

A Catchment Based Approach to Managing Flood Risk



Image: Floodplain scrape on River Cocker. © West Cumbria Rivers Trust



Image: The Flood Hub



Image: The Flood Hub



Image: Lakeside Flood Solutions



Image: Environment Agency



Image: Dave Porter / Alamy Stock Photo

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INTRODUCTION

A catchment based approach to managing flood risk.

Throughout history, communities have settled on floodplains (the area of land directly adjacent to a river which experiences flooding during periods of high discharge). With climate change science predicting an increase in the frequency and severity of high rainfall events, we need to change the way we think about managing flood risk to protect vulnerable communities.

There are many factors which contribute to flood risk within a catchment and rather than taking a piecemeal approach, stakeholders such as Risk Management Authorities (RMAs), water companies, partner organisations, communities and landowners etc, can all collaborate and work together to help slow and store water within a catchment to reduce the risk of flooding.

The catchment based approach can include activities such as: restoring or implementing natural features and processes, improving land management techniques, river restoration and management, enhancing drainage and sewer systems, and strengthening the resilience of our buildings and communities. Whilst the catchment based approach is the ideal way to manage flood risk throughout the catchment, it's important to be aware that it is not always possible.

As part of a catchment based approach, the following methods can be used which are outlined in this booklet:

- Maintenance throughout the catchment
- Natural Flood Management (NFM)
- Sustainable Drainage Systems (SuDS)
- Flood Risk Management Schemes (FRMS)
- Property Flood Resilience (PFR)
- Community resilience

Catchment Management



Natural Flood Management (NFM)
NFM involves using techniques to restore or mimic natural functions to help store more water in the catchment and slow the flow of water downstream. Methods include leaky dams, peatland restoration, storage areas and tree planting.

Storage Areas
Storing water on the floodplain or in upstream storage areas during heavy rainfall reduces the volume in the river's channel and reduces peak flows downstream. Outlet structures can return the water to the river at a controlled rate.

Sustainable Drainage Systems (SuDS)
SuDS can be used to slow, retain and infiltrate rainwater runoff through water butts, permeable paving, rain gardens and more. On a larger scale, SuDS such as swales, ponds and wetlands can be used.

Agricultural Land Management
Techniques to reduce runoff on farmland include buffer strips, cross drains and contour cultivation across fields instead of up and down. Certain machinery practices help to reduce soil compaction which increases water capacity and soil health.

Gravel Management
Removing gravel from pinch points such as bridges can help watercourses flow more freely. Whilst this can increase channel conveyance, it may also speed up the flow of water downstream.

Flood Risk Management Schemes
Flood schemes combine hard engineering and other techniques to reduce flood risk to communities. Methods include flood walls, embankments, storage areas and coastal management.

Property Flood Resilience (PFR)
Individuals can use PFR in their homes and businesses to increase their resilience to flooding. Options include flood barriers on doors, automatic airbricks, non-return valves and pumps.

Monitoring
Gauge boards and telemetry systems on watercourses help to monitor flood conditions and act as early warning systems.

Highway Maintenance
Gullies on highways and other assets such as soakaways can play a big part in managing surface water runoff. Maintenance of assets is important to ensure they work in heavy rainfall events.

Community Resilience
Working together and forming flood action groups helps communities become more resilient. They can work with key agencies to better understand and manage their flood risk.

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This resource has been produced by Newground who work in partnership with the Environment Agency

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Maintenance Throughout the Catchment

Maintenance is an important part of the catchment based approach to help keep water free flowing and reduce flood risk. Examples include:

- **Gravel Removal** - This involves removing silt (a material made of fine sand), clay and small particles of rock from gravel bars that form on the river bed or around in-stream structures such as bridge supports.
- **Highway Maintenance** - Gullies on highways and other assets such as soakaways can play a big part in managing surface water runoff. Maintenance of assets is important to ensure they work in heavy rainfall events.
- **Riparian Ownership Maintenance** - A riparian owner is somebody who has either a main river or ordinary watercourse running on, through, beneath or alongside the boundary of their land. If you own a watercourse you are responsible for ensuring that water flows through it naturally, and for maintaining it by removing blockages that may impede the flow of water or cause flooding. However, you are not responsible for proactively reducing the risk of flooding from the watercourse.
- **Maintenance of Flood Risk assets** - Flood risk assets are any structure or landscape feature which has a flood risk management function, such as a culvert, flood gate, or trash screen. They require maintenance to ensure they can continue to function effectively, and they may not necessarily be located close to a watercourse.



