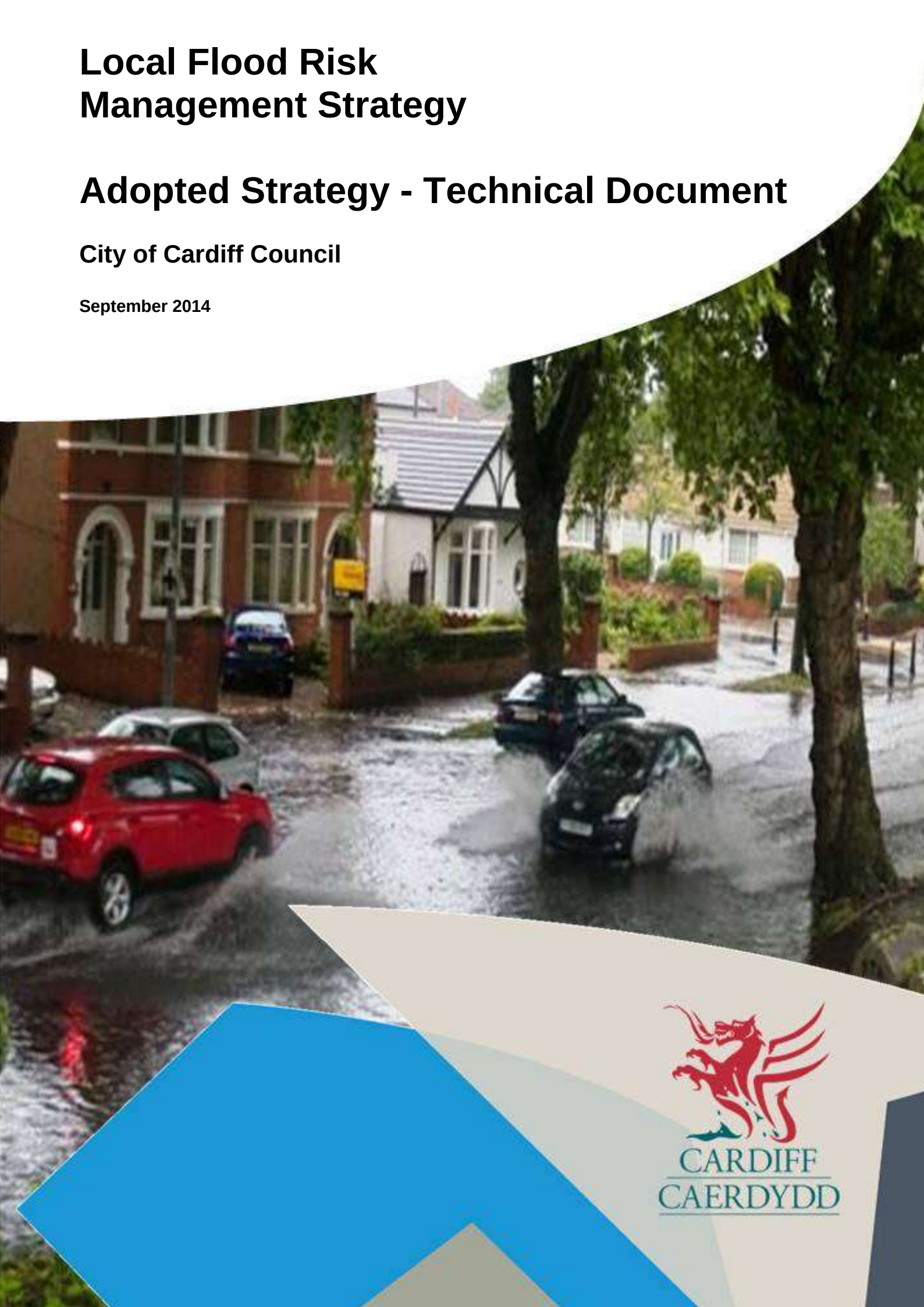
Local Flood Risk Management Strategy

Adopted Strategy - Technical Document

City of Cardiff Council

September 2014



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Foreword

The impacts of climate change are visible all around us and flooding is becoming an increasing risk for all of us. We cannot hold back the forces of nature, but we can put in place a strategy to prepare and protect our city.

Our priority is to ensure;

- that the people who live in Cardiff and the businesses that support our city understand the flood risks that face them
- that people are reassured by the work that Cardiff Council are carrying out to reduce and manage the risk of flooding

Cardiff Council seeks to go beyond the guidance requirements and truly build a community approach to flood management and resilience. We must ensure a comprehensive and partnership focused approach to the **flood water management in our city** by fully understanding our flood and coastline erosion risks.

This strategy will form one of the key building blocks to the long term sustainability of our capital as well as delivering benefits to our communities and safeguard the quality of life for future generations.

Councillor Ramesh Patel - City of Cardiff Council, Cabinet Member for Transport, Planning & Sustainability

Executive summary

Introduction

The risks of flooding have grown over recent years due to changing weather patterns and more localised high intensity rainfall events. Flooding can have a significant impact on our lives, property, and businesses with more and more serious incidents being recorded across the UK each year. Flooding can come from various sources; rivers, streams, the sea and more commonly in Cardiff from blocked drains or old sewers that cannot cope with the volumes of water from heavy rainfall.

Cardiff Council has a strong commitment to reduce the risks of flooding across Cardiff and minimise the impacts that any flood event could have on our communities, environment and economy.

Although Cardiff have not had many significant flooding incidents there are an increasing number of local flooding issues that occur in periods of heavy rain. The numbers of localised flooding incidents are growing each year and the Council are taking action now to protect the residents and businesses of Cardiff for the future.

Statutory role

The Flood and Water Management Act (FWMA) that was introduced in 2010, places a duty on Cardiff Council to act as the Lead Local Flood Authority (LLFA) and prepare a Local Flood Risk Management Strategy (LFRMS). This strategy sets out how the Council will seek to manage flood risk in the area and prepare our communities.

This Strategy details the roles and responsibilities of the organisations in Cardiff which contribute to managing flood risk in Cardiff, as well as how we are working to reduce the consequences of flooding. The council's legal responsibilities are outlined on how we will develop, maintain, apply and monitor a programme for local flood risk management.

Roles & Responsibilities

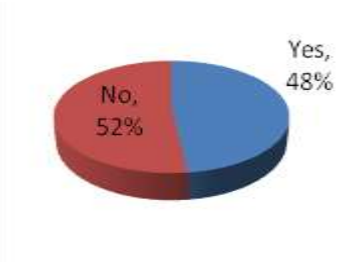
The Council as the LLFA is responsible for surface water, streams, culverts and ground water flooding. The strategy outlines our responsibilities as well as those of key partners such as Welsh Water, the Natural Resources Wales and the Internal Drainage Board. All parties must work together to prevent and prepare for flooding.

As well as external partners, a variety of Council service areas have a role in supporting the prevention and preparations for flooding events;

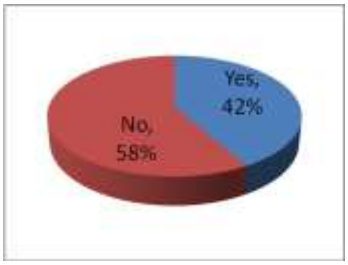
- Emergency management – ensure resources are in place to cope with and recover from events ,
- Harbour Authority – control and maintenance of the Barrage which reduces the risk to the city
- Highways – in maintenance, developing preventative schemes, and coastal management
- Housing – preparing our housing stock and supporting residents
- Planning – to protect future developments
- Social services – in working with residents to prepare and protect themselves against flooding
- Street Cleansing – in keeping the road gullies and drains free from litter

Current flood risk understanding

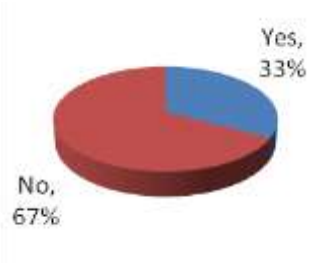
A recent survey of residents has demonstrated that further work is required in raising awareness of flooding issues, support and advice that is available to residents and businesses.



