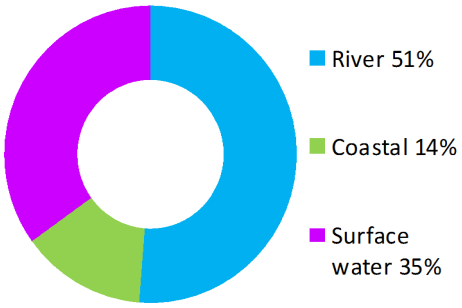
White Cart Water catchment (Potentially Vulnerable Area 11/13)

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 objectives to manage flooding

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

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

Summary of actions to manage flooding

The actions below have been selected to manage flood risk.

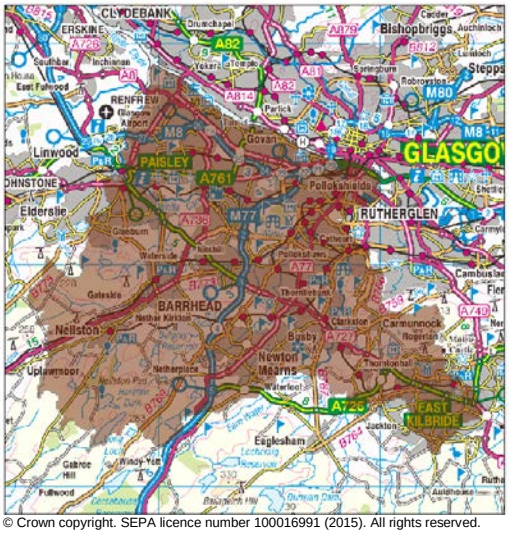
Flood protection scheme/works	*Natural flood management works*	*New flood warning*	Community flood action groups	*Property level protection scheme*	Site protection plans
Flood protection study	Natural flood management study	Maintain flood warning	Awareness raising	Surface water plan/study	Emergency plans/response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

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^2.



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.

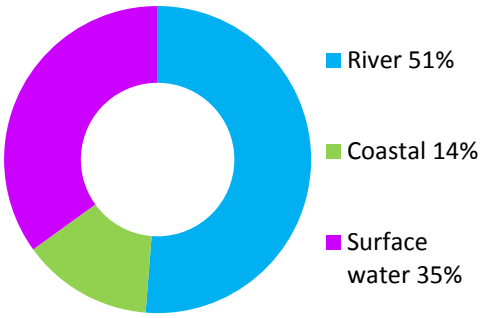


Figure 1: Annual Average Damages by flood source

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 Kittoch 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
Residential properties (total 180,000)	1,200	4,700	14,000
Non-residential properties (total 32,000)	530	2,800	5,800
People	2,700	10,000	31,000
Community facilities	<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
Utilities assets	50	160	230
Transport links - roads (km)	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)
Transport links - rail (km)	10.4	32.2	38.6
Environmental designated areas (km²)	0.1	0.1	0.1
Designated cultural heritage sites	24	53	57
Agricultural land (km²)	2.7	3.1	3.1

Table 1: Summary of flooding impacts[1]

