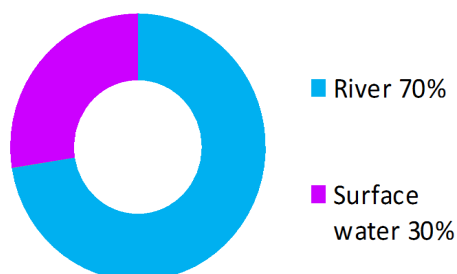


Gryfe catchment - Bridge of Weir to Houston (Potentially Vulnerable Area 11/11)

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 70km² 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.

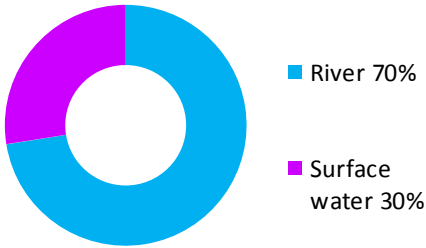
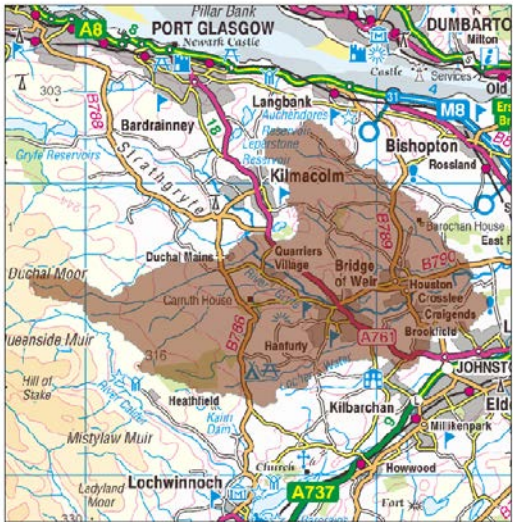


Figure 1: Annual Average Damages by flood source

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 ²)	<0.1	<0.1	<0.1
Designated cultural heritage sites	2	4	5
Agricultural land (km ²)	2.0	2.4	2.7