Would you know how to find out if you live in a flood risk area?



Would you know where to get advice if your property was at risk of flooding?



Would you know what to do if your property became flooded?

Strategy Objectives

The Council has built upon the national strategy objectives to develop our strategy with local objectives that will go beyond the statutory requirements. These objectives are set out in the following table and will seek to achieve the following outcomes;

- Ensure a clear understanding of the local risks of flooding and erosion, so that investment in risk management can be prioritised more effectively;
- Set out clear and consistent plans for risk management so that communities and businesses can make informed decisions about the management of the residual risk;
- Encourage innovative management of flood and coastal erosion risks, taking account of the needs of communities and the environment;
- Form links between the local flood risk management strategy and local spatial planning;
- Ensure that emergency plans and responses to flood incidents are effective and that communities are able to respond properly to flood warnings;
- Help communities to recover more quickly and effectively after incidents.

Table 1 National and Local Strategy Objectives

National Strategy Main Objective	Local Strategy Sub Objectives
Reducing the impacts on individuals, communities, businesses and the environment from flooding and coastal erosion	Provide strategic leadership and direction at a local level
	Develop policies for effective land use management and enhanced development control procedures where appropriate
	Establish regular maintenance schedules for flood and coastal erosion risk management assets
Raising awareness of and engaging people in the response to flood and coastal erosion risk	Ensure that by 2026 everyone who lives in a flood risk area understands the flood risk they are subject to, the consequences of this risk and how to live with that risk
Providing an effective and sustained response to flood and coastal erosion events	Ensure the preparation and testing of Emergency Plans
	Respond to events in a timely and appropriate manner
	Facilitate recovery from flooding within the shortest possible timescales
Prioritising investment in the most at risk communities	Seek external funding opportunities

Priorities

After reviewing the current position and future requirements and risks within Cardiff the following priorities have been established;

- build stronger links with key stakeholders and neighbouring Local Authorities
- continue to build on the work undertaken with regards to community resilience planning
- embed awareness of flooding mitigation measures across all Council functions
- fully understand the coastal erosion risks
- raise awareness across all communities of Cardiff, particularly focusing on those at highest risk of flooding and those that require more support such as low socio-economic standing and vulnerable communities
- reduce the consequences of flooding through hard engineering and design schemes
- reduce the consequences of flooding through the construction of appropriately designed sustainable defences which benefit the local environment

The following table sets out Cardiff Council's actions to be taken to achieve these priorities.

Table 1 Priority actions to manage local flood risk in Cardiff

Delivery Theme	Activity type	Suggested Measure(s)
Flood Forecasting & Response	Flood Awareness	• Identification of at risk groups within communities, including vulnerable individuals.
	Emergency Response Plans	• Complete emergency plans for all sources of flood risk. • Local level emergency exercises to test response and recovery arrangements over the life of the Strategy. • Early and appropriate response to all emergency events. • Development and implementation of effective evacuation protocols for emergency events • Identification and provision of suitable respite accommodation as appropriate over the life of the Strategy.
	Community Flood Plans	• Development of community level emergency plans as required to support Cardiff communities
Asset Management & Maintenance	Asset Management Plans	• Development of a register of natural and manmade structures or features likely to have an effect on flood risk by 2015. • Establishment of a programme of regular and appropriate maintenance for flood and coastal erosion risk management assets.
	Defence / Structure Management	• Designation of natural and manmade structures or features likely to have an effect on flood or coastal erosion risk over the life of the Strategy. • Development of repair schedules including provision for the installation of resilient measures by 2015.
	Channel Maintenance	• Development of procedures for the effective clearance of debris.
	Culvert Maintenance	• Establishment of a programme of regular and appropriate maintenance for flood and coastal erosion risk management assets. .
High Level Awareness & Engagement	Partnership Working	• Implementation of statutory responsibilities including those set out within the Flood and Water Management Act 2010 and the Flood Risk Regulations. • Link with wider work undertaken with regards making Cardiff a more resilient and sustainable area to live • Programme of community based awareness and engagement activities, utilising the Flood Risk Management Community Engagement Toolkit. • Raise awareness internally with regards to the impact of flood risk on normal operations and post event situations • Contribution funding from third-parties / non-public sources

Finance

Cardiff Council currently spends approximately £1M every year on direct activities related to managing flood risk through the services provided by the Highways Drainage teams

Analysis carried out for this strategy estimates that across Cardiff the following numbers of properties could be affected by local flood risk sources;

- 1 in 30 annual chance event - over 10,000 properties
- 1 in 200 annual chance event - over 30,000 properties

If Cardiff Council was to stop carrying out the actions listed above, and allow the natural land drainage systems to cope, without maintenance, it is estimated that in any given year the potential economic impact of local flood risk to these properties will be over £13.2M.

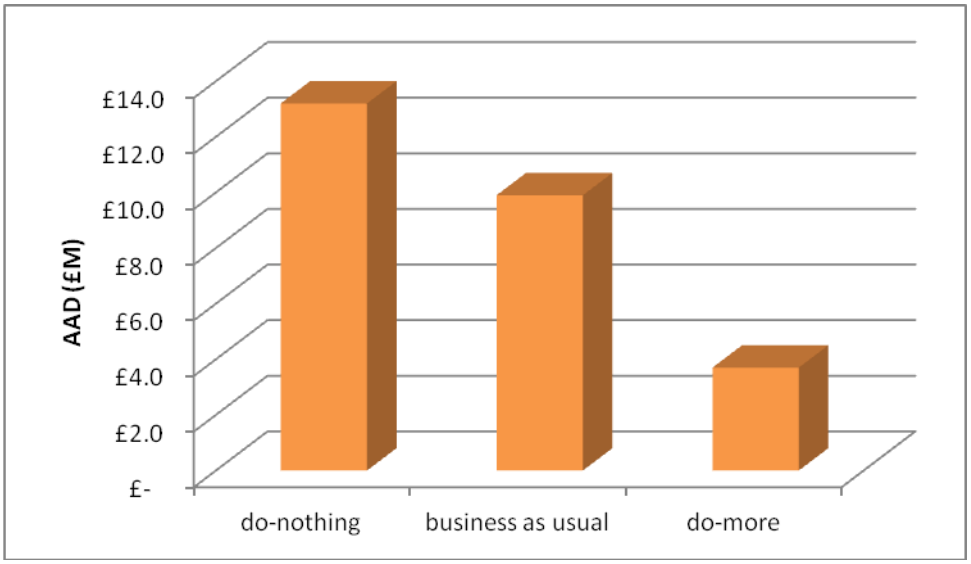


Figure 1 Average Annual Damage due to flooding

The Council have adopted a do-more approach.

Strategy Review

This strategy will become the building blocks for the future strategy to minimise flood risks across Cardiff. With new and changing legislation emerging it is proposed that a review should take place in 2015 to tie in with the delivery of Flood Risk Management Plans as part of the Flood Risk Regulations.

After that the strategy would continue to be reviewed in line with the Flood Risk Regulations, at 6 yearly intervals, with the next review in 2021.

