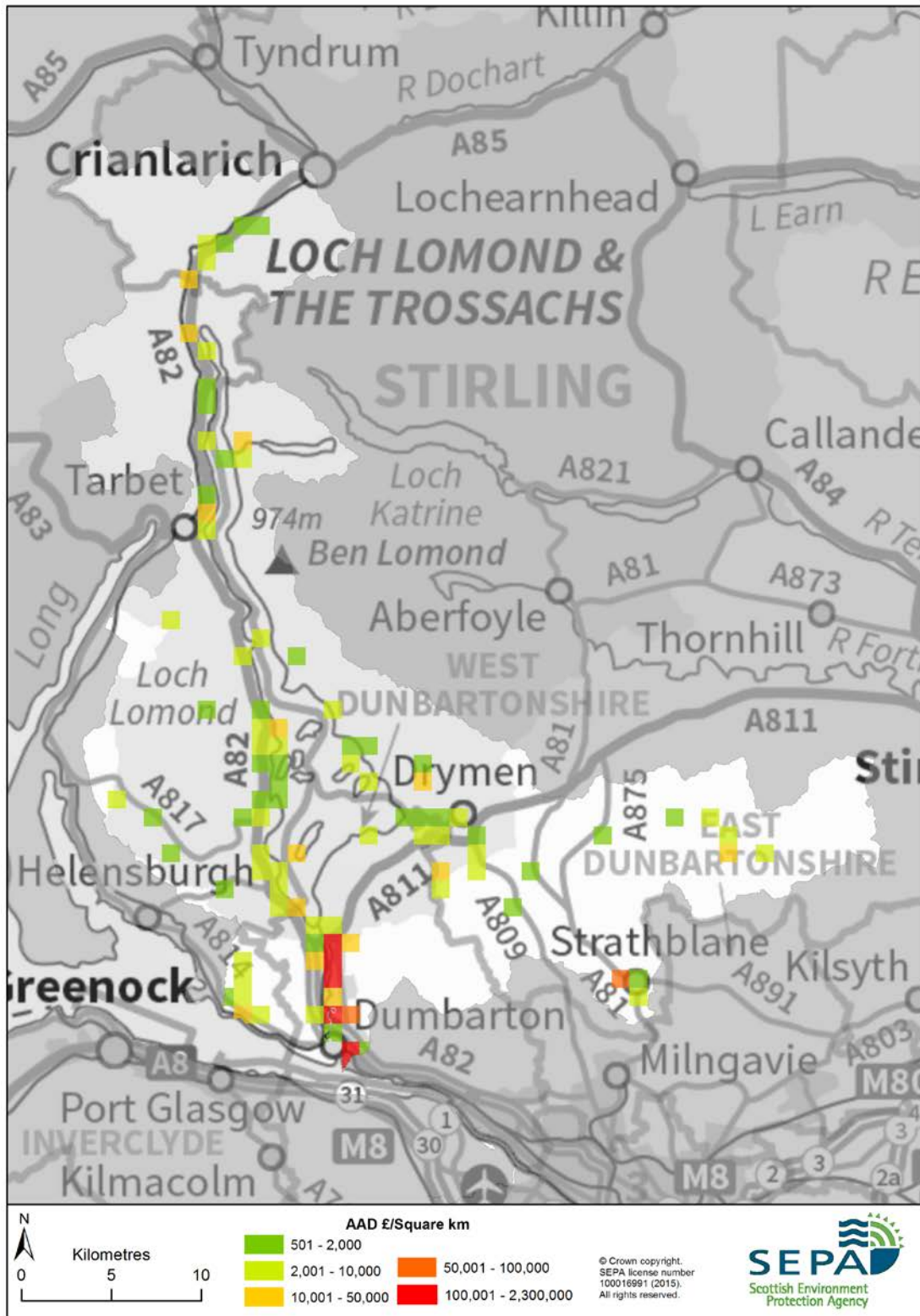
The damage calculations do not include any wider, indirect impacts flooding may have, including the impact to tourism in the area.

Figure 2 shows the Annual Average Damages throughout the catchment group.

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
Utility assets	<10	Includes: electricity sub stations
Roads (km)	3	Notably the A82 primary road running along the west bank of Loch Lomond, (the road is currently being redesigned)
Railway routes (km)	1.4	Notably between Crianlarich and Inveruglas and in Dumbarton
Agricultural land (km <sup>2</sup> )	15	

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



**Figure 2:** Annual Average Damages from river flooding

## Designated environmental and cultural heritage sites at risk

Within the catchment there are approximately 24 designated cultural heritage sites at risk of river flooding. These sites include scheduled monuments, gardens and designed landscapes and listed buildings.

There are approximately 16km<sup>2</sup> of environmental designated area at risk of river flooding within the Leven catchment group. The majority of these are Special Protected Areas (<7km<sup>2</sup>) and Sites of Special Scientific Interest (<6km<sup>2</sup>), with smaller areas of Special Areas of Conservation (<2km<sup>2</sup>).

## History of flooding

There is a long history of flooding in this area, although floods have tended to have relatively localised impacts to people and properties. They have become more frequent over the last 15 years with 10 floods recorded since 2000.

Early records of flooding in the area mostly impacted crops during harvest, the earliest of which was in 1782. Records of flooding to properties from the Leven start in 1846 with six further floods between 1880 and 1903. More recently on 11 March 1990, heavy rain caused Loch Lomond to rise, flooding individual properties around the Loch. Furthermore, in October and December 2006 the River Leven overtopped its banks.

The most recent recorded flooding occurred on 29 November 2011, when high tide coincided with high river flow within the Gruggies Burn. This resulted in transportation disruption and homes in Wallace Street being badly affected. There were similar conditions which led to flooding on the same river in 1909. The Gruggies Burn has also flooded in July 2002, August 2004 and September 2005 with flooding to properties and roads. The Knowle Burn in Dumbarton has also experienced recent frequent flooding with incidents in June 2010, July and August 2005, September and October 2005 and July 2002, which have impacted properties and disrupted transport.

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

## 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 chapter of this document.

### Flood protection schemes

West Dunbartonshire Council completed a scheme on the Knowle Burn in 2015. The scheme helps to protect nearly 70 residential properties and includes flood storage pond with inlet & outlet control structures near Garshake Road with a series of downstream channel improvements and flood embankments.



While not a formal flood protection structure, a barrage across the River Leven in Alexandria maintains levels within Loch Lomond at a maximum of 8m Above Ordnance Datum. The operation of the barrage is regulated by an Act of Parliament

## **Climate change and future flood risk**

The 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 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 Leven catchment may increase by 44%<sup>1</sup>. This would potentially increase the number of residential properties at risk of river flooding from approximately 990 to 1,230 and the number of non-residential properties from approximately 160 to 230.

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 of this document.