Table 1: Summary of flooding impacts¹

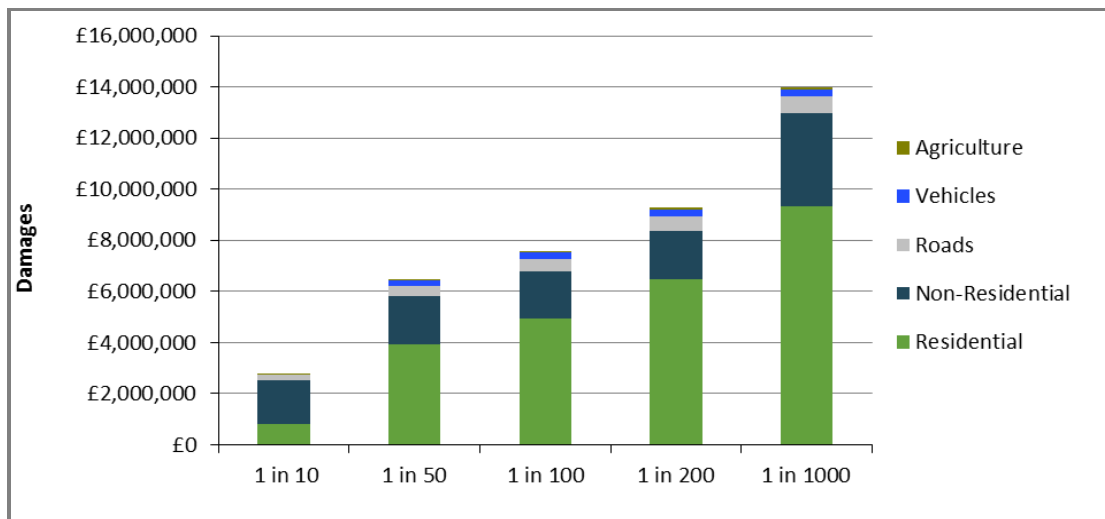


Figure 2: Damages by flood likelihood

¹ Some receptors are counted more than once if flooded from multiple sources

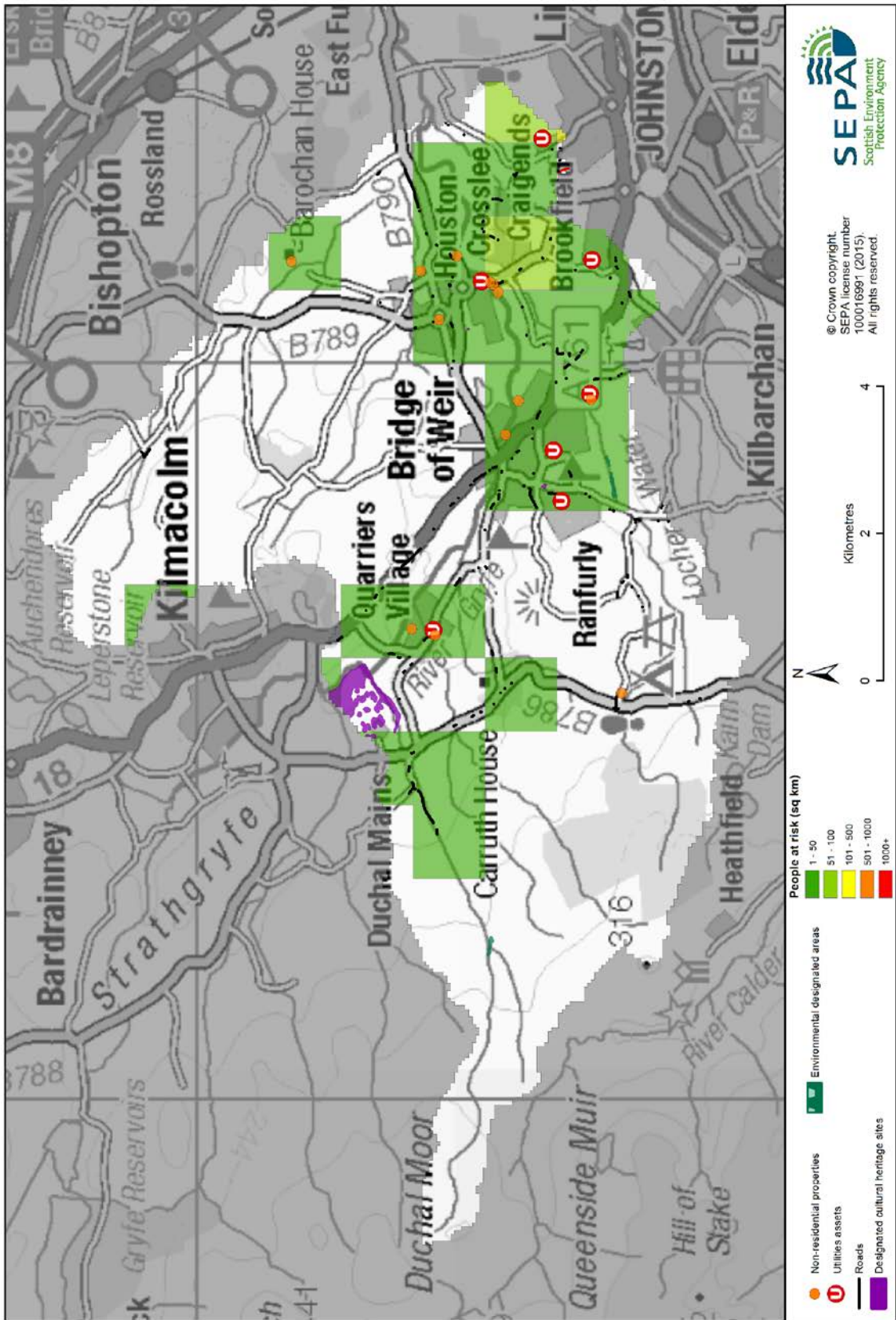


Figure 3: Impacts of flooding

Objectives to manage flooding in Potentially Vulnerable Area 11/11

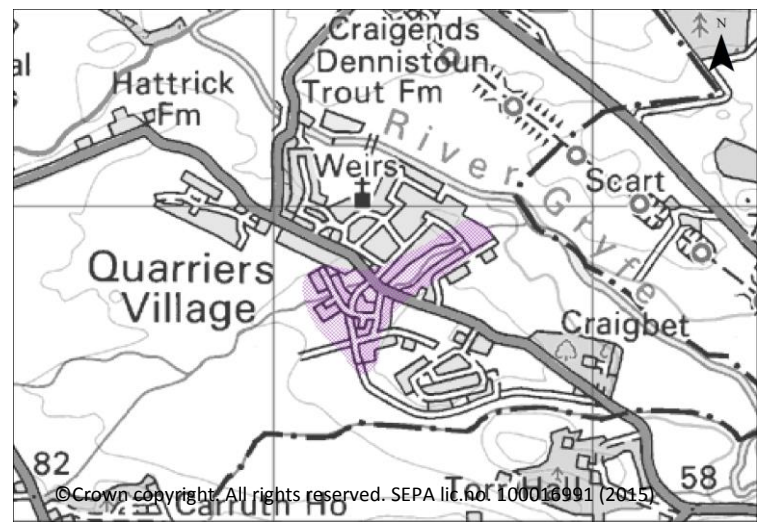
Objectives provide a common goal and shared ambition for managing floods. These objectives have been set by SEPA and agreed with flood risk management authorities following consultation. They were identified through an assessment of the underlying evidence of the causes and impacts of flooding. Target 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"> • 190 residential properties • £430,000 Annual Average Damages
Applies across Clyde and Loch Lomond Local Plan District	Reduce overall flood risk	11132	<ul style="list-style-type: none"> • 190 residential properties • £430,000 Annual Average Damages
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

Action (ID):	FLOOD PROTECTION SCHEME/WORKS (110330006)				
Objective (ID):	Reduce the risk of flooding from the Gotter Water and River Gryfe to residential properties in Quarriers Village (11033)				
Delivery lead:	Inverclyde Council				
Priority:	National:		Within local authority:		
	41 of 42		4 of 4		
Status:	Under development	Indicative delivery:	2016-2021		
Description:	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.				
Potential impacts					
Economic:	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.				
Social:	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.				