1. Introduction

The increased risk of flooding associated with climate change is raising the profile of flooding in Wales and across the UK. A more sustainable approach to flood risk management is required to help to reduce this increased risk of flooding to our lives, property and economics. Many factors contribute to flooding: heavy rainfall, accelerated snowmelt, severe winds over water, unusually high tides, storm waves against a coast, failure or blockage of drains and other structures that retained the water. The risks of flooding and coastal erosion cannot be stopped as they are natural process. However steps can be taken to reduce the likelihood of flooding events, in turn reducing the consequences of a flood.

Flooding has many impacts; it causes damage to homes and possessions as well as disruption to communications. Worse case scenarios can endanger the lives of people and create long standing worries over the security of people's homes. This has an impact on livelihoods and the local economy. Income from tourism can be lost and local regional reputations damaged. Rapid water runoff causes infrastructure damage, soil erosion and pollution of waterways. In a city such as Cardiff surface water can delay traffic and disrupt local businesses and services. Floods can interfere with drainage and economic use of lands, such as open spaces, businesses and urban areas. Structural damage can occur in homes, business and bridge abutments. For local authorities that have seen a significant flood event the financial losses can run into millions of pounds.

Following the flooding across large areas of the UK in the summer of 2007 the Government commissioned the Pitt Review (Pitt, 2010). This review recommended a change in legislation with regards the responsibility and accountability of flood risk within England and Wales. This review resulted in the ***Flood and Water Management Act (FWMA) 2010***.

This Act places a responsibility upon Local Authorities, (as ***Lead Local Flood Authorities (LLFAs)***), to develop, maintain, apply and monitor a strategy for local flood risk management (***Local Flood Risk Management Strategy (LFRMS)***).

Over the last twenty years Cardiff has seen significant development that has extended the residential areas of the county whilst also seeing redevelopment of large brown-field areas. Within areas of new development current planning policies will have helped to manage flood risk to acceptable levels. However, in previously developed areas of Cardiff there remains an unknown level of risk and the consequence (impact) if flooding were to occur could be significant. In addition Cardiff's coast line is an ever changing environment and can contribute to an increased flooding risk and the erosion of land.

Through the development of Cardiff's Local Flood Risk Management Strategy it is important that we understand the risks of various flooding sources that Cardiff may face, take proactive steps to mitigate these risks as well as raise awareness across our communities and prepare for any such event.

1.1. Scope of the Local Flood Risk Management Strategy

In the development of a flood strategy, Cardiff will seek to balance the needs of communities, the economy and the environment.

A '***local flood risk***' is defined within the Act as being a flood risk from:

- Surface runoff;
- Groundwater; and
- Ordinary watercourses[1]

Flood risk from other sources such as the Taff, Rhymney and Ely Rivers and reservoirs are managed by Natural Resources Wales as part of their duties. Natural Resources Wales has produced a series of flood maps for their areas of responsibility to help inform the public of the potential risk from these sources. Further information can be found at the following website.

(http://maps.environment-agency.gov.uk/wiyby/wiybyController?ep=maptopics&lang=_e)

[1] The reference to ordinary watercourses, above, includes a reference to a lake, pond or other area of water which flows into an ordinary watercourse; Section 10(3) of the Flood and Water Management Act 2010:

1.2. Cardiff's aspirations for the Local Flood Risk Management Strategy

In addition to the statutory requirements Cardiff seek to go beyond the guidance set out by the Welsh Government and provide the framework to develop a holistic approach to ensure all Council services contribute to the management of flood risk within the County.

The Cardiff strategy will form the framework within which local communities have a say in decisions about local flood and erosion risk management. In combination with the National Strategy, the Cardiff LFRMS will encourage more effective risk management by enabling people, communities, business and the public sector to work together to:

- Ensure a clear understanding of the risks of flooding and erosion, nationally and locally, so that investment in risk management can be prioritised more effectively;
- Set out clear and consistent plans for risk management so that communities and businesses can make informed decisions about the management of the residual risk;
- Encourage innovative management of flood and coastal erosion risks, taking account of the needs of communities and the environment;
- Form links between the local flood risk management strategy and local spatial planning;
- Ensure that emergency plans and responses to flood incidents are effective and that communities are able to respond properly to flood warnings; and
- Help communities to recover more quickly and effectively after incidents.

Cardiff Council is taking the opportunity in developing this Strategy to refresh the approach to flood risk management within the Council as it strives to be a Carbon Lite City and achieve sustainable development.

1.3. Statutory requirements of the strategy

The Flood and Water Management Act 2010 sets out what must be contained within a Local Flood Risk Management Strategy (LFRMS).

The Welsh Government has also provided guidance on what LFRMSs should contain and how they should be developed (Welsh Government, 2011a).

Cardiff's strategy must also be consistent with the National Strategy for Flood and Coastal Erosion Risk Management (Welsh Government, 2011b).

Cardiff's strategy must contain the following information:

- Identify Risk Management Authorities (RMAs) in Local Flood Risk Management (LFRM) area of Cardiff (***Section*** 2)
- Set out the flood and coastal erosion risk management functions, roles and responsibilities of the various Risk Management Authorities in the LFRM area (***Section*** 2*).*
- An assessment of local flood risk (***Section*** 3)
- Set out objectives for managing flood risk (***Section*** 5)
- Develop measures (actions) to achieve the objectives (***Section*** 5)
- Set out how and when the measures will be implemented (***Section*** 5)
- The costs and benefits of the measures (***Section*** 6)
- How the LFRMS contributes to wider environmental and sustainability objectives (***Section*** 7)
- How and when the LFRMS will be reviewed (***Section*** 8)

1.4. Guiding Principles

Cardiff will embrace the requirements of The Welsh Government expectations for the Risk Management Authorities and go further to deliver their flood and coastal erosion risk management functions in a manner that:

- Embeds sustainable development as the central organising principle informing decisions and enhancing the economic, social and environmental wellbeing of people and communities, achieving a better quality of life for our own and future generations;
- Is focussed on the needs of individuals, communities and businesses and which recognises that different groups have different needs and varying capacity to deal with flood risk and that the service they receive must be tailored accordingly;
- Supports the wider economic renewal programme, ensuring investment in infrastructure is sustainable from a flood and coastal erosion risk perspective and investing in developing the skills required to implement effective and innovative risk management measures across Wales;
- Promotes equality and does not have a negative impact on poverty;
- Ensures community engagement, awareness raising and key stakeholder partnership working
- Is based upon a holistic understanding of the risks and consequences;
- Considers the full range of risk management responses including broader potential environmental, economic or social opportunities;
- Contributes to the holistic management of our water, land and marine resources reflecting the ecosystem approach set out in the Natural Environment Framework;
- Facilitates long term resource and investment planning;
- Enables effective prioritisation of investment, resources and actions;
- Maximises opportunities to adapt to climate change;
- Takes account of the requirements of relevant European and domestic legislation including the Flood Directive, the Water Framework Directive and the Habitats Directive

This strategy also links in with the Welsh Government specific guidance for Risk Management Authorities on Adapting to Climate Change (Welsh Government, 2011c) and Sustainable Development (Welsh Government, 2011d).

1.5. Related Legal Drivers

Flood Risk Management is affected by a range of guidance and legislation which interlinks and has been considered during the development of this strategy.