### **Runoff reduction**

The assessment shows large areas with high potential for runoff reduction around Loch Lomond, encompassing a number of tributaries north of Loch Lomond (River Falloch, Allt Fionn Ghlinne and Dubh Eas) as well as Loch Lomond itself and areas as far south as Blairglas and Balmaha.

### **Floodplain storage**

The assessment also indicates a high potential for floodplain storage exists at Loch Lomond, however further work would be required to assess any potential. The barrage at Alexandria, which regulates loch levels and the varied uses of the loch may limit the potential for significant additional storage.

### **Sediment management**

Areas of high erosion and high deposition exist along the River Leven south of Loch Lomond, and along the flood risk areas of the Vale of Leven. Other notable areas of high erosion and moderate deposition also exist along Endrick Water and Gourlays Burn in the east of the catchment group. Incorporating sediment management

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

measures in these areas may reduce damages downstream in areas such as Drymen.

## River flooding Firth of Clyde catchment group

### Catchment overview

The Firth of Clyde catchment group is located within the Clyde and Loch Lomond Local Plan District and covers over 980km<sup>2</sup>. The catchment group is over 94% rural and almost 6% urban, with a population of approximately 120,000.

This river catchment group contains three local authorities; Argyll and Bute Council, Inverclyde Council and North Ayrshire Council.

The main river catchment within this area is the River Eachaig which is located on the Cowal Peninsula. The Eachaig flows out of Loch Eck, which is surrounded on all sides by steep hills rising to over 700m. The Eachaig flows from the loch down to sea level and discharges into Holy Loch. The remainder of watercourses in the area are characteristically steep burns which flow directly from the numerous hills in the area in to the various sea lochs of the Firth of Clyde.

In the north of the catchment group the River Cur flows from its origin in Monevechadan, southeast of Ardnò and meets the River Shellish, before discharging to Loch Eck at Invernòaden.

The average annual rainfall for the area is 2,515mm, which is very high for Scotland.

### Flood risk in the catchment

Within the catchment group there are approximately 540 residential properties predicted to be at risk of river flooding, 92% of which are located within a Potentially Vulnerable Area. There are also approximately 380 non-residential properties predicted to be at risk of river flooding, 77% of which are located within a Potentially Vulnerable Area. There are four Potentially Vulnerable Areas in this catchment (Figure 1):

- Helensburgh to Loch Larg (11/02)
- Isle of Bute (11/06)
- Dunoon (11/07)
- Greenock to Gourock (11/08).

### Main areas at risk

The main areas at risk of river flooding can be seen in Table 1, which 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
Gourock / Greenock / Port Glasgow	380	£440,000
Rothesay	280	£630,000
Dunoon	100	£270,000

**Table 1:** Main areas at risk of river flooding

## Economic activity and infrastructure at risk

The Annual Average Damages caused by river flooding in the Firth of Clyde catchment group are approximately £1.8 million. This accounts for approximately 3% of the estimated Annual Average Damages from all flooding sources within the district. The damages are distributed as follows:

- 45% residential properties (£810,000)
- 41% non-residential properties (£730,000)
- 7% emergency services (£130,000)
- 4% roads (£67,000)
- 2% vehicles (£40,000)
- 1% agriculture (£17,000).

Figure 2 shows the Annual Average Damages throughout the catchment.

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

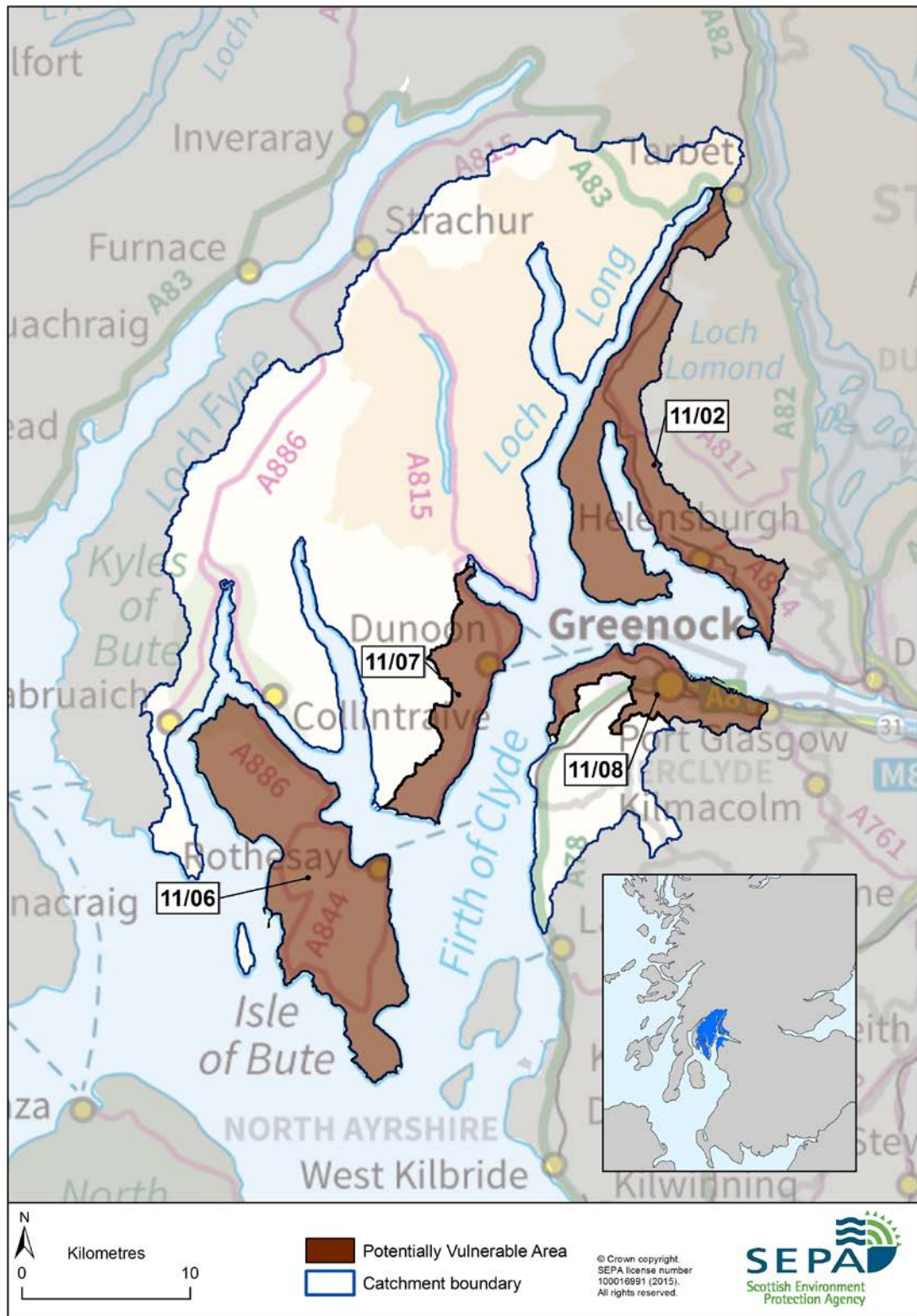
	Number at risk	Further detail
<b>Community facilities</b>	<10	Includes: educational buildings and emergency services
<b>Utility assets</b>	20	Includes: electricity sub stations, telecommunications, gas production and distribution and mineral and fuel extraction
<b>Roads (km)</b>	6	Notably: A78 between Greenock and Ardgowan A83 through Ardgartan forest
<b>Railway routes (km)</b>	0.7	Notably in Greenock
<b>Agricultural land (km<sup>2</sup>)</b>	9.4	