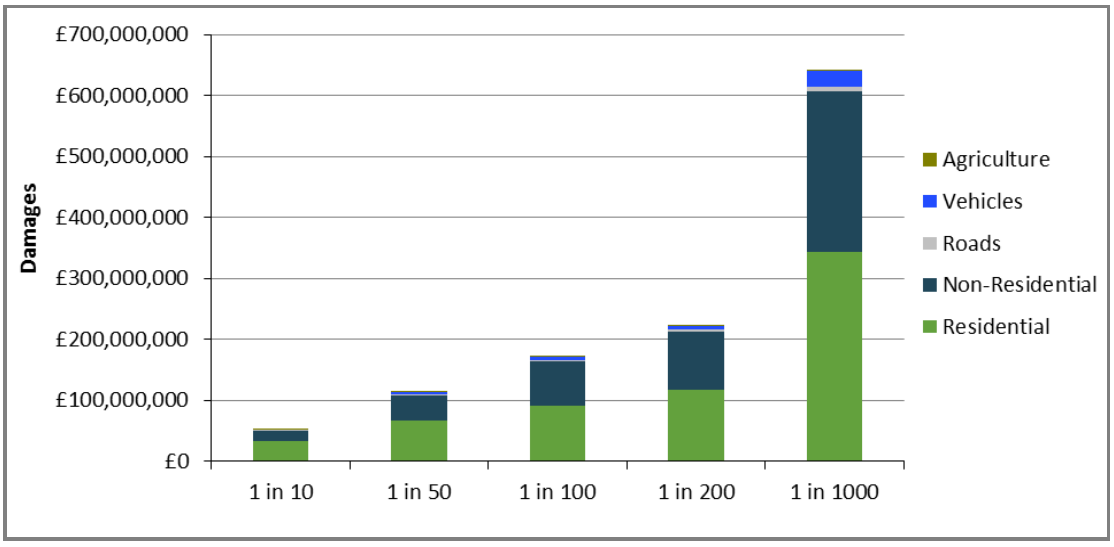


Figure 2: Damages by flood likelihood

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

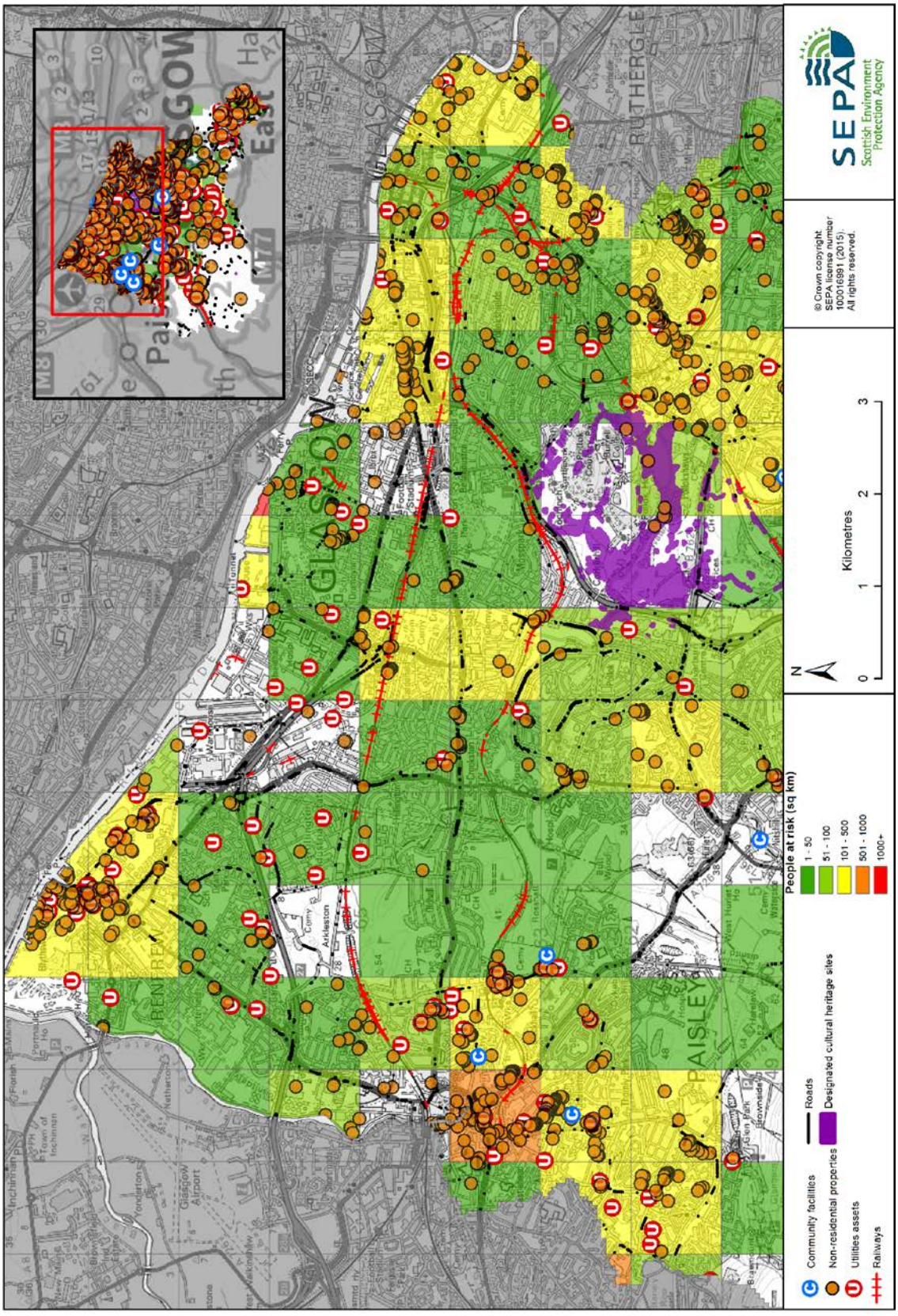