Some of these include:

- The Climate Change Act (2008)
- The Conservation of Habitats and Species Regulations (2010)
- The Civil Contingencies Act (2004)
- Strategic Environmental Assessment (SEA) Directive (2001/42/EC)
- The Land Drainage Act (1991)
- The Water Framework Directive (2007)
- The Wildlife and Countryside Act (1981)
- Countryside and Rights of Way (CROW) Act (2000)
- The Public Health Act (1936)

2. Roles and responsibilities

It is important to identify the various roles and responsibilities of the Council and the numerous key parties that contribute to flood risk management within Cardiff. The more formal and statutory bodies are called Risk Management Authorities (RMAs). Contact details for the risk management authorities are set out in Appendix B.

Those bodies that have a statutory role to support flood risk management in Cardiff and have a significant role to play in Cardiff's flooding work may also have responsibilities in other Local Flood Risk Management areas. They may also have different functions, roles, duties and responsibilities in other areas (e.g. fisheries, waste management or biodiversity). ***Table 2.1*** only shows information related to flood and erosion risk management. The information set out in this section relates only to the Cardiff area of control.

Table 2.1 sets out the following information on the Risk Management Authorities in the Cardiff area:

- **Risk Management Authority** – the name of the RMA, and where applicable relevant department
- **Responsibilities for flood and erosion risk management** – this column sets out the general responsibilities of the RMA in relation to flood and erosion risk management. This provides information on all the flood and erosion risk management responsibilities of the RMA, not just those under the Flood and Water Management Act.
- **Statutory duties** – these are things that the RMA is required to do by legislation for the management of flood and erosion risk
- **Permissive powers** – powers that allow / enable the RMA to do things. They are not required to use these powers and it is the responsibility of the RMA to decide if they should use these powers.
- **Geographic area of responsibility** – a description of the area within which the RMA has responsibility. This may be a part of, all of or a larger area than that covered by the Cardiff LFRMS.

Figure 2-1 - Flood Risk Management Authorities

Although the Welsh Government is not a Risk Management Authority, it does have wide-ranging responsibilities in relation to flooding and coastal erosion:

- Overall responsibility for all matters relating to flooding and coastal erosion
- Setting national policy
- Developing a National flood and erosion strategy
- Creating legislation
- Providing most public sector funding
- Determining what action (if any) should be taken if the National Strategy is not being implemented or if actions are increasing levels of risk from flood and erosion

From April 2013, the Welsh Government established a single environmental body for Wales, Natural Resources Wales (NRW). This merged the functions of the Environment Agency Wales, the Countryside Council for Wales, the Forestry Commission Wales and some Welsh Government functions.

This new body takes on all of the responsibilities of the Environment Agency in relation to flood and coastal erosion risk management in Wales.

Table 2.1 - Risk Management Authorities and their responsibilities, duties and powers

Risk Management Authority	Responsibilities for flood and erosion risk management	Statutory duties	Permissive powers	Geographic area of responsibility
Natural Resources Wales – Risk Management Authority	Oversight role for all flood and coastal erosion risk management in Wales • Provision of technical advice and support to Risk Management Authorities, • Lead on Flood Awareness Wales • Lead on national raising awareness programme • Lead on other national initiatives • Single point of contact for enquiries and information on flood risk Operational responsibilities for flooding from ***rivers***, the ***sea*** and ***coastal erosion*** • Collect data • Map the risks of flooding from main rivers, the sea and reservoirs • Conduct assessments in relation to the risks of flooding from main rivers, the sea and reservoirs • Data review and co-ordination for submission of information to the European Commission • Approve Coastal Protection Authority works in relation to coastal erosion and coastal protection	• Co-operate with other Risk Management Authorities, including sharing data • Report to Welsh Ministers on flood and coastal erosion risk in Wales • Report to Welsh Ministers on the application of the National Strategy for flood and erosion risk management • Set up Regional Flood and Coastal Committees • Act in a manner which is consistent with the National Strategy for Flood and Erosion Risk Management in Wales • Act in a manner which is consistent with Local Flood Risk Management Strategies and guidance	• To request information • To raise levies for local flood risk management works, via Flood Risk Management Wales • To designate certain structures or features that affect flood or coastal erosion risk • To undertake works • To cause flooding or coastal erosion under certain conditions	All Wales

Risk Management Authority	Responsibilities for flood and erosion risk management	Statutory duties	Permissive powers	Geographic area of responsibility
Cardiff Council Lead Local Flood Authority	Operational responsibilities for ***local flood risks*** from ***ordinary watercourses***, ***surface water*** and ***groundwater*** • SuDS Adopting and Approving Body • Maintaining SuDS • Consenting works on ordinary watercourses • Conduct assessments in relation to the risks of flooding from all sources except main rivers, the sea and reservoirs • Map the risks of flooding from all sources except main rivers, the sea and reservoirs • Plan for the management of flooding from all sources except main rivers, the sea and reservoirs	• Preparation of Local Flood Risk Management Strategies (LFRMS) • Act in a manner which is consistent with the National Strategy for Flood and Erosion Risk Management in Wales • Act in a manner which is consistent with Local Flood Risk Management Strategies and guidance • Co-operate with other Risk Management Authorities, including sharing data • Investigate flooding within its area, insofar as appropriate • Maintain a register of structures and features likely to affect flood risk • Contribute to sustainable development • Duties under the civic contingency act to assess risks and write plans against those risks	• To request information • To issue enforcement notices & impose penalties for non-compliance with a request for information • To designate certain structures or features that affect flood or coastal erosion risk • To undertake works • To cause flooding or coastal erosion under certain conditions	Cardiff Council local authority area
Coastal Protection Authority[2]			• To carry out works in relation to coastal erosion and coastal protection • To consent coastal protection works	Cardiff Council local authority area
Local Highway Authority	Responsibility for all **flooding issues affecting highways** (except trunk roads) • Dealing with the causes of highway flooding where these concerns blocked culverts and/or gullies that cause water to flood the road and affect property on either side.			

[2] They may also be referred to as 'coastal erosion risk management authority', 'coastal local authority' or 'maritime authority'

Risk Management Authority	Responsibilities for flood and erosion risk management	Statutory duties	Permissive powers	Geographic area of responsibility
Caldicot & Wentlooge Internal Drainage Board – Risk Management Authority	Operational responsibility for **land drainage, water level management**, and **ordinary watercourses** within the Caldicot & Wentlooge Drainage District • Maintaining land drainage structures, water level management structures and ordinary watercourses • Contribute to the preparation of local flood risk strategies	• Act in a manner which is consistent with the National Strategy for Flood and Erosion Risk Management in Wales • Act in a manner which is consistent with Local Flood Risk Management Strategies and guidance • Co-operate with other Risk Management Authorities, including sharing data • Contribute to sustainable development	• To designate certain structures or features that affect flood or coastal erosion risk • To undertake works • To cause flooding or coastal erosion under certain conditions	Caldicot & Wentlooge Drainage District – this includes areas within Cardiff and Newport. It does not cover the whole area of the Cardiff LRFMS
Dŵr Cymru Welsh Water – Risk Management Authority	• Responsible for the **provision of water**, making appropriate arrangements for the **drainage of foul water**, the **treatment of waste**, **surface water sewers** and **combined sewers**[3]. • Primary responsibility for **floods from water and sewerage systems** – this includes sewer flooding, burst pipes or water mains or floods causes by failures in the water or sewerage systems.	• Act in a manner which is consistent with the National Strategy for Flood and Erosion Risk Management in Wales • To have regard to the content of Local Flood Risk Management Strategies • Co-operate with other Risk Management Authorities, including sharing data		Most of Wales and some areas of England. It includes the whole area of the Cardiff LFRMS
Welsh Government South Wales Trunk Road Agent – Risk Management Authority	• Responsibility for all **flooding issues affecting trunk roads** • Dealing with the causes of highway flooding where these concerns blocked culverts and/or gullies that cause water to flood the road and affect property on either side.			All South Wales local authorities. It includes the whole area of the Cardiff LFRMS

[3] 'Combined sewers' carry both surface water run-off and waste water from homes and businesses

2.1. Internal Cardiff Council Service Areas

It is important to recognise that the consequences and impacts of flooding can cut across many Council service areas, each having a role to play in reducing flooding risk, raising awareness and supporting the response to a flooding event.