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

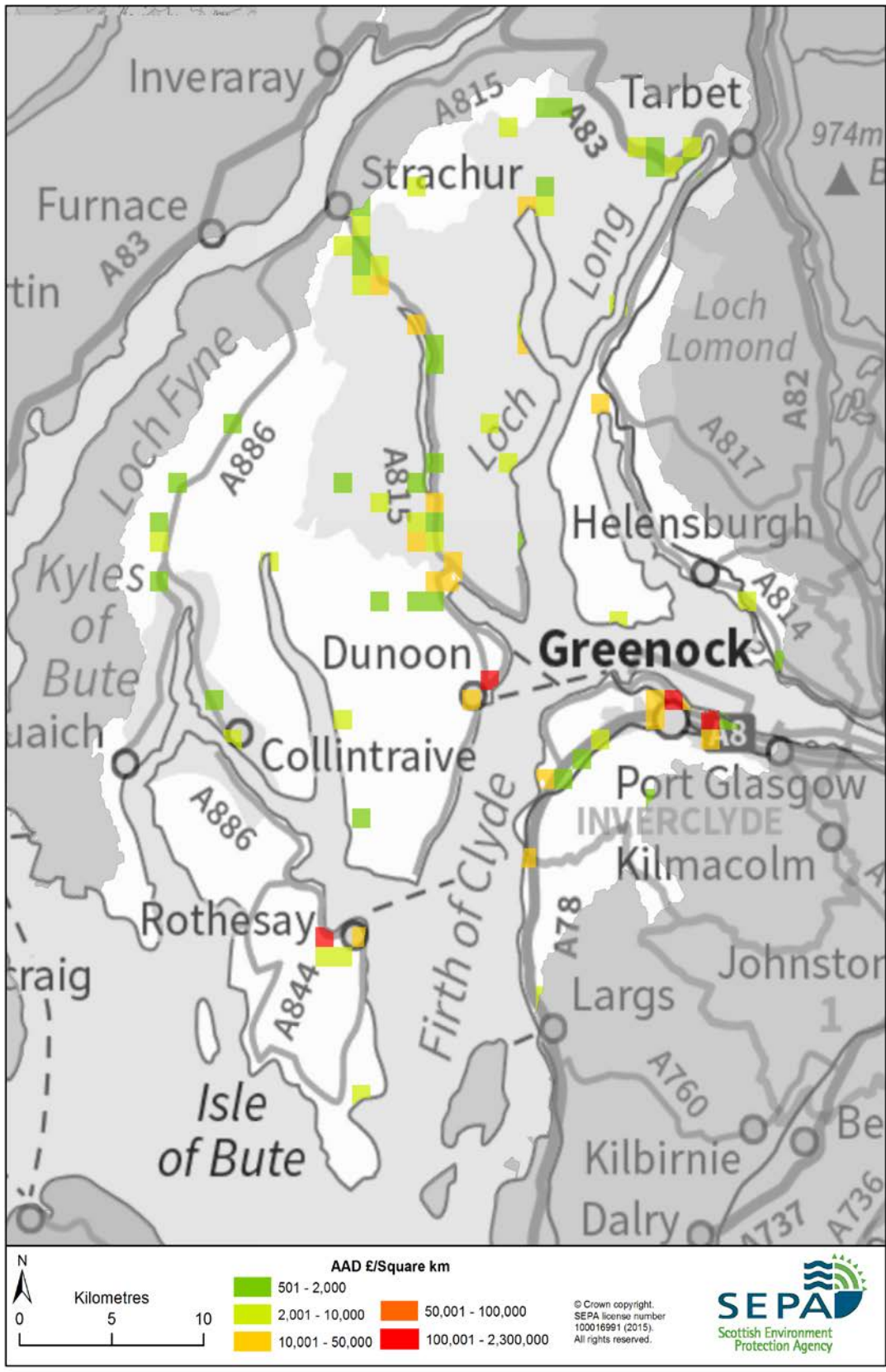
## Designated environmental and cultural heritage sites at risk

Within the catchment there are approximately 10 designated cultural heritage sites at risk of river flooding. These sites include; scheduled monuments, gardens and designed landscapes and listed buildings.

There are approximately 7km<sup>2</sup> of environmental designated areas at risk of river flooding within the catchment group. The majority of these are Sites of Special Scientific Interest (<6km<sup>2</sup>) with Special Protected Areas (<1km<sup>2</sup>).



**Figure 1:** River catchment for the Firth of Clyde catchment group



**Figure 2:** Annual Average Damages from river flooding

## History of flooding

There have been few recorded river floods to have impacted properties in the area. As a result of the characteristics of the catchment most flooding is combined with other sources. This can be surface water flowing down the steep hillsides or coastal interaction in the flatter lower catchments. The most significant floods in the area occurred in Greenock in 2014, 2013 and 2011. These floods resulted in several streets in the town centre, including shops, being impacted and the closure of roads causing major traffic disruption.

The earliest recorded flooding in the area was in 1780 with flooding to the north of Loch Eck destroying properties in a small community. Flooding to Rothesay and Greenock have been reordered from 1852.

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

## 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 chapter of this document.

### Flood protection schemes

Argyll and Bute Council has a number of relevant flood protection schemes within this area. These help to reduce surface water and river flooding:

- Kilbride Road Flood Protection Scheme (2009) consists of overland flow, ditches and pipe.
- In Kilcreggan (2011) flood defence works to reduce the risk of flooding were constructed. This provides additional storage capacity to roadside ditches.
- Milton Burn Flood Protection Scheme (2012) consists of walls, embankments and an overflow pipe.

In addition to the above schemes the spillways of five reservoirs above Greenock have been altered to provide attenuation during high flows and help to reduce the impact of flooding to the town.

## Climate change and future flood risk

The 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 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 Firth of Clyde may increase by 44%<sup>1</sup>. This would potentially increase the number of residential properties at risk of river flooding from approximately 540 to 810 and the number of non-residential properties from approximately 380 to 500.