Figure 3a: Impacts of flooding

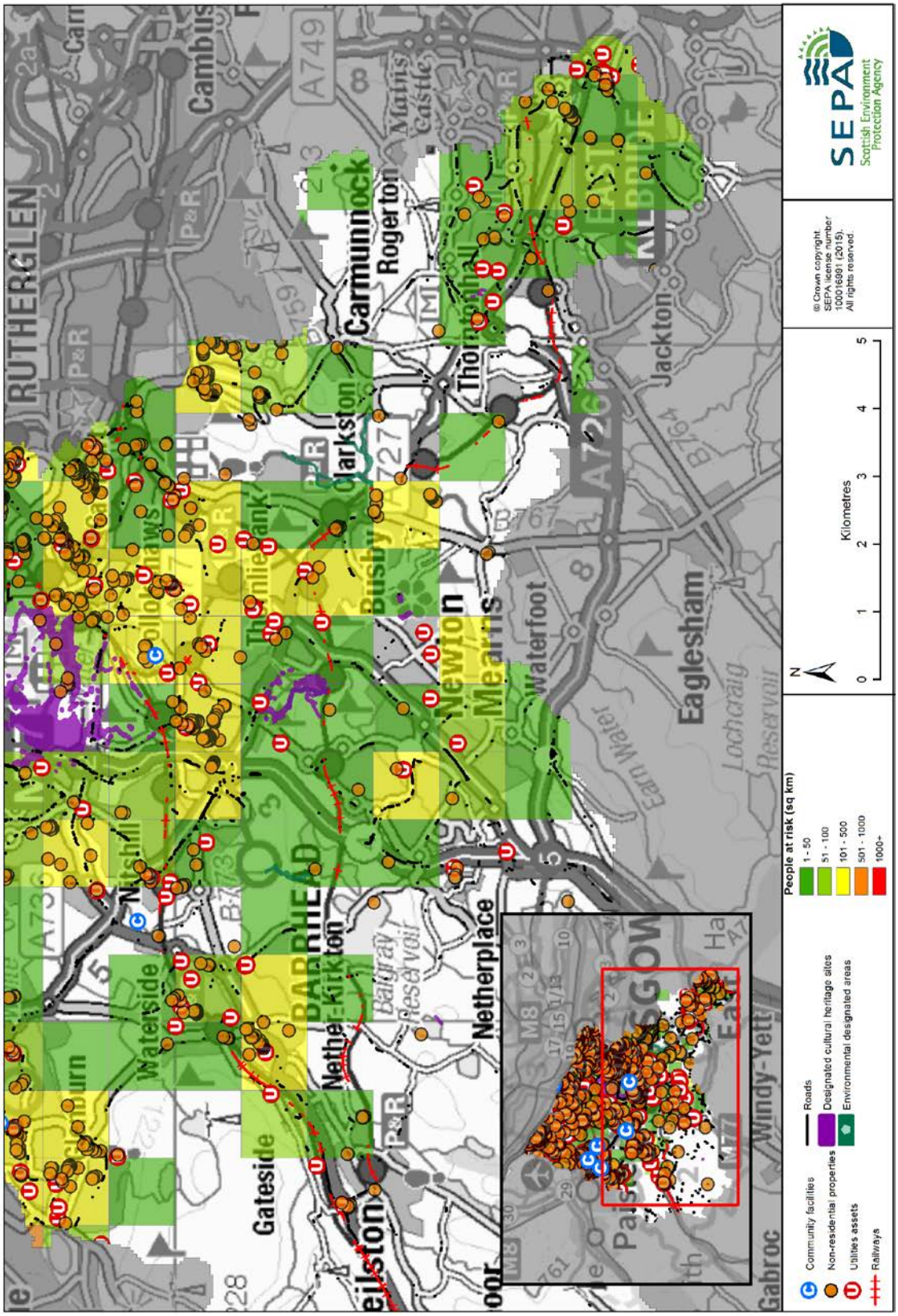


Figure 3b: Impacts of flooding

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.