2.1.1. Emergency Management Unit

To prepare, plan and respond to flooding events, through working with other services areas and key partners. This involves producing emergency response plans for various flooding events, testing and training individuals in readiness for such an event; raise awareness of such events through community engagement and community resilience planning; as well as support the response to any such event. Much of this work is done in partnership with Natural Resources Wales and the emergency services.

2.1.2. Highways

Through the control, inspection and maintenance of road surfaces, gullies and drains the risks of flooding can be reduced. The consenting of structures and control of planning applications that relate to ordinary water courses helps to control the flow of water in key channels and reduce the risk of flooding. As well as the forward planning and construction of highway infrastructure, there is also a need to be responsive to blocked drains and gulley's that require increased attention during periods of heavy rain as this can impact on the consequences and duration of a flooding event.

2.1.3. Planning & Neighbourhood renewal

Through planning guidance and enforcement, acceptable standards for new developments and street scene can be introduced to reduce the likelihood and consequences of flooding events. Officers have a duty to consider the impacts and risks of flooding when considering planning applications and developing the long terms strategic vision for Cardiff's Local Development Plan that can help Cardiff's long term flood mitigation strategies. In addition the consultation work undertaken with developers, architects and home owners can provide an opportunity to raise the awareness of flooding issues.

2.1.4. Communities and Housing

To ensure the Councils housing stock is fit for purpose and mitigates flood risk and the consequences of such events are reduced. There are opportunities to improve flood prevent through the development of new housing stock, maintenance and repair to existing properties as well as raise awareness across all Council tenants.

2.1.5. Schools & Education

There is s duty to ensure our schools and educational facilities are safe and fit for purpose. Emergency response preparation is important to ensure children and adults are protected and removed to safety as quickly as possible. Also provide an ideal learning platform for raising awareness of flooding risks and the impacts on our communities.

2.1.6. Parks

Parks maintain several areas of open space that are used as purposely designed over spill areas should the adjacent river breach its banks. Also the importance of tree planting can have a positive or negative impact on surface water run off. Plants, grass areas and trees can help retain water and slow the surface run off, so reducing the risks of surface flooding. Equally a tree planted close to a gully or drain can increase the risks of surface flooding as the leaves can block the water flow, together with potential root intrusion creating blockages within the main sewers or drains.

2.1.7. Waste Management & Street Cleansing

Litter, leaves and grit in gullies and around drains can lead to increased surface water flooding, hence the timely removal of such debris is an important function to reduce the impacts of flooding. Cardiff Council have implemented a trial solution of "tidal parking" of "temporary parking restrictions" on identified streets through the co-ordination of the street cleansing and highway operations teams. Initial findings suggest this has proven successful in managing to clear areas efficiently and effectively.

2.1.8. Sustainability

Flooding is closely linked to climate change and the increasing number of extreme weather events resulting in heavy and prolonged rainfall.. Heavy rainfall after a period of very dry weather can present the same risks as heavy rain falling on saturated ground. By embedding sustainable considerations across all council activities these risks can be reduced and awareness of mitigation measures brought forward. The Council can contribute to long term mitigation through on-going commitments to green energy and reducing carbon emissions.

2.1.9. Social Care

There is a duty to ensure our facilities are safe and fit for purpose. Emergency response preparation is important to ensure people are protected and removed to safety as quickly as possible, as well as providing an opportunity for raising flooding risks and the impacts on our more vulnerable communities.

2.1.10.Communities First

Communities First have worked with the more vulnerable sectors of our communities to raise awareness of issues relating to flooding and bring forward discussions on how communities can help themselves prepare and respond to such events.

2.1.11.The Harbour Authority

The Harbour Authority manages the Cardiff Bay Barrage which was created to meet two needs. First, to create a 2km^2 permanent fresh water lagoon that would attract investment into the largely disused Cardiff docklands area and spur regeneration. Second, to provide a vital flood relief structure from both rising sea levels and water levels in the rivers Taff and Ely. Both benefits have been realised and demonstrates how operating flood defence structures can have more than one positive outcome. Cardiff Bay Barrage now forms a significant section of the Cardiff coastal defence system.

3. Local Flood Risk in Cardiff

3.1. General characteristics of Cardiff

The administrative boundary of Cardiff Council is an area of approximately 158 km^2 and contains a population of around 346,000 (according to the 2011 census).

In Cardiff there are estimated to be 148,109 residential properties, 8,011 non-residential properties and 1,341 critical services (hospitals, nursing/care/retirement homes, electricity sub stations, schools, Police, Fire and Ambulance Stations, prisons and sewage or wastewater treatment works).

3.2. Sources of flood risk

Flooding can be as a result of one or more sources of flooding. The management of flood risk needs to take account of all sources of flooding that may affect a particular area. The interactions between different sources of flooding also needs to be considered to ensure that taking action to manage the risk from one source does not affect the risk of flooding from a different source or in a different area, simply moving the risk from one place to another.

3.2.1. Main river

Natural Resources Wales is responsible for the management of flood risk from Main Rivers (as defined in the Water Resources Act 1991). Cardiff falls within the Ely, Taff and Rhymney river catchments. The Environment Agency has prepared Catchment Flood Management Plans (CFMPs) for these catchments; the Taff and Ely CFMP (EAW, 2009) and the Eastern Valleys CFMP (EAW, 2009), which includes the River Rhymney.

Flooding occurs from Main Rivers typically when contributing rainfall that runs into the rivers is greater than the flow of water that the river channel can convey naturally. At this point the river will spill out of its bank and flood the surrounding area. Natural Resources Wales have constructed a number of flood defences within the county to reduce the chance of this occurring.

3.2.2. Ordinary watercourses

Ordinary watercourses are any rivers or streams that are not designated as Main Rivers. The Land Drainage Act 1991, as amended by the Flood & Water Management Act 2010, places both general and specific duties on Cardiff Council regarding the consenting and enforcement of structures within an ordinary watercourse.

Flooding occurs from ordinary watercourses in a similar manner to Main Rivers where the contributing rate of rainfall is greater than the river channel capacity. In the past, a number of watercourses have been placed in large pipes, or culverts, below the surface to allow the wider development of an area. As a result the effect of the overland flooding that will occur when a culvert cannot cope with all the flow reaching it is often more serious than flooding from an open watercourse. Compared with an open watercourse there is an increased risk of blockage once a culvert is installed. It is more difficult to remove a blockage from a culvert than from an open un-culverted watercourse.

Cardiff Council invest a large amount of time and money in ensuring work is carried out to keep identified key culverts clear, where there is a recognised risk of flooding if the culvert were to become blocked. In the future, Cardiff Council will encourage and promote the removal of culverts in order to restore a more natural watercourse environment. This is in accordance with NRW and Cardiff Council culvert policies.