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 of this document.

### Runoff reduction

Almost all of the catchment has high or medium potential for runoff reduction. Incorporating runoff reduction measures could help to reduce flood impacts in areas such as Greenock and Rothesay.

### Floodplain storage

There are areas with the potential for additional flood storage throughout the catchment. Many of these are lochs located upstream including; Loch Thom upstream of Ardgowan, Loch Fad upstream of Rothesay and Loch Eck upstream of Benmore. Some of the lochs are impounding reservoirs and therefore subject to control regimes which regulate their levels and may restrict their suitability to provide additional flood storage. Attenuation storage on the reservoirs above Greenock has previously been installed.

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<sup>1</sup> From the study 'An assessment of the vulnerability of Scotland's river catchments and coasts to the impacts of climate change' (CEH, 2011).



## 3.3 Coastal flooding

### Clyde and Loch Lomond 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 coastal area of the Clyde and Loch Lomond Local Plan District covers approximately 500km of the Firth of Clyde coastline.

There are seven local authorities in this area; Argyll and Bute Council, Glasgow City Council, Inverclyde Council, Renfrewshire Council, North Ayrshire Council, South Lanarkshire Council and West Dunbartonshire Council.

A high percentage of the Inner Firth of Clyde coastline is protected by some form of coastal defence works reflecting the highly developed nature of the coastal area.

#### Flood risk

There are estimated to be approximately 3,600 residential properties and approximately 1,300 non-residential at risk of coastal flooding. This risk has been calculated from the inland projection of still water levels. Additionally, there is potential impact from locally generated wave mechanisms affecting the coastline. In the Inner Firth of Clyde fetch lengths are relatively small in most directions therefore locally generated waves are the most common. Waves generated from the south are less common; however, wave heights can be double those experienced from other directions. These larger waves could result in additional flooding to some areas.

There are 13 Potentially Vulnerable Areas in this Local Plan District at risk of coastal flooding as listed below. One further Potentially Vulnerable Area (11/17/1) is crossed by the coastal area however there are no damages identified from coastal flooding (Figure 1).

- Loch Lomond and Vale of Leven (11/01)
- Helensburgh to Loch Larg (11/02)
- Kilsyth to Bearsden – north of Glasgow City (11/04)
- Yoker catchment – Clyde (Clydebank to Partick) (11/05)
- Isle of Bute (11/06)
- Dunoon (11/07)
- Greenock to Gourock (11/08)
- Clyde south - Port Glasgow to Inchinnan (11/09)
- Bishopton (11/10)
- Black Cart Water catchment – Lochwinnoch to Johnstone (11/12)
- White Cart Water catchment (11/13)
- Rutherglen (11/14)
- Glasgow City centre (11/16).

## Main areas at risk

The main areas at risk of coastal flooding can be seen in Table 1. This shows the number of properties at risk and the total Annual Average Damages caused by coastal flooding for each of these areas. This includes damages to residential and non-residential properties, transport and agriculture.

	Residential and non-residential properties at risk of coastal flooding	Annual Average Damages
Dumbarton	1,700	£11 million
Glasgow City	1,000	£2.4 million
Renfrew	660	£1.2 million
Rothesay	490	£870,000
Gourock/Greenock/Port Glasgow	400	£360,000
Renton	110	£410,000
Clydebank	70	£1.8 million
Port Bannatyne	70	£150,000
Kilchattan Bay	20	£90,000
Ardnadam	10	£60,000
Geilston	10	£50,000
Helensburgh	10	£40,000

**Table 1:** Main areas at risk of coastal flooding



## Economic activity and infrastructure at risk

The Annual Average Damages caused by coastal flooding within this catchment are approximately £19 million. The damages are distributed as follows:

- 59% non-residential properties (£11 million)
- 27% residential properties (£5.2 million)
- 5% emergency services (£1.0 million)
- 5% roads (£940,000)
- 3% vehicles (£540,000)
- 1% agriculture (£16,000).

The highest damages are predicted to occur around Clydebank, Dumbarton, Renfrew and Rothesay. High damages can also be seen in Glasgow City (along the Clyde), Port Glasgow, Gourock and Renton. This is due to the density of businesses in the area and the impact on entertainment services, commercial services and industrial properties. Figure 2 shows the Annual Average Damages throughout the coastal area.

Please note that economic damages to rail were not assessed as information on damages at a strategic scale is not available.

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

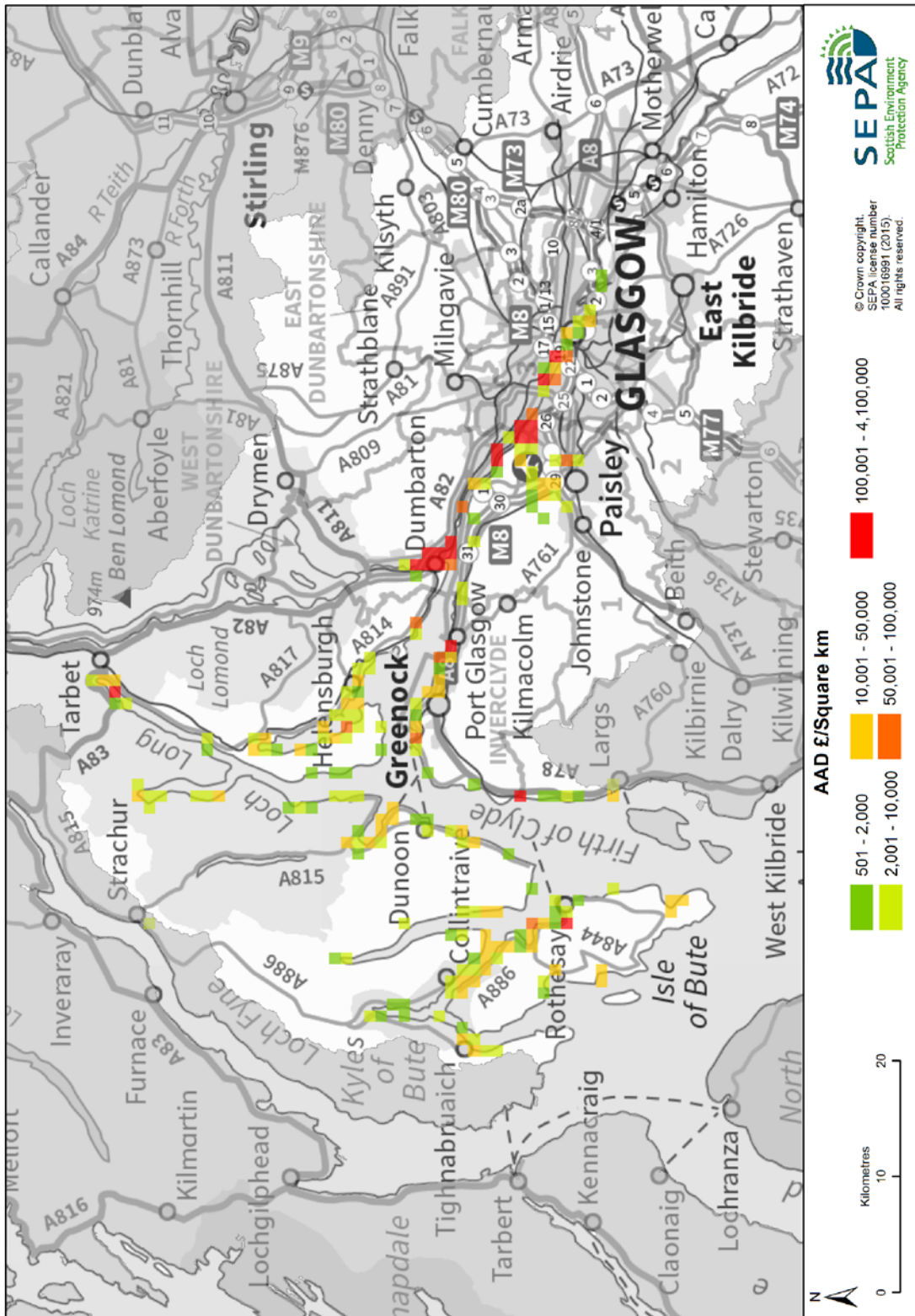
	Number at risk	Further detail
<b>Community facilities</b>	<10	Includes: educational buildings and healthcare facilities.
<b>Utility assets</b>	50	Includes: electricity substations, fuel extraction sites, energy production sites and telecommunications sites
<b>Roads (km)</b>	53	Includes: 1.2km of the M8 1km Primary roads 23km A roads 7.5km B roads 12km minor roads
<b>Railway routes (km)</b>	2.8	
<b>Agricultural land (km<sup>2</sup>)</b>	9	