Environmental:	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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Action (ID):	NEW FLOOD WARNING (111320010)		
Objective (ID):	Reduce overall flood risk (11132)		
Delivery lead:	SEPA		
Status:	Not started	Indicative delivery:	post 2021
Description:	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.		

Action (ID):	SURFACE WATER PLAN/STUDY (111160018)		
Objective (ID):	Reduce the economic damages and risk to people from surface water flooding in Johnstone and Kilbarchan (11116)		
Delivery lead:	Renfrewshire Council		
Status:	Not started	Indicative delivery:	2016-2021
Description:	The area must be covered by a surface water management plan or plans that set objectives for the management of surface water flood risk and identify the most sustainable actions to achieve the objectives.		

Action (ID):	SURFACE WATER PLAN/STUDY (111170018)		
Objective (ID):	Reduce the economic damages and risk to people from surface water flooding in Linwood (11117)		
Delivery lead:	Renfrewshire Council		
Status:	Not started	Indicative delivery:	2022-2027
Description:	The area must be covered by a surface water management plan or plans that set objectives for the management of surface water flood risk and identify the most sustainable actions to achieve the objectives.		

Action (ID):	SURFACE WATER PLAN/STUDY (111170019)		
Objective (ID):	Reduce the economic damages and risk to people from surface water flooding in Linwood (11117)		
Delivery lead:	Scottish Water in partnership with Renfrewshire Council		
Status:	Ongoing	Indicative delivery:	2016-2021
Description:	An integrated catchment study will be carried out to support the surface water management plan process and improve knowledge and understanding of surface water flood risk and interactions with other sources of flooding e.g. with the sewer network, watercourses and the sea.		

Action (ID):	STRATEGIC MAPPING AND MODELLING (111320019)		
Objective (ID):	Reduce overall flood risk (11132)		
Delivery lead:	Scottish Water		
Status:	Not started	Indicative delivery:	2016-2021
Description:	Scottish Water will carry out an assessment of flood risk within the highest risk sewer catchments to improve knowledge and understanding of surface water flood risk.		

Action (ID):	FLOOD FORECASTING (111320009)		
Objective (ID):	Reduce overall flood risk (11132)		
Delivery lead:	SEPA		
Status:	Existing	Indicative delivery:	Ongoing
Description:	The Scottish Flood Forecasting Service is a joint initiative between SEPA and the Met Office that produces daily, national flood guidance statements which are issued to Category 1 and 2 Responders. The service also provides information which allows SEPA to issue flood warnings, giving people a better chance of reducing the impact of flooding on their home or business. For more information please visit SEPA's website.		

Action (ID):	SELF HELP (111320011)		
Objective (ID):	Reduce overall flood risk (11132)		
Delivery lead:	—		
Status:	Existing	Indicative delivery:	Ongoing
Description:	Everyone is responsible for protecting themselves and their property from flooding. Property and business owners can take simple steps to reduce damage and disruption to their homes and businesses should flooding happen. This includes preparing a flood plan and flood kit, installing property level protection, signing up to Floodline and Resilient Communities initiatives, and ensuring that properties and businesses are insured against flood damage.		

Action (ID):	AWARENESS RAISING (111320013)		
Objective (ID):	Reduce overall flood risk (11132)		
Delivery lead:	Responsible authorities		
Status:	Existing	Indicative delivery:	Ongoing
Description:	SEPA and the responsible authorities have a duty to raise public awareness of flood risk. Improved awareness of flood risk and actions that prepare individuals, homes and businesses for flooding can reduce the overall impact. From 2016 SEPA will engage with the community through local participation in national initiatives, including partnership working with Neighbourhood Watch Scotland. In addition, SEPA will engage with local authorities and community resilience groups where possible. Local authorities will be undertaking additional awareness raising activities. Further details will be set out in the Local FRM Plan.		

Action (ID):	MAINTENANCE (111320007)		
Objective (ID):	Reduce overall flood risk (11132)		
Delivery lead:	Inverclyde Council and Renfrewshire Council, asset / land managers		
Status:	Existing	Indicative delivery:	Ongoing
Description:	Local authorities have a duty to assess watercourses and carry out clearance and repair works where such works would substantially reduce flood risk. They produce schedules of clearance and repair works and make these available for public inspection. Scottish Water undertake inspection and repair on the public sewer network. Asset owners and riparian landowners are responsible for the maintenance and management of their own assets including those which help to reduce flood risk.		

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

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