3.2.3. Coastal erosion and flood risk

The management policy of the Cardiff coastline is set out in the Severn Estuary Shoreline Management Plan 2 (SMP2) (Severn Estuary Coastal Group, 2010). The SMP2 is a non–statutory document, containing policies proposing how the shoreline around the Severn Estuary should be managed over the next 100 years. The study area of the SMP2 follows the shoreline from Lavernock Point, near Penarth in Wales to Anchor Head, just north of Weston Bay in England. The upstream boundary is at Haw Bridge, near Gloucester, which is just below the current tidal limit and still influenced by the sea. It also includes the islands of Flat Holm and Steep Holm.

The proposed management policies for the Cardiff Coastline are to continue with the current policy to 'Hold the Line' to the east of Cardiff Bay and along the Wentlooge Levels where ground levels are lower. In the future, options to explore 'Managed Realignment' should be considered for the Wentlooge Levels. To the south and west, where ground levels are higher and risk of erosion is less due to the change in geology, the No Active Intervention policy will continue.

Coastal and tidal processes can affect local flood risk indirectly. During storm events the water level in the estuary can rise up significantly causing a storm surge resulting in a greater "tide-lock" impact when rivers and drainage systems are unable to discharge freely to the sea.

These surges typically occur at the same time as heavy rainfall and can have an impact on restricting the flow of water into the sea, out along the rivers or the culverted outfalls from drainage systems such as those in place on the Gwent Levels. This can have implications for the management of surface water flooding (see below).

3.2.4. Groundwater

Groundwater Flooding occurs when water levels in the ground rise above the natural surface. Low lying areas underlain by permeable strata are particularly susceptible. There is little documented evidence of groundwater flooding in the area and therefore the risk of flooding from this source is considered to be small, and this is confirmed by the summary provided in the Taff and Ely Catchment Flood Management Plan (EAW 2009).

During the feasibility stage of the Cardiff Bay Barrage project, concerns were raised about the possibility of groundwater levels rising in south Cardiff resulting in properties in the area being damaged. As a result, a comprehensive Groundwater Protection Scheme was incorporated into the Cardiff Bay Barrage Act 1993 providing owners and occupiers with recourse should circumstances prove that groundwater damage '*was caused or probably caused…[by] construction of the Barrage*', to remedial works or compensation.

The Act obliged Cardiff Bay Development Corporation, now Cardiff Harbour Authority (which is part of the Council) to monitor groundwater levels for a period before (pre-impoundment) and after (post-impoundment) the construction of the Barrage, so that the impact of impoundment on groundwater levels could be determined.

Dewatering has been provided for areas identified as being susceptible to damage from groundwater. The dewatering system includes vertical wells, horizontal drains and pumping. Dewatering has to continue until 2019 under the terms of the Act; this is an on-going maintenance and equipment replacement obligation on the Cardiff Harbour Authority.

3.2.5. Surface water

Surface Water flooding usually occurs when the surface water runoff rates (due to rainfall) exceed the capacity of drainage systems to remove it. The Environment Agency has produced a national assessment of surface water flood risk in the form of two national mapping datasets. The first generation national mapping, Areas Susceptible to Surface Water Flooding (AStSWF) contains three susceptibility thresholds for a rainfall event that has a 1 in 200 annual chance of occurrence.

The national methodology has since been updated to produce the Flood Map for Surface Water (FMfSW), a revised model with two flood events (1 in 30 and 1 in 200 annual chance) and two depth thresholds (greater than 0.1m and greater than 0.3m deep).

As Local Lead Flood Authority, Cardiff Council completed their Preliminary Flood Risk Assessment (PFRA) (Hyder Consulting (UK) Ltd, 2011) in accordance with the Flood Risk Regulations in October 2011. The 1 in 200 annual chance event and 0.3m deep threshold has been used by the Environment Agency to produce indicative Flood Risk Areas and the output from this has been used by the LLFA to identify properties and critical services at risk of surface water flooding and assessed against national guidelines. This assessment identified a number of areas across the county where risk levels could exceed the set criteria. The adopted key risk area covers the majority of the county as shown in the following figure. Further work in accordance with the Flood Risk Regulations will be continuing to better understand the consequence of surface water flood risk within the area.

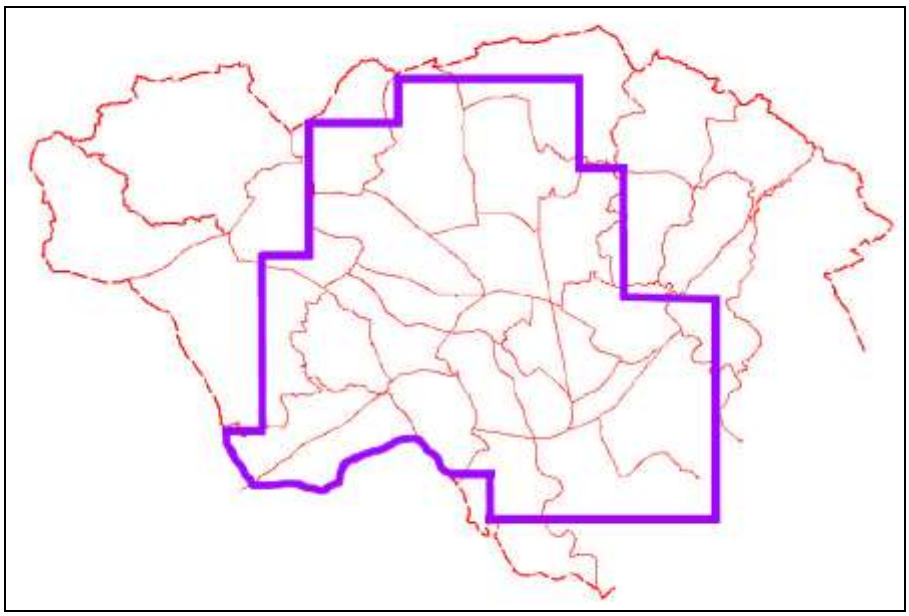


Figure 3-1 - PFRA key-risk area
source: PFRA Figure 7.3

3.2.6. Reservoirs

As noted in section 2 above Natural Resources Wales is responsible for managing the risk of flooding from reservoirs in Wales. The Environment Agency has prepared an assessment of the flood risk due to flood inundation from reservoirs which is being used by Natural Resources Wales to inform their actions.

The Council's Emergency Management Unit has worked with Natural Resources Wales to ensure suitable mitigation and emergency plans are in place should such an event occur. It is emphasised however that this level of risk is extremely low, with designated reservoirs being looked after and maintained under the terms of the Reservoirs Act 1975.

3.2.7. Flooding from sewers and water supply pipes

Dŵr Cymru Welsh Water has two key responsibilities: to provide a high quality water supply to customers and; to take away wastewater and return it to the environment safely. In providing their basic function of containing, carrying and treating water and wastewater, these assets may present flood risks which can result from system failures, burst pipes and mains, or similar escapes from the sewer network and other assets, for which Welsh Water are responsible.

Flooding from foul sewers is generally caused by blockages or the failure of pumped systems and usually affects only limited numbers of properties. Flood water containing foul sewage means that it does cause significant distress to those affected.

Sewers can be categorised into three types:

- foul sewers, which are designed to carry soiled water that has been used for washing and cooking purposes, as well as the contents of toilets and trade effluent;
- surface water sewers, which are designed to carry rainwater runoff from roofs, yards and roads; and
- combined sewers, which receive a mixture of foul sewage and surface water.