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

## Designated environmental and cultural heritage sites at risk

It is estimated that approximately 40 designated cultural heritage sites are at risk of coastal flooding within the catchment. These sites include; scheduled monuments, gardens and designed landscapes, World Heritage Sites and listed buildings.

There are approximately 10 environmental designated areas at risk of coastal flooding, including two Special Protection Areas and eight Sites of Special Scientific Interest. These notably include the Ruel Estuary, the north end of Bute, the Inner Clyde and the Largs coast.



**Figure 2:** Annual Average Damages from coastal flooding

## History of flooding

Recent and notable coastal floods were reported in January 2014, when the entire west coast of Scotland experienced major coastal flooding. Areas that were affected include Helensburgh, Dumbarton, Rothesay, Greenock, Port Glasgow and Gourock. Incidences of coastal flooding have also been reported in Gourock since 1930 with similar flooding on 11 January 1974 affecting access roads to the ferry terminal.

A report in 2001 stated that the highest sea level recorded at Helensburgh was experienced on 5 January 1991. This tidal flood also affected Dumbarton when an extreme high tide coincided with a moderately high river flow and resulted in over £500,000 of damages. Rothesay suffered an estimated £4 million of damages from this coastal flood.

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

## 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 chapter of this document.

### Flood protection schemes

The coastal flood protection schemes that have been identified in this area are summarised below:

- Rothesay Flood Protection Scheme (2002) involved the construction of new coastal floodwalls and raising of the existing walls of the Mill Lade.
- North Renfrew Flood Protection Scheme, at the time of publication is under construction. The purpose of this scheme is to prevent and/or mitigate flooding in Renfrew from the River Clyde. The operations consist of flood embankments, retaining walls, demountable barriers, river basin remediation and infill and pump station construction on the existing Mill Burn culvert.
- Additionally there are flood protection schemes, within the tidal limit of the Clyde, that are designed to protect principally against river flooding. However, they also offer protection against coastal flooding.

In addition to the formal flood protection schemes there are large areas of this coastline that have hard shoreline, which includes reinforcement structures. Reinforcement structures use materials, such as rock armour, man-made armour, revetments, retaining walls, gabion baskets, seawalls and sheet piling to protect vulnerable coastlines or harbours from erosion.

The location and type of all existing coastal defences in this coastal area are shown in Figure 4 overleaf.

### Coastal flood warning schemes

There are 15 coastal flood warning areas within this Local Plan District 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)	Properties within FWA	% of properties registered May 2014
Dumbarton Common (Dumbarton)	235	13%
Dumbarton Central (Dumbarton)	379	10%
Dumbarton East (Dumbarton)	994	17%
Kames Bay Pointhouse Crescent (Port Bannatyne)	85	36%
Helensburgh	415	22%
Rothesay Town Centre (Rothesay)	407	19%
Dunoon Pier (Dunoon)	104	23%
Hunters Grove (Dunoon)	4	0%
Renfrew	2,410	11%
Glasgow Quay Walls	410	13%
Largs Seafront (Largs)	70	35%
Skelmorlie A78 Shore Road (Skelmorlie)	0	N/A
Gourock Cove Road (Gourock)	150	31%
Largs Fort Street	210	3%
Greenock and Port Glasgow	300	18%