Natural Flood Management (NFM)

Natural flood management (NFM) involves using various techniques to restore or mimic natural functions of rivers, floodplains and the wider catchment. It aims to store water in the catchment and slow the rate at which water runs off the landscape into rivers, to help reduce flood risk to communities downstream. NFM can also be known as working with natural processes, slow the flow, sustainable land management, upstream management, or nature-based solutions.

Types of NFM measures

There are many types NFM measures that can be used to slow the flow, these include:

- River and floodplain restoration
- Leaky woody dams
- Tree planting
- Moorland restoration
- Short rotation willow coppicing
- Flood storage
- Agricultural land management

Coastal natural flood management (NFM) uses natural materials to reduce wave energy and the risk of coastal flooding and erosion. The measures which can be used include:

- Dune regeneration
- Beach nourishment
- Managed realignment



Natural Flood Management (NFM)

Multiple benefits of NFM

Natural Flood Management measures have a number of great benefits for:

- ✓ Reduced flood risk
- ✓ Biodiversity and conservation
- ✓ Financial incentives and capital gains
- ✓ Habitat and green spaces
- ✓ Improving water quality
- ✓ Community spirit
- ✓ Reduced erosion
- ✓ Resilient ecosystems
- ✓ Sediment management

Case Study: Kinder Scout

Moors for the Future, in partnership with the Environment Agency, utilised upstream management techniques to restore degraded moorland in the upper catchment of the River Derwent to hold back water and increase the amount of time it takes to reach the river during heavy rainfall. This £1 million project between 2009 and 2015 aimed to demonstrate how using these techniques would affect flood risk.

Issues

- Heavily eroded peat in poor condition.
- Sphagnum moss, a species essential to the formation of new peat, was virtually wiped out.
- In 2009, 34% of the blanket bog contained severely gullied and bare peat areas.

Solutions

- Gully blocking 1,284 stone dams and 834 timber dams.
- Bare peat stabilisation using approximately 2,310 tonnes of heather shrub since 2003.
- Annual lime and fertiliser treatment.
- Planting of 38,000 plugs of moorland species.
- Grazing exclusion.

Benefits

- Average peak flows reduced by 30%.
- Average runoff slowed by around 20 minutes.
- 5km² of peat restored over 12 years.
- Gully blocking and re-vegetation resulted in the water table rising by 30%.



David Dunford /SK0889: Gully blocking on Kinder /
CC BY-SA 2.0

Sustainable Drainage Systems (SuDS)

Sustainable Drainage Systems, or 'SuDS', are designed to control surface water close to where it falls and mimic natural drainage as closely as possible. SuDS provide opportunities to:

- Reduce the causes and impacts of surface water flooding.
- Remove pollutants from urban runoff at source.
- Combine surface water management with benefits for green space, recreation, wildlife and amenity.

Types of SuDS

There are a number of different types of SuDS measures that can be installed at residential properties and/or larger developments, which include:

- Bioretention strips
- Detention basins
- Green roofs
- Permeable paving
- Rain gardens
- Rainwater harvesting
- Retention ponds
- Swales
- Wetlands

Multiple Benefits of SuDS

SuDS often provide a range of benefits to people and the environment and have benefits for:

- ✓ Rainwater demand
- ✓ Biodiversity and ecology
- ✓ Recreation and health
- ✓ Amenity and economy
- ✓ Water quality
- ✓ Climate resilience

Case Study: Growgreen Manchester

There are five rivers that run through the city that together with an ageing sewer system, culverted rivers, and surface water issues can cause flooding. Surface water flooding has increased tenfold between 1945 and 2008 and is predicted to increase with climate change.

This GrowGreen project aims to tackle some of these flooding issues, and created the first 'park that drinks water' in West Gorton in June 2020.

The demonstration project aims to provide evidence of how nature based solutions can be used to reduce flood risk whilst providing other benefits. Features in the park include bioretention tree pits, swales, rain gardens, permeable paving and an irrigation channel to provide flood protection to the surrounding urban areas.



Image: Manchester City Council



This project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement No 730283

Property Flood Resilience (PFR)

At an individual level, Property Flood Resilience (PFR) can be used to reduce the impact and damage to your home or business caused by flooding. There are a number of different PFR measures which can be split into 'resistance' and 'resilience'. A **resistance** approach aims to prevent floodwater from entering the property, whereas a **resilience** approach aims to reduce the damages resulting from floodwater entering your property and improve the property's recoverability. Not all areas can be protected by flood risk management schemes as the cost vs benefit criteria render them unfeasible. Therefore, it is important for homeowners, business owners and tenants to take ownership of protecting their belongings.