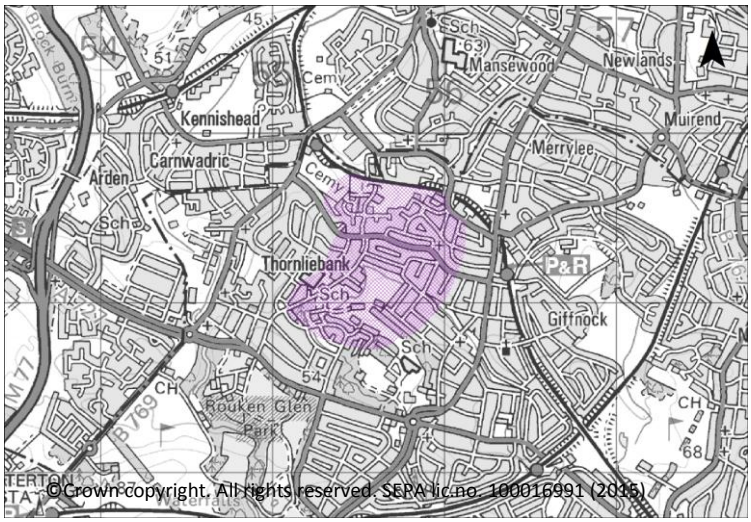
Reduce the risk of river and surface water flooding to residential properties in Giffnock

Indicators:

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

Objective ID: 11012

Target area:



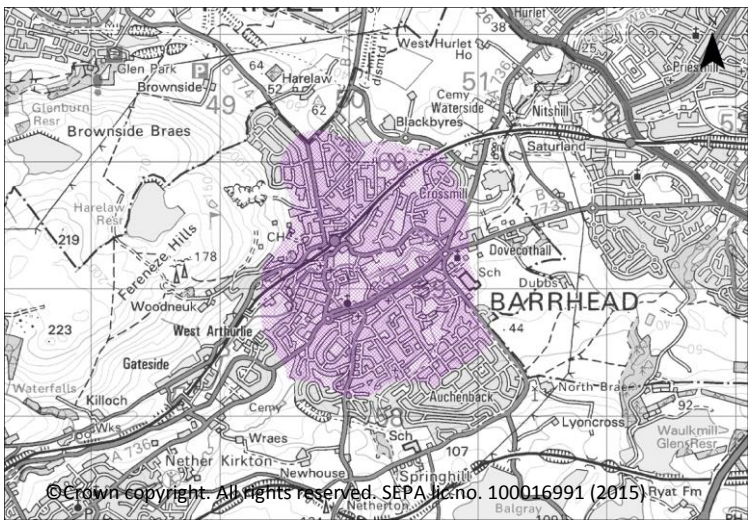
Reduce the risk of river and surface water flooding to residential properties and non-residential properties in Barrhead

Indicators:

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

Objective ID: 11013

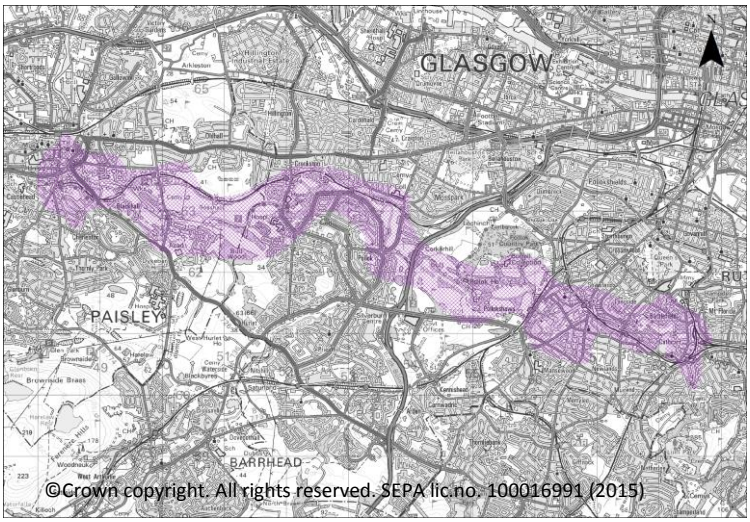
Target area:



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	

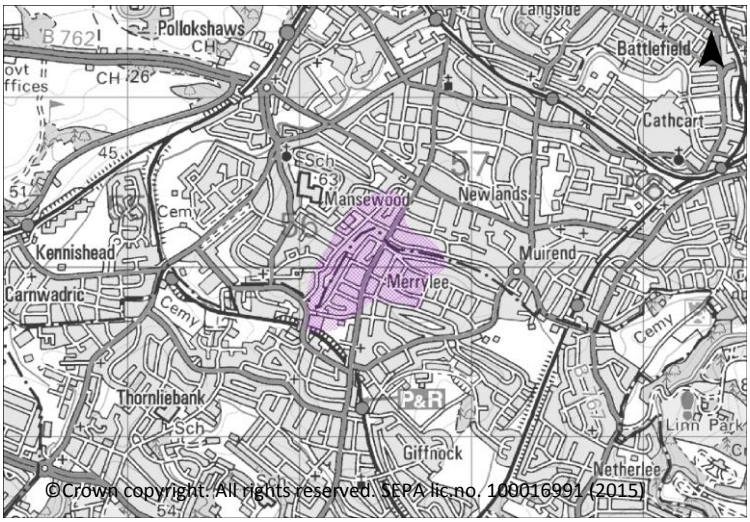
Reduce the risk of river and surface water flooding to residential properties and non-residential properties in Merrylee

Indicators:

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

Objective ID: 11027

Target area:



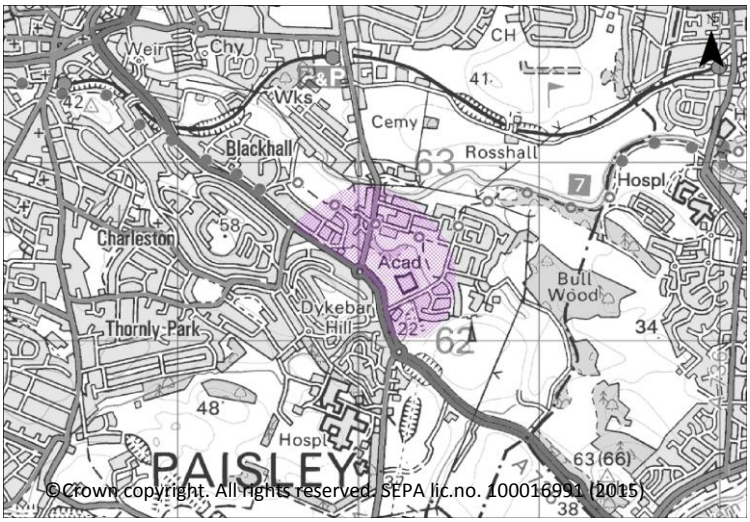
Reduce the risk of flooding from the Hawkhead Burn and surface water to residential properties and non-residential properties in Paisley

Indicators:

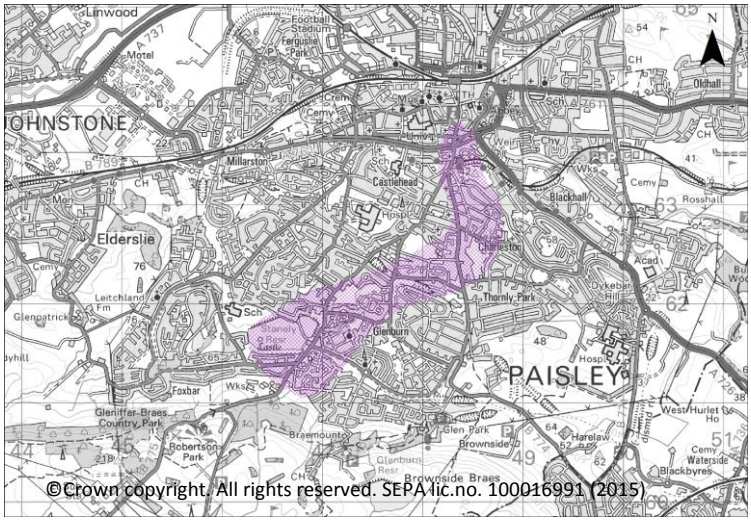
- 30 residential properties
- <10 non-residential properties
- £89,000 Annual Average Damages

Objective ID: 11058

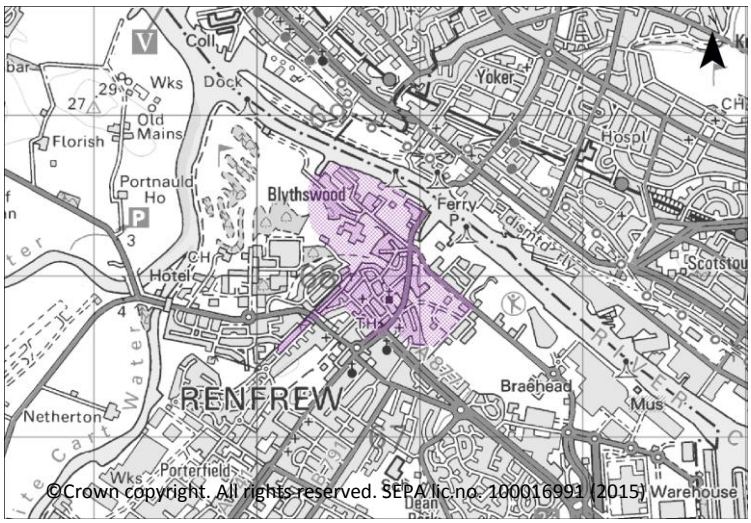
Target area:



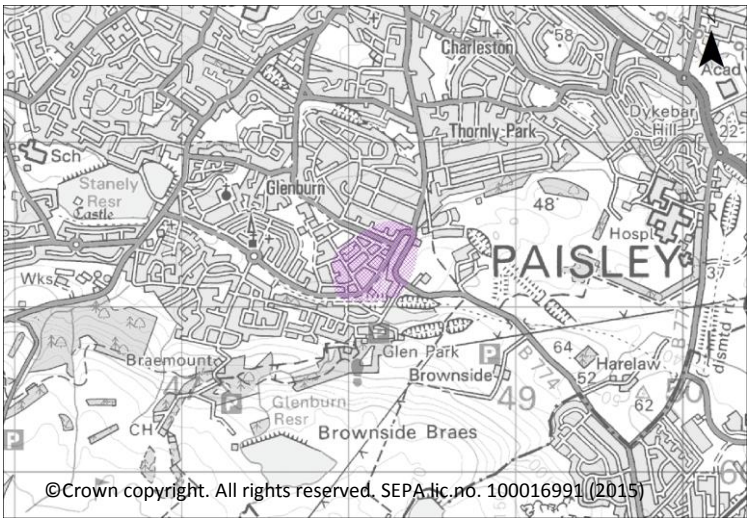
Reduce the risk of flooding from the Espedair Burn / Gleniffer Burn and surface water to residential properties, non-residential properties, community facilities and transport routes in Paisley

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	• 4,700 residential properties • £10 million Annual Average Damages
Applies across Clyde and Loch Lomond Local Plan District	Reduce overall flood risk	11132	• 4,700 residential properties • £10 million 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 11/13 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	*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** (110190006)		
Objective (ID):	Reduce the risk of river flooding to residential properties and non-residential properties from the White Cart Water (11019)		
Delivery lead:	Glasgow City Council		
Priority:	National:	Within local authority:	
	26 of 42	**1 of 2**	
Status:	**Under development**	Indicative delivery:	**2016-2021**
Description:	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. The proposed scheme includes building flood walls in locations where properties are still identified to be at risk. 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.		
Potential impacts			
Economic:	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.		
Social:	A reduction in flood risk would have a positive benefit to the health and wellbeing of the community.		
Environmental:	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		

Environmental:	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.

Action (ID):	**FLOOD PROTECTION SCHEME/WORKS** (110120006)		
Objective (ID):	Reduce the risk of river and surface water flooding to residential properties in Giffnock (11012)		
Delivery lead:	Scottish Water		
Status:	**Ongoing**	Indicative delivery:	**2016-2021**
Description:	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. 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. 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.		
Potential impacts			
Economic:	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.		
Social:	A reduction in flood risk would have a positive benefit to the health and wellbeing of the community.		
Environmental:	Flood protection works can have both positive and negative impacts on the ecological quality of the environment depending on how they are designed.		

Action (ID):	**FLOOD PROTECTION SCHEME/WORKS** (110630006)		
Objective (ID):	Reduce the risk of coastal flooding to residential properties, non-residential properties and transport routes in Renfrew North (11063)		
Delivery lead:	Renfrewshire Council		
Status:	**Ongoing**	Indicative delivery:	**2016-2021**
Description:	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	
Economic:	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.
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.
Environmental:	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.

Action (ID):	**FLOOD PROTECTION STUDY** (110590005)		
Objective (ID):	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)		
Delivery lead:	Renfrewshire Council		
Priority:	National:		Within local authority:
	11 of 168		**1 of 6**
Status:	**Not started**	Indicative delivery:	**2022-2027**
Description:	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,		

	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. These actions would also serve to benefit properties north of Thornley reservoir. 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.
Potential impacts	
Economic:	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.
Social:	A reduction in flood risk would have a positive benefit to the health and wellbeing of the community and socially vulnerable people located within the flood protection 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.
Environmental:	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.