Flooding from surface water and combined sewers occurs when any of these types of sewer becomes overloaded due to heavy rainfall (or sometimes snow melt), when sewers become blocked, or more rarely, when mechanical or electrical equipment breaks down. The likelihood and severity of sewer flooding caused by overloading depends on the capacity of the sewerage system of sewers in question, which can be affected by a range of factors, including pipe size and weather conditions. Sewers are not specifically designed to deal with floodwater.

3.3. Flood risk assessments

The Cardiff LFRMS must contain an assessment of local flood risk. The Welsh Government guidance on the development of LFRMS sets out a range of information sources that should be used to carry out the assessment of local flood risk:

- The **Preliminary Flood Risk Assessment (PFRA)** - Cardiff Council carried out a PFRA in 2011. It provides a high level overview of flood risk from local flood sources, including surface water, groundwater and ordinary watercourses. The report on the PFRA has been published by Cardiff Council as a separate document (Hyder Consulting (UK) Ltd, 2011).
- **Historic flood risk data and information** – the PFRA included a review of information on flood events that have happened in the past.
- **Flood Hazard Maps for Strategic Flood Risk Areas (SFRAs)** – these sources of information are in the process of being compiled and will be completed by June 2013. They have not, therefore, been used in the development of this first Cardiff LFRMS but will be available for future reviews and strategies.
- **Flood Risk Maps for SFRAs** - these sources of information are in the process of being compiled and will be completed by June 2013. They have not, therefore, been used in the development of this first Cardiff LFRMS but will be available for future reviews and strategies.
- **Environment Agency data on surface water flooding –** - The EA developed a number of surface water flooding maps that are available to download. These were updated regularly by the EA and will continue to be updated. These were used to inform the assessment completed for the PFRA, and will be used in the future to further inform investment planning and the flood plans for the SFRAs
- **Locally specific data** – this can include anecdotal evidence on areas that are known to flood and any data that Cardiff Council may collect for its own geographic area

Llannon Road culvert during flood conditions

February 2008

4. How is Local Flood Risk currently managed?

Flood risk management is not new to Cardiff and work has been on-going for several years to prevent, prepare and reduce the likelihood and consequences of flooding. Flood mitigation work can take on two distinct forms; structural and non-structural

- Structural - are infrastructure changes; physical structures; coastal defences that help retain, channel or prevent water movement.
- Non-structural - are more informative or less obvious such as awareness raising, emergency planning, planning controls, sympathetic landscaping or making use of sustainable drainage methods (SuDs)

Both approaches have been used by Cardiff.

4.1. Cardiff Council current actions

4.1.1. Emergency responses

Cardiff Council's Emergency Management Unit have a number of emergency plans that can be put in place if a significant flood event was to occur in Cardiff. Emergency event scenarios have been run with key service areas and other emergency services to test the Council's resilience for such events. The related officers also provide advice to local businesses and communities in how do deal with and reduce their own consequence should a flood event occur and work closely with other service areas to prepare for such incidents.

4.1.2. Community Awareness

Community awareness of the risks of flooding is growing slowly across Cardiff. Natural Resources Wales, Communities First and the Council's Emergency Management Unit run community workshops and action days to support communities that are at a high risk of flooding. They raise awareness across all communities and businesses of the level of flood risk that a community faces, and identify steps individuals can take to help improve the resilience of their homes.

Although the general awareness of flooding is growing, partially due to national media coverage of flooding incidents such as Boscastle, Gloucestershire and more recently Aberystwyth, more needs to be done to prepare communities for such incidents.

4.1.3. Highways Maintenance

The council highways service area work hard to maintain and repair the council owned drains, culverts and gullies, through a programme of inspections and cleaning to remove blockage and debris from watercourses as well as to maintain grids and trash screens. They undertake a mixture of proactive maintenance and reactive work, dealing with calls for blocked drains and surface water flooding. They can also operate portable pumps to reduce the damage that would otherwise be caused by a flooding incident.

4.1.4. Flood alleviation schemes

Cardiff Council is continually reviewing the need for capital investment to reduce flood risk across the area. One current example is a planned scheme in Rhiwbina.

The urban watercourses in Rhiwbina have an established history of flooding to residential and commercial properties over the past twenty years. The most recent and significant event occurred in June 2009 inundating properties in Wenallt Road, Heol Uchaf , Pen Y Dre and several other locations in Rhiwbina village. The flooding caused significant damage to both residential and commercial properties. Funding has been secured and works begun on designing and delivering a flood defence improvement works to protect against a 1 in 100 annual chance storm event including an allowance for climate change. A total of 216 properties will benefit from the increased level of protection offered by the engineering works proposed under this scheme.

The cost of the scheme has been estimated at £1.5M .Grant funding has been secured from Welsh Government and the European Regional Development Fund (ERDF) for the majority of the scheme, but a proportion of the scheme has been allocated from Council funds. The latest target date for the scheme completion is December 2014.

The Council also continues to work with Natural Resources Wales to explore new alleviation schemes in high risk areas of the City, such as Penylan, Waterloo Gardens area.

4.1.5. Coastal Erosion

Cardiff Council monitor erosion along the coastline within the county. Coastline erosion surveys are also underway so we better understand the risks that face our communities that live near the coast and these will inform the council's programme of works and possible capital bid schemes once concluded.

4.1.6. Cardiff Bay Barrage

In November 1999 the barrage was completed and the sluice gates closed at high water to retain sea water from the Bristol Channel within the 500-acre bay. The Cardiff Bay Barrage was created to meet two needs. First, to create a 2km^2 permanent fresh water lagoon that would attract investment into the largely disused Cardiff docklands area and spur regeneration. Second, to provide a vital flood relief structure from both rising sea levels and water levels in the rivers Taff and Ely. Both benefits have been realised and demonstrates how operating flood defence structures can have multiple benefits. Cardiff Bay Barrage now forms a significant section of the Cardiff coast line coastal defence system.

4.1.7. Partnership working

Cardiff Council engage with a number of related public bodies to try and realise a better environment for the people of Cardiff. Cardiff Council are members of the following organisations / working groups;

- **Caldicot & Wentloog Levels Internal Drainage Board (CWLIDB)** is responsible for the day to day management of the drainage system on the Gwent Levels where valuable agricultural, commercial and residential land would otherwise be flooded on an annual basis. The work of the Board is also essential to maintaining the nationally important ecological and archaeological interest of the area.

  The CWLIDB Board consists of Members elected from the agricultural drainage rate payers and Members appointed by levy-paying local authorities.
- **South East Wales Flood Risk Management Group (SEWFRMG)** has been set up to promote the exchange of information between Local Authorities (LA), Internal Drainage Boards (IDB), Natural Resources Wales, the Welsh Local Government Association (WLGA) and Welsh Government (WG) and to provide a basis for a regional strategic overview.

  Underpinning this is the responsibility placed upon each Lead Local Flood Authority (LLFA) by the Flood & Water Management Act (FWMA) to consult with Risk Management Authorities:

  "A relevant authority must cooperate with other relevant authorities in the exercise of their flood and coastal erosion functions. "
- **Cardiff Area Flood Group.** The Cardiff Area Flood Group has been established to ensure a multi-agency approach to a major flooding incident within the City and County of Cardiff.
- **Severn Estuary Coastal Group (SECG)** is a partnership of local authorities and other organisations around the Severn Estuary that is developing Shoreline Management Plans (SMPs).

4.2. Reports and incidents

Cardiff has not had a significant flooding event for several years and the last flood of note that caused property damage and disruption was in 2009. Detailed recording of incidents is not available for periods before 2010. However, surface water flooding is a growing concern for Cardiff residents and anecdotal evidence suggests the number of reported incidents is growing (see Figure 4-1).