Multiple Benefits of PFR

There are multiple benefits of installing PFR measures, these are:

- ✔ **Flood protection** - property is better protected against flood damage with quicker, easier recovery.
- ✔ **Reduced costs** - Installing PFR can result in reduced insurance premiums and excesses and prevent insurance claims being made.
- ✔ **Easier maintenance** - Resilient surfaces are easier to clean and maintain.
- ✔ **Mental health benefits** - Provides reassurance and peace of mind for residents so they don't worry as much.
- ✔ **Property value**
- ✔ **Safer living**

Property Flood Resilience (PFR) Case Study: Burnley, Lancashire

This case study recounts the experiences of a resident from Burnley in Lancashire. The property first flooded during Storm Eva in December 2015 which caused internal damage. In February 2020, Storms Ciara and Dennis made for the wettest February on record and sadly resulted in her home flooding for a second time.

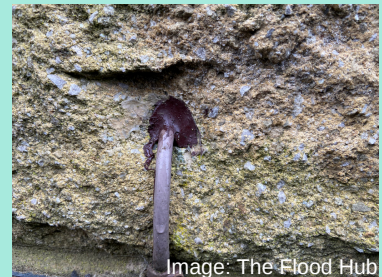


Image: The Flood Hub

The resident utilised government funding in the form of a flood grant to protect their property with a package of passive, 'self-activating' flood defence products and was pleased that the design of her existing doors could be matched and 'like-for-like' flood doors could be installed.



Image: The Flood Hub

Other measures installed:

- 2x single flood doors
- 1x set of flood French doors
- 4x automatic self-closing air bricks
- 4x non-return valves fitted to wastewater outlet pipes
- Sealing of pipework and cable entry points around the property.

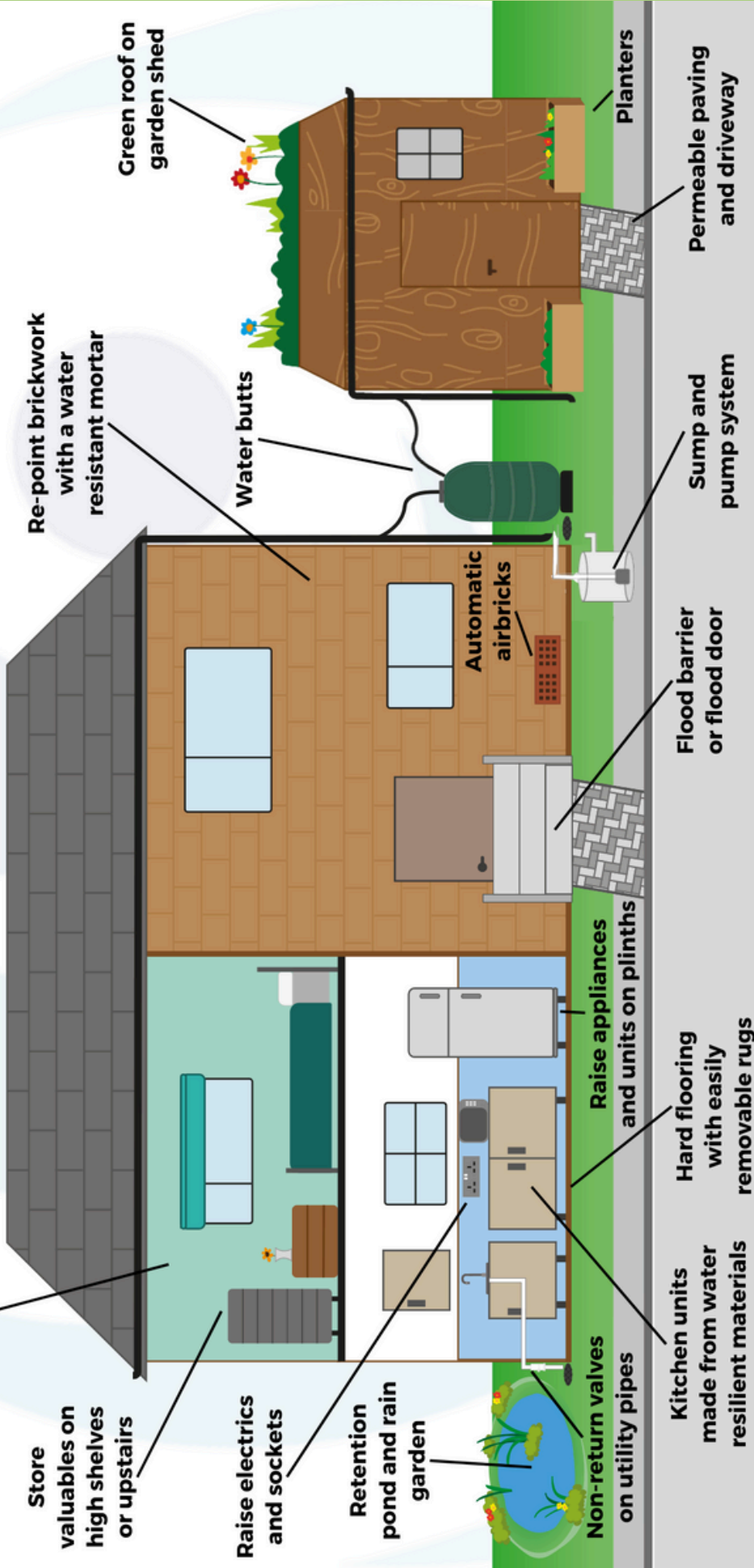
Property Flood Resilience (PFR)