Action (ID):	**FLOOD PROTECTION STUDY** (110270005)		
Objective (ID):	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)		
Delivery lead:	Glasgow City Council		
Priority:	National:		Within local authority:
	16 of 168		**2 of 8**
Status:	**Not started**	Indicative delivery:	**2016-2021**
Description:	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		

	by Glasgow City Council with the cooperation of East Renfrewshire Council. Review of the study will establish the level of risk and if further stages are required to examine actions to manage flooding. The flood mapping from the study should be used to revise SEPA's strategic mapping.
Potential impacts	
Economic:	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.
Social:	A reduction in flood risk would have a positive benefit to the health and wellbeing of the community.
Environmental:	Flood protection studies should consider the positive and negative impacts of proposed actions on the ecological quality of the environment.

Action (ID):	**FLOOD PROTECTION STUDY** (110130005)		
Objective (ID):	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)		
Delivery lead:	East Renfrewshire Council		
Priority:	National:	Within local authority:	
	49 of 168	**1 of 2**	
Status:	**Not started**	Indicative delivery:	**2016-2021**
Description:	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. This study is linked to a surface water management plan for the area and any recommendations should be considered.		
Potential impacts			
Economic:	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.		
Social:	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		

Social:	environments and create opportunities for recreation and tourism. There may be changes in visual amenity and land use as a result of this action.
Environmental:	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.

Action (ID):	**FLOOD PROTECTION STUDY** (110120005)		
Objective (ID):	Reduce the risk of river and surface water flooding to residential properties in Giffnock (11012)		
Delivery lead:	East Renfrewshire Council		
Priority:	National:		Within local authority:
	79 of 168		**2 of 2**
Status:	**Not started**	Indicative delivery:	**2022-2027**
Description:	A diversion at Thornliebank is being carried out by Scottish Water which may alleviate some flooding in the area. Upon completion of the Scottish Water work a study is recommended to investigate if there is any remaining flood risk. 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. 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.		
Potential impacts			
Economic:	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.		
Social:	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.		
Environmental:	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-		

Environmental:	natural habitats and recreational land in the footprint of the storage area. However, there is the potential for creation of new wetland habitats.

Action (ID):	**FLOOD PROTECTION STUDY** (110580005)		
Objective (ID):	Reduce the risk of flooding from the Hawkhead Burn and surface water to residential properties and non-residential properties in Paisley (11058)		
Delivery lead:	Renfrewshire Council		
Priority:	National:	Within local authority:	
	110 of 168	**5 of 6**	
Status:	**Not started**	Indicative delivery:	**2022-2027**
Description:	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. 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.		
Potential impacts			
Economic:	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.		
Social:	A reduction in flood risk would have a positive benefit to the health and wellbeing of the community and socially vulnerable people located within the flood protection study area. There may be negative impacts through disturbance to the local community during the construction phase.		
Environmental:	Flood protection studies should consider the positive and negative impacts of proposed actions on the ecological quality of the environment. 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.		

Action (ID):	**FLOOD PROTECTION STUDY** (110170005)		
Objective (ID):	Reduce the risk of flooding to non-residential properties and community facilities in Gorbals from the River Clyde (11017)		
Delivery lead:	Glasgow City Council		
Priority:	National:	Within local authority:	
	156 of 168	**8 of 8**	
Status:	**Not started**	Indicative delivery:	**2016-2021**
Description:	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.		
Potential impacts			
Economic:	The study will be used to identify the level of risk to non-residential buildings and community facilities in the area.		
Social:	A reduction in flood risk would have a positive benefit to the health and wellbeing of the community.		
Environmental:	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.		

Action (ID):	**NATURAL FLOOD MANAGEMENT STUDY** (110590003)		
Objective (ID):	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)		
Delivery lead:	Glasgow Clyde Valley Green Network on behalf of local authorities		
Status:	**Not started**	Indicative delivery:	**2016-2021**
Description:	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	
Economic:	The economic impact of natural flood management actions is difficult to define. However, these actions can reduce risk for high likelihood events.
Social:	A reduction in flood risk would have a positive benefit to the health and wellbeing of the community and socially vulnerable people located within the 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.
Environmental:	Natural flood management actions can have a positive impact on the ecological quality of the environment by restoring and enhancing natural habitats.

Action (ID):	**SURFACE WATER PLAN/STUDY** (110070018)		
Objective (ID):	Reduce the economic damages and number of people at risk of surface water flooding in Glasgow City (11007)		
Delivery lead:	Glasgow City Council		
Status:	**Not started**	Indicative delivery:	**2028-2033**
Description:	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.		