**Table 3:** Flood warning areas

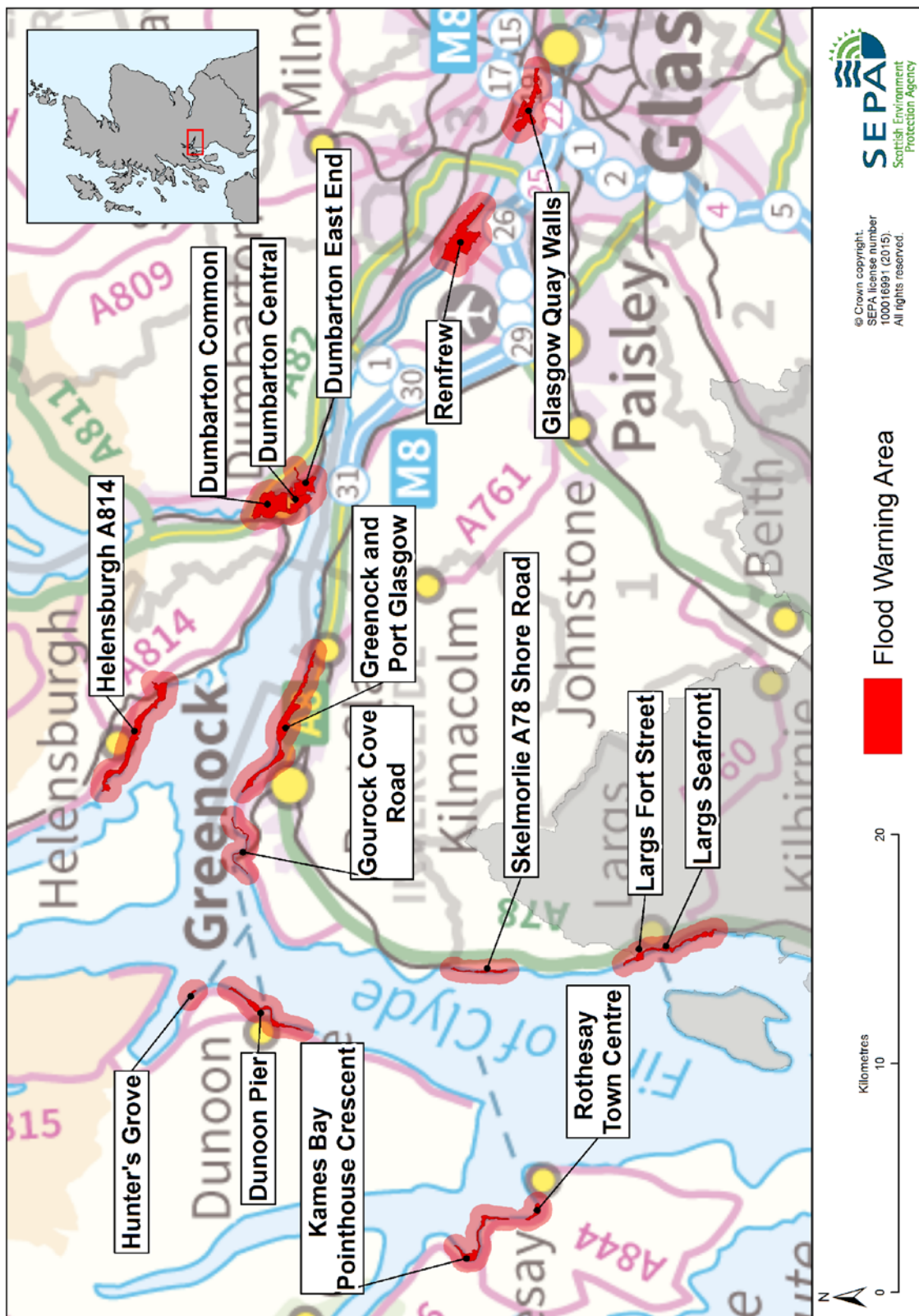


Figure 3: Coastal flood warning areas





## 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 sea level increase for the Clyde and Loch Lomond Local Plan District is approximately 0.47m by 2080. This may increase the number of residential properties at risk of coastal flooding from approximately 3,700 to 7,500 and the number of non-residential properties from approximately 1,300 to 2,400. Coastal flood modelling by SEPA has not taken into account the impacts of future climate change 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 of this document.

### Wave energy dissipation

The assessment shows that there are generally areas of high potential for wave energy dissipation along the Firth of Clyde, notably along the Isle of Bute coast, Kames Bay, Lunderston Bay and Ettrick Bay.

### Estuarine surge attenuation

Some significant areas with potential for estuarine surge attenuation are present along the Firth of Clyde, including between Erskine Bridge and Milton, Gare Loch and Cove Bay, as well as areas along Loch Long. There are medium potential areas scattered along the majority of the coastline.

## 3.4 Surface water flooding

### Clyde and Loch Lomond Local Plan District

This chapter provides supplementary 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 Clyde & Loch Lomond Local Plan District there are approximately 13,000 residential and 6,300 non-residential properties at risk of surface water flooding. Approximately 98% of all properties at risk from surface water flooding are located within Potentially Vulnerable Areas.

#### Main areas at risk

Glasgow and surrounding areas are highly urbanised and have the greatest risk from surface water flooding in the Clyde and Loch Lomond Local Plan District. Outside of Glasgow, there are 11 areas that have more than 100 residential properties at risk of surface water flooding. Table 1 shows ten areas with the greatest number of properties at risk and the associated Annual Average Damages caused by surface water flooding. The damages include impacts to residential and non-residential properties, vehicles, emergency services and roads. Surface water flooding within these heavily urbanised areas is often associated to flooding from urban watercourses. In many areas, flooding of this type presents the greatest flood risk.

The level of flood risk due to surface water flooding in the greater Glasgow area led to the establishment of the Metropolitan Glasgow Strategic Drainage Partnership (MGSDP). The MGSDP is formed from organisations that are involved in the operation of the sewerage and drainage network within the Greater Glasgow area, including among others: local authorities; Scottish Water; SEPA and Scottish Canals. It provides a forum for the organisations to work in an integrated, collaborative partnership. The MGSDP remit spans from strategic to project level scale. Its objectives are flood risk reduction, river water quality improvement, enabling economic development, habitat improvement and integrated investment planning.

	Residential and non-residential properties at risk of surface water flooding	Annual Average Damages
Glasgow City	8,400	£4.4 million
Paisley and Johnstone	1,700	£1.1 million
Gourock / Greenock / Port Glasgow	890	£1.5 million
Clydebank	540	£440,000
Dumbarton	480	£410,000
Coatbridge / Airdrie	390	£330,000
Rutherglen	380	£260,000
East Kilbride	340	£560,000
Alexandria and Balloch	320	£900,000
Giffnock and Thornliebank	250	£110,000

**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 are approximately £20 million. The damages are distributed as follows:

- 47% residential properties (£9.4 million)
- 44% non-residential properties (£8.8 million)
- 7% roads (£1.4 million)
- 2% vehicles (£400,000).