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Flood Resilient House



When protecting a property from flooding, it is effective to use techniques that are both flood resistant (keep water out) and flood resilient (reduce the impact of damage). There are many adaptations you can make to your house and garden, including with the use of sustainable drainage systems (SuDS). Here are some options...



Last reviewed: April 2024
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[Click here to download a PDF copy of our 'Flood Resilient House' resource.](#)

Flood Risk Management Schemes (FRMS)

Risk Management Authorities (RMAs) such as the Environment Agency and local authorities use Flood Risk Management Schemes to protect urban areas that are at risk of flooding, giving consideration to a wide range of options to address flood and coastal erosion risk to communities and properties throughout the catchment.

There are many measures that can be used to manage and reduce the risk of flooding as part of flood risk management schemes, such as:

- Built and hard engineered defences
- Flood storage
- Temporary defences and barriers
- Land management and natural flood management

Due to funding requirements, potential flood schemes must go through an options appraisal process before they are approved and implemented.

Multiple Benefits of Flood Schemes

Flood schemes have multiple benefits for people, the environment and the economy, some examples include:

People

- ✓ Many properties, community facilities and infrastructure are better protected from flooding.
- ✓ Creation of recreational space.
- ✓ Reassurance for residents.

Economy

- ✓ Increased investment as areas are better protected.
- ✓ Businesses, assets and electrical equipment are better protected.
- ✓ Money saved from future flood damage.
- ✓ Employees of local businesses are better protected.

Environment

As part of some flood schemes, there could be the following benefits:

- ✓ Numerous new trees planted.
- ✓ Increased biodiversity and habitat creation.
- ✓ Improvements to footpaths.
- ✓ Coastal areas could be protected from erosion.

Flood Risk Management Schemes (FRMS)

Case Study: Kendal and Kent Catchment FRMS

In 2015 2,276 properties and businesses were flooded in Kendal, Burneside, Staveley and Ings as a result of Storm Desmond. The Environment Agency have worked closely with Cumbria County Council, South Lakeland District Council, United Utilities and other professional partners, including the local community, to better understand the complex flood issues that affect Kendal, Burneside, Staveley and Ings within the River Kent catchment.

The preferred option takes a catchment based approach and includes a combination of:

- **Linear defences** - 6km of defences including flood walls with panels, bunds and flood gates to allow access to amenities.
- **Improved pumping and conveyance** - The implementation of a new pumping station and the installation of a 2km long upper catchment drain.
- **Upstream storage** - Upstream storage for 2.8million m³ of water.
- **Complimentary natural flood management interventions and wider environmental improvements** - 3600 new trees will be planted and 55 hectares of environment and habitat enhancements to create diverse habitat for wildlife and improved access for the community.

Once the scheme is complete, 1,480 homes and 1,151 business in Kendal, Burneside, Staveley and Ings will be better protected.