Action (ID):	**SURFACE WATER PLAN/STUDY** (110880018)		
Objective (ID):	Reduce the economic damages and risk to people from surface water flooding in Barrhead (11088)		
Delivery lead:	East 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. 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.		

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

Delivery lead:	East Renfrewshire Council		
Status:	**Not started**	Indicative delivery:	**2016-2027**
Description:	The area must be covered by a surface water management plan or plans that set objectives for the management of surface water flood risk and identify the most sustainable actions to achieve the objectives. 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.		

Action (ID):	**SURFACE WATER PLAN/STUDY** (110900018)		
Objective (ID):	Reduce the economic damages and risk to people from surface water flooding in Newton Mearns (11090)		
Delivery lead:	East 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. 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.		

Action (ID):	**SURFACE WATER PLAN/STUDY** (110920018)		
Objective (ID):	Reduce the economic damages and risk to people from surface water flooding in Darnley Mains (11092)		
Delivery lead:	Glasgow City 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. 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.		

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

Action (ID):	**SURFACE WATER PLAN/STUDY** (111181018)		
Objective (ID):	Reduce the economic damages and risk to people from surface water flooding in Paisley (11118)		
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. 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.		

Action (ID):	**SURFACE WATER PLAN/STUDY** (111190018)		
Objective (ID):	Reduce the economic damages and risk to people from surface water flooding in East Kilbride (11119)		
Delivery lead:	South Lanarkshire 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** (111190019)		
Objective (ID):	Reduce the economic damages and risk to people from surface water flooding in East Kilbride (11119)		
Delivery lead:	Scottish Water in partnership with South Lanarkshire Council		
Status:	**Not started**	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 and		

	watercourses.

Action (ID):	SURFACE WATER PLAN/STUDY (111300018)		
Objective (ID):	Reduce the economic damages and risk to people from surface water flooding in Newlands (11130)		
Delivery lead:	Glasgow City 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. 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.		

Action (ID):	SURFACE WATER PLAN/STUDY (111310018)		
Objective (ID):	Reduce the economic damages and risk to people from surface water flooding in Nitshill and Priesthill (11131)		
Delivery lead:	Glasgow City 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. 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.		

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 review the assessment of flood risk within the highest risk sewer catchments to improve knowledge and understanding of surface water flood risk.		

Action (ID):	**MAINTAIN FLOOD PROTECTION SCHEME** (110190017)		
Objective (ID):	Reduce the risk of river flooding to residential properties and non-residential properties from the White Cart Water (11019)		
Delivery lead:	Glasgow City Council		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	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.		

Action (ID):	**MAINTAIN FLOOD PROTECTION SCHEME** (110590017)		
Objective (ID):	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)		
Delivery lead:	Renfrewshire Council		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	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.		

Action (ID):	**MAINTAIN FLOOD PROTECTION SCHEME** (110630017)		
Objective (ID):	Reduce the risk of coastal flooding to residential properties, non-residential properties and transport routes in Renfrew North (11063)		
Delivery lead:	Renfrewshire Council		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	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.		

Action (ID):	**MAINTAIN FLOOD WARNING** (111320030)		
Objective (ID):	Reduce overall flood risk (11132)		
Delivery lead:	SEPA		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	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. Continue to maintain the Glasgow Quay Walls and Renfrew flood warning areas which are part of the Firth of Clyde coastal flood warning scheme.		

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):	**COMMUNITY FLOOD ACTION GROUPS** (110190012)		
Objective (ID):	Reduce the risk of river flooding to residential properties and non-residential properties from the White Cart Water (11019)		
Delivery lead:	Community		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	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.		

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 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.		

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

Action (ID):	**SITE PROTECTION PLANS** (110190015)		
Objective (ID):	Reduce the risk of river flooding to residential properties and non-residential properties from the White Cart Water (11019)		
Delivery lead:	Glasgow City Council		
Status:	**Existing**	Indicative delivery:	**Ongoing**
Description:	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.		

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:	Providing an emergency response to flooding is the responsibility of many organisations, including local authorities, the emergency services and SEPA. Effective management of an emergency response relies on emergency plans that are prepared under the Civil Contingencies Act 2004 by Category 1 and 2 Responders. The emergency response by these organisations is co-ordinated through regional and local resilience partnerships. This response may be supported by the work of voluntary organisations.		

Action (ID):	**PLANNING POLICIES** (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:	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.		