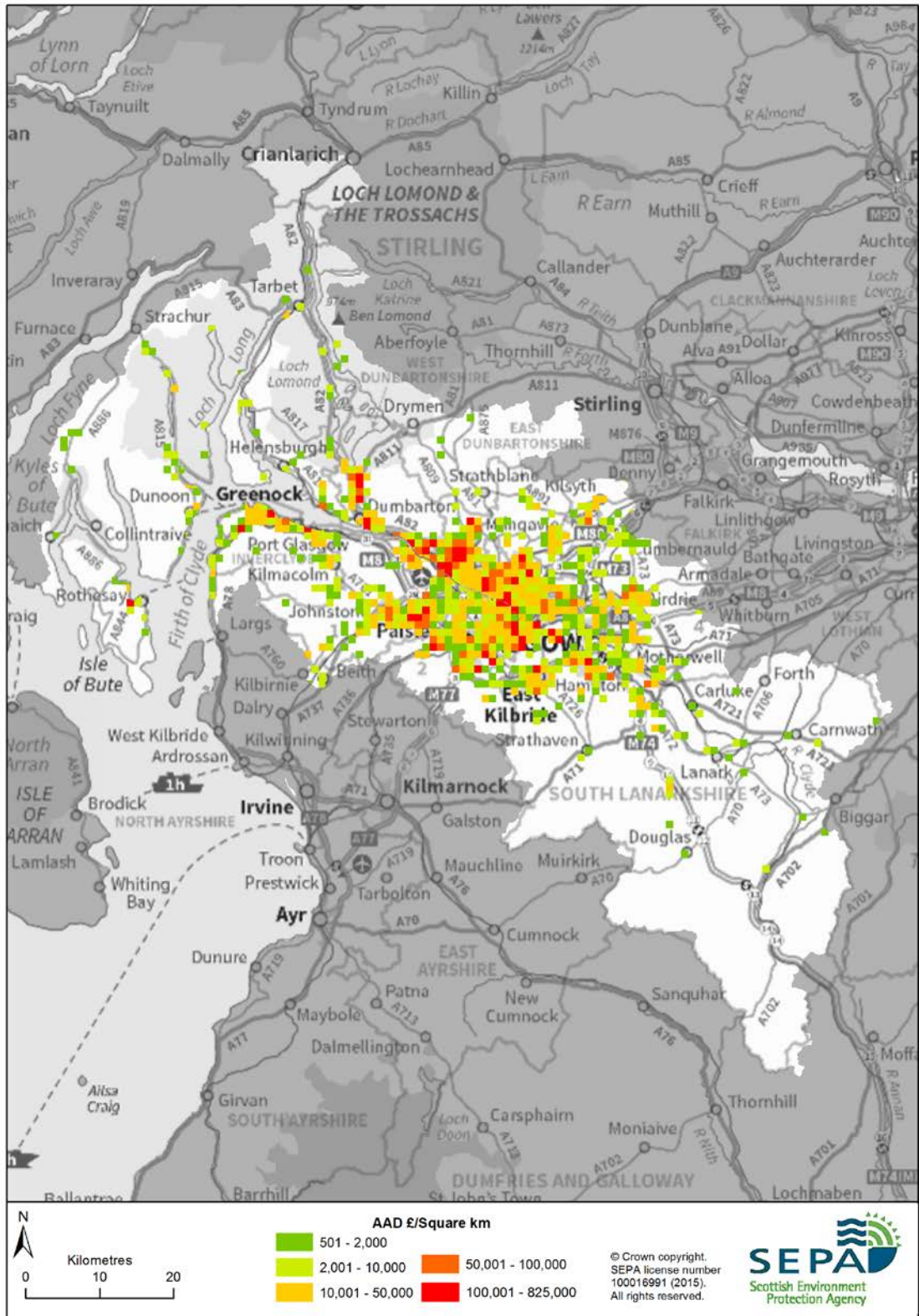
Figure 1 shows the distribution of Annual Average Damages from surface water flooding across the Local Plan District. The figure shows a high concentration of damages in and around Glasgow.

Please note that economic damages to airports and rail were not assessed as information on damages at a strategic scale is not available.

Table 2 shows the approximate numbers of further infrastructure assets that are at risk of flooding within this catchment.

	Number at risk	Further detail
Community facilities	60	Includes; educational buildings and emergency services.
Utility assets	570	Includes; electricity substations, fuel extraction sites and gas regulation sites.
Roads (km)	391	Includes; M73, M8, M80 and M74
Railway routes (km)	127	Includes; West coast line and Glasgow to Edinburgh routes.
Airports	1	

**Table 2:** Infrastructure at risk of surface water flooding



**Figure 1: Annual Average Damages from surface water flooding**

## Designated environmental and cultural heritage sites at risk

Within the Local Plan District it is estimated that 184 designated cultural heritage sites have a risk of surface water flooding. These sites include; scheduled monuments, gardens and designed landscapes, battlefield sites, World Heritage 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

There has been a long history of surface water related floods within the Clyde and Loch Lomond Local Plan District. The most notable of these floods occurred on the 30 July 2002 in Glasgow, when an estimated 1 in 100 year flood resulted in 500 properties being flooded along with serve disruption to road and rail services. The estimated cost of damages was in the region of £100 million.

The earliest recorded flooding in Glasgow was in 1926, and since this time there have been many flood events reported in the city.

The earliest recorded flooding within the Clyde and Loch Lomond Local Plan District was in Hamilton in 1871, with a number of further floods over the next decade in Carluke, Coatbridge, Airdrie, Kilsyth, Wishaw, Kirkintilloch and Paisley, with Coatbridge and Airdrie flooding regularly during this period.

More recently surface water floods have occurred regularly over the last ten years causing flooding to roads and properties across the region including flooding in Greenock, Dumbarton and Bearsden, which have all flooded multiple times during this period. The most recent flooding was in July 2015 with localised flooding impacts in Glasgow and surrounding towns.

## 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.

Since 2002 substantial work has been carried out in the metropolitan Glasgow area to identify those areas that are at highest risk from surface water flooding. Much of this has been helped by the Metropolitan Glasgow Strategic Drainage Partnership

(MGSDP). As a consequence many of these areas have already had surface water management plans established. The priority areas for surface water management studies do not include those areas where a surface water management plan has already been carried out and options for mitigation are being established.

### **Flood protection schemes**

Due to the risk posed by surface water flooding in this Local Plan District many flood protection schemes and works carried out to date have taken surface water flooding into account, including:

- Argyll and Bute – Kilcreggan: Ditches constructed in 2011 to reduce surface water flood risk from overland flow.
- Argyll and Bute – Dunoon: Ditches and pipes to reduce surface water flood risk from overland flow.
- East Dunbartonshire - Milton of Campsie: Bund created in 2013 / 2014 to reduce surface water flood risk from overland flow.
- South Lanarkshire – Blantyre, Armour Court: Swales, road drainage improvements and culvert were constructed in 2011.
- South Lanarkshire – Larkhall, Machan Road: Surface water storage tanks were constructed in 2012.
- South Lanarkshire – East Kilbride Flood Prevention Scheme: creation of interceptor swales, land drainage improvements and removal of surface water flows from the combined sewer drainage system, to reduce flooding to 16 properties.
- South Lanarkshire – A70 Douglas Flood Prevention Scheme: culvert upgrading works and associated flood protection measures to address localised surface water issues to reduce flooding on the A70.
- White Cart Water Flooding Project – Part of the White Cart Water scheme constructed between from 2009 to 2012 has helped to reduce surface water flooding in Glasgow.
- Toryglen Regional Sustainable Urban Drainage pond in 2009
- Ruchill Sustainable Urban Drainage pond in 2008
- Camlachie Burn Overflow project in 2012

In addition to the above, since 2013 the Scottish Water Glasgow Wastewater Strategy (GWS) has delivered:

- Colquhoun Park Flood Alleviation Scheme constructed between 2014 to 2015
- South Dalmarnock Regional Sustainable Urban Drainage pond – Clyde Gateway in 2014
- London Road / Clyde Gateway East Sustainable Urban Drainage, Clyde Gateway in 2012
- Shawfield Masterplan Culvert Works, Clyde Gateway constructed between 2013 to 2015

### **Surface water management studies**

The organisations involved in the operation of the sewerage and drainage network within the Greater Glasgow area have carried out a number of studies to identify the level of risk from surface water flooding and potential mitigation actions. Some of the more recent studies are listed below.