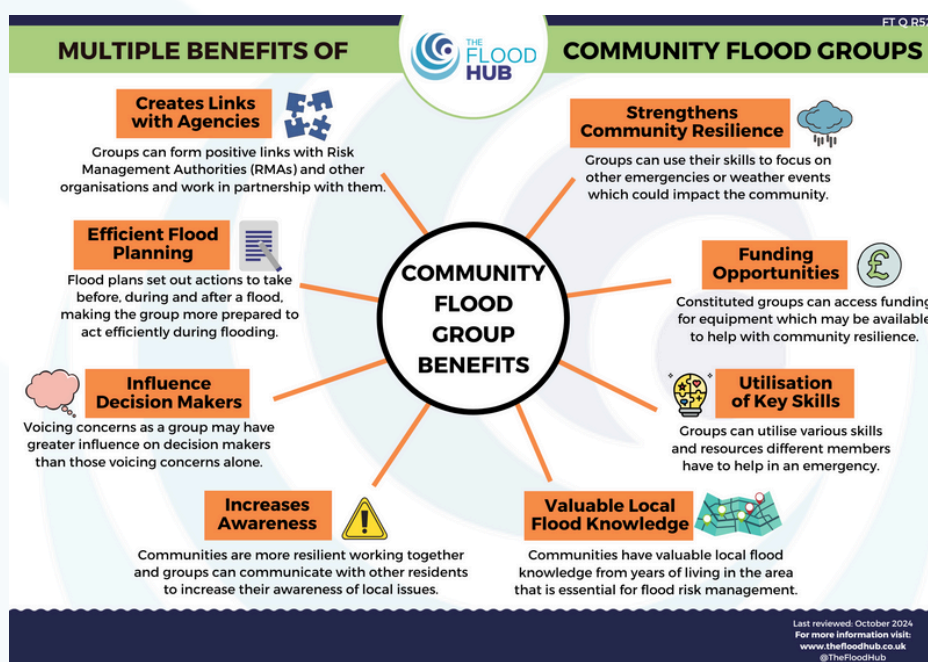
Images: Environment Agency. Kendal Flood Risk Management Scheme page: www.thefloodhub.co.uk/kendal

Community Resilience

Working together as a community and understanding flood risk at a local level can help a greater proportion of residents to become more resilient to flooding. Flood Action Groups (FLAGs) can be set up in communities at risk of flooding with the aim of increasing awareness of flood risk and putting a plan in place to be more prepared for possible future flood events.

The role of a Flood Action Group can have multiple benefits:

- ✔ **Strengthens community resilience** - Groups can use their skills to focus on other emergencies or weather events which could impact the community.
- ✔ **Funding opportunities** - Constituted groups can access funding for equipment which may be available to help with community resilience.
- ✔ **Utilisation of key skills** - Groups can utilise various skills and resources different members have to help in an emergency.
- ✔ **Valuable local flood knowledge** - Communities have valuable local flood knowledge from years of living in the area that is essential for flood risk management. This knowledge could help to influence the development of future flood scheme opportunities to better manage flood risk.
- ✔ **Increased awareness** - Communities are more resilient working together. Flood groups can raise awareness of flooding and flood risk, as well as local flood risk assets, such as drainage networks, culverts and trash screens. They can also raise awareness around the number of different risk management authorities and their responsibilities in flood risk management.
- ✔ **Influence decision makers** - Voicing concerns as a group may have greater influence on decision makers than those voicing concerns alone.
- ✔ **Efficient flood planning** - Flood plans set out actions to take before, during and after a flood, making the group more prepared to act efficiently during flooding.
- ✔ **Creating links with agencies** - Groups can form positive links with Risk Management Authorities (RMAs) and other organisations and work in partnership with them.



[Click here to download a PDF copy of the resource](#)

Community Resilience

Case Study: Willowbank Apartments, Carlisle

Willowbank Apartments is located within 70 yards of the River Caldew and contain 29 apartments; 9 of which are located on the ground floor. On 6th December 2015 the building flooded to a depth of approximately 4 feet, resulting in substantial damage. The freeholder of the site arranged for the repair of the building.

Residents utilised available funding in the form of a flood grant from Carlisle City Council and the Cumbria Community Foundation to install a package of flood defence solutions. Residents also approached Newground for some support and assistance in developing a communal flood plan. As part of this, some of the residents volunteered to take on practical roles; such as the co-ordination of the group and the installation of the defences in an emergency.

The final communal flood plan included:

- A suitable trigger points for action
- A site plan of the building
- Installation procedures for the flood barriers
- An inventory list of equipment
- Details of roles and responsibilities
- A resident contact list
- A register for evacuation.



Flood barriers were installed to the rear windows.



Residents signed up to receive Environment Agency flood alerts and warnings.

For more information on each of the above, please visit our:

- 'How Flood Risk is Managed' page:
www.thefloodhub.co.uk/how-flood-risk-is-managed
- 'Natural Flood Management Page' :
www.thefloodhub.co.uk/nfm
- Sustainable Drainage Systems (SuDS) page:
www.thefloodhub.co.uk/suds
- 'Property Flood Resilience Page': www.thefloodhub.co.uk/pfr
- 'Flood Risk Management Schemes' page:
www.thefloodhub.co.uk/frms
- 'Community' page: www.thefloodhub.co.uk/community