- Glasgow Surface Water Management Study from 2010 to 2012
- International Financial Services District and City Centre West surface water management plan in 2012

- Gartloch / Gartcosh surface water management plan in 2009
- Yoker / Cleddans Burn Hydraulic Model from 2013 to 2014
- Spittal / Cityford Burn Hydraulic Model from 2013 to 2014
- Cardowan surface water management plan from 2013 to 2014
- City Centre surface water management plan from 2013 to 2014
- Shawfield Flood Risk Assessment in 2010

As part of the Scottish Water Glasgow Strategic Study the following have been undertaken:

- Dalmarnock Integrated Drainage Plan from 2009 to 2015
- Shieldhall Integrated Drainage Plan from 2009 to 2014
- Dalmuir Integrated Drainage Plan from 2009 to 2014
- Daldowie Integrated Drainage Plan from 2009 to 2014
- Paisley Integrated Drainage Plan from 2009 to 2014
- Glasgow Strategic Study Estuary - River WQ Optioneering Assessments in 2010
- Glasgow Strategic Study - Inner Clyde Estuary Oxygenation Pilot Trial from 2011 - 2012
- GSS - Lower River Clyde Wastewater Strategy from 2011 to 2012
- LRC3 and Overall Glasgow Strategic Study Final Water Quality Analysis in 2013

## 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 surface water 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 13,000 to 18,000 and the number of non-residential properties from approximately 6,300 to 8,500.

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. <sup>i</sup>
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 <sup>ii</sup> ), wetlands, rivers, canals (and their banks) and other watercourses <sup>iii</sup>
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 <sup>iv</sup> .
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. <sup>v</sup>
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 from 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. <sup>vi</sup>
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 <sup>vii</sup> .
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’ <sup>viii</sup>

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. <b>High likelihood:</b> 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. <b>Medium likelihood:</b> 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. <b>Low likelihood:</b> 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 <sup>ix</sup> .
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.

<b>Term</b>	<b>Definition</b>
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 <sup>x</sup> .
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 <sup>xi</sup> .
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 <sup>xii</sup> .
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 <sup>xiii</sup>
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. <sup>xiv</sup>
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.

<sup>i</sup> <http://apps.sepa.org.uk/bathingwaters/> accessed 14/10/2015 last updated 2015

<sup>ii</sup> <http://www.susdrain.org/delivering-suds/using-suds/suds-components/swales-and-conveyance-channels/swales.html> accessed 12/10/2015 last updated 2012

<sup>iii</sup> <http://www.gov.scot/Resource/Doc/362219/0122541.pdf> accessed 12/10/2015 last updated 2011

<sup>iv</sup> <http://www.legislation.gov.uk/ukpga/2004/36/schedule/1> accessed 12/10/2015 last updated 2004

<sup>v</sup> <http://evidence.environment-agency.gov.uk/FCERM/en/FluvialDesignGuide/Chapter9.aspx?pagenum=10> accessed 12/10/2015 last update 07/03/2012

<sup>vii</sup> [http://ec.europa.eu/environment/water/flood\\_risk/](http://ec.europa.eu/environment/water/flood_risk/) accessed 12/10/2015 last updated 17/09/2015

<sup>viii</sup> <http://www.gov.scot/Resource/Doc/362219/0122541.pdf> accessed 12/10/2015 last updated 2011

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- <sup>ix</sup> <http://www.snh.gov.uk/protecting-scotlands-nature/protected-areas/local-designations/lnr/> accessed 12/10/2015 last updated 12/07/2015
- <sup>x</sup> <http://www.snh.gov.uk/protecting-scotlands-nature/protected-areas/national-designations/sssisi/> accessed 12/10/2015 last updated 21/01/2015
- <sup>xi</sup> <http://www.snh.gov.uk/protecting-scotlands-nature/protected-areas/international-designations/sac/> accessed 12/10/2015 last updated 01/03/2013
- <sup>xii</sup> <http://www.snh.gov.uk/protecting-scotlands-nature/protected-areas/international-designations/spa/> accessed 12/10/2015 last updated 01/03/2013
- <sup>xiii</sup> <http://watermaps.environment-agency.gov.uk/wiyby/wiyby.aspx?topic=ufmfsw#x=357683&y=355134&scale=2> accessed 12/10/2015 last updated 12/10/2015
- <sup>xiv</sup> <http://ukclimateprojections.metoffice.gov.uk> Document © Crown copyright 2009 accessed 01/12/15 last updated 30/04/2012

## Annex 2: Land use planning

Flood risk management actions from national planning policies
<p><b>AVOID DEVELOPMENT IN MEDIUM TO HIGH RISK AREAS</b></p> <p>a) <b>Planning authorities</b> 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.</p> <p>b) <b>Planning authorities and SEPA</b> require the submission of flood risk assessments that accord with SEPA's <i>Technical Flood Risk Guidance for Stakeholders</i>, 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.</p> <p>c) <b>SEPA</b> 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.</p> <p>d) <b>SEPA and planning authorities</b> 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.</p>
<p><b>REDUCE IMPACTS TO EXISTING BUILDINGS</b></p> <p>a) <b>SEPA, planning authorities and local communities</b> 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.</p>
<p><b>PROTECT AND ENHANCE NATURAL FEATURES THAT HAVE A POSITIVE IMPACT ON REDUCING OVERALL FLOOD RISK</b></p> <p>a) <b>SEPA and planning authorities</b> 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.</p>
<p><b>NEW DEVELOPMENTS ARE DESIGNED TO ENSURE THAT SURFACE WATER DRAINAGE DOES NOT INCREASE FLOOD RISK ON OR OFF SITE</b></p> <p>a) <b>SEPA</b> prepares guidance for planning authorities and developers on the use of surface water hazard maps for land use planning purposes.</p> <p>b) <b>Planning authorities</b> 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.</p> <p>c) <b>SEPA</b> 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.</p>
<p>a) <b>NEW DEVELOPMENT IS RESILIENT TO PREDICTED FUTURE CHANGES IN CLIMATE</b> <b>Planning authorities</b> 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.</p>

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:

### **Ordnance Survey**

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### **Local authorities**

SEPA acknowledges the provision of flood models and other supporting data and information from local authorities in Scotland and their collaboration in the production of flood risk management information.

### **Scottish Water**

SEPA acknowledges the inclusion of surface water flooding data generated by Scottish Water in preparation of flood risk information.

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.