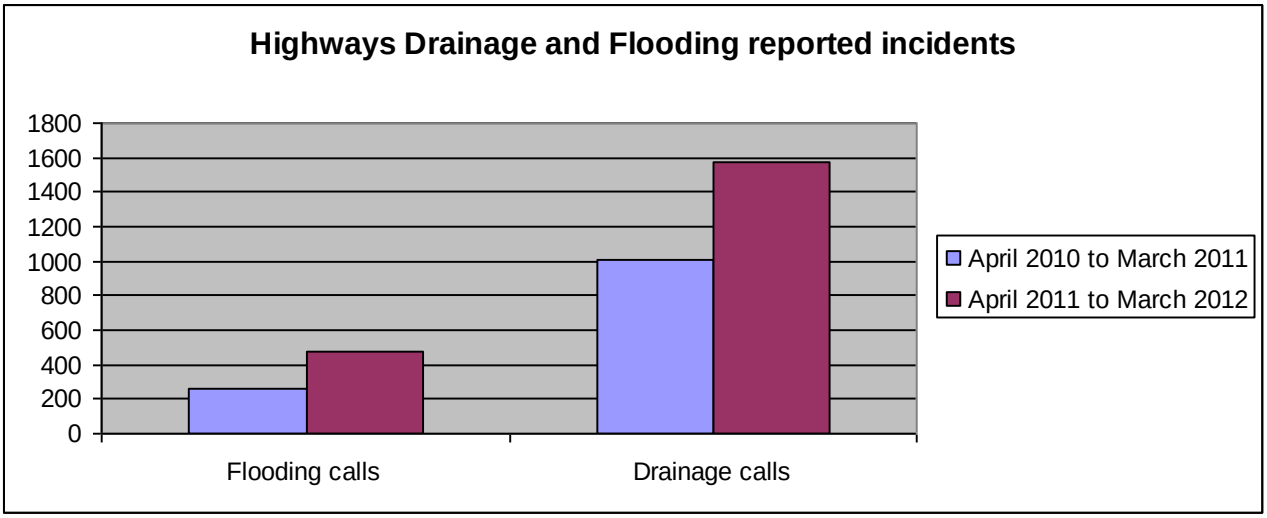


Figure 4-1 - Highways and drainage reported incidents

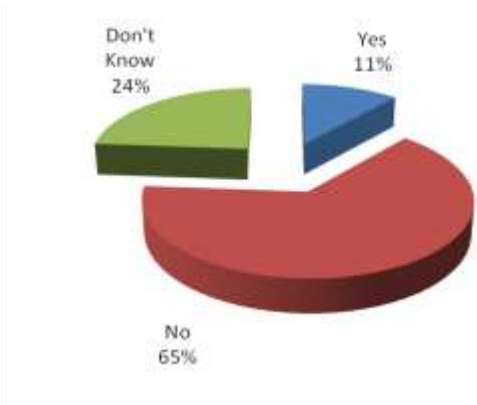
4.3. Current levels of understanding

The Council engages with the community through the "Ask Cardiff" annual surveys. 2012 was the first year that a question was asked to understand the current level of awareness of flood risk. This work will begin to form a baseline of understanding across Cardiff in relation to flooding.

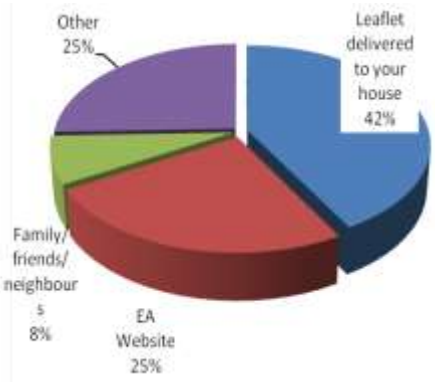
The responses suggest that the level of basic knowledge relating to flooding is reasonable, but more work needs to be done in targeted areas, particularly for the vulnerable sectors of our communities and in preparing people for an event.

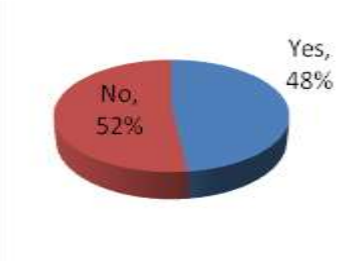
Summary responses to key questions are provided below., Results: September 2012

Is your property in a flood risk area?

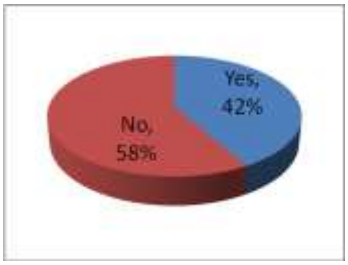


If 'yes' how did you find out?

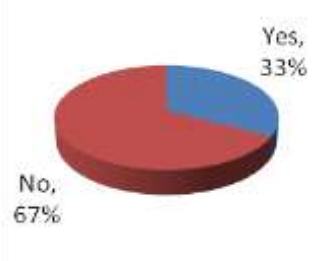




Would you know how to find out if you live in a flood risk area?



Would you know where to get advice if your property was at risk of flooding?



Would you know what to do if your property became flooded?

4.4. Future Focus

Through the development and consideration of flooding risks across Cardiff the following areas have been identified as needing further development or provide an opportunity to go beyond the statutory requirements, to strengthen Cardiff's position. These will be incorporated in the Councils objectives and mitigation measures.

- As flooding and coastal erosion are not wholly contained by Council boundaries, further focus should be placed on **partnership working** with neighbouring Local Authorities and the flood risk authorities such as Dwr Cymru-Welsh Water and the IDB.
- **Closer working with other Flood Risk Management Authorities** to deliver schemes with shared benefits.
- Set a clear and robust **Sandbags Provision Policy** to provide clarity on the Councils position of sandbag provision at the time of flooding. This policy will be taken forwards in consultation with local ward members and communities (see Appendix A).
- Continue to build on the work undertaken by the Emergency Management Unit in conjunction with Natural Resources Wales and Communities First for **community resilience planning**. **Consultation and engagement** will be key to tackling the consequences of flooding and increase awareness of flood protection steps individuals can take to protect their property. Including exploring the possibility of providing **reduced cost flood protection devices** for communities to purchase.
- From the initial Ask Cardiff Survey results it is clear that further work in required on **awareness raising** across all aspects of Cardiff's communities and business sector. By utilising all the existing communications channels at the Councils disposal awareness messages can be delivered across all services.
- As the coastline is constantly changing a new **Coastline survey** is required to ensure the Council are fully aware of all the issues. By understanding the current coastal erosion risks, key land owners and possible timeline for erosion, the Council will be able to explore the detailed cost-benefits of any work that may be identified.
- As well as raising generic awareness of flooding issues and consequences, the **communication of changing roles and responsibilities** needs to be delivered to all key stakeholders, particularly in areas such as **ordinary water consents** and the associated planning permissions required
- **Embed flooding consideration** in all service areas decisions and appropriate communications.
- Planning consents and **consent enforcement** is required to ensure water courses and structures are protected
- To develop **Specific Planning Guidance (SPG)** in relation to flooding issues to mitigate flood risk for future developments.
- To engage and support the Welsh Government in their negotiations with insurance industry on premiums for properties in high risk areas.

As well as improving on existing activities there are also the following duties that the Council will have to carry out due to changing statutory roles and responsibilities or pending Welsh Government guidelines.

- Maintain a **register of flood risk assets**. All LLFA's must collect, collate and maintain a drainage asset register recording the ownership, condition and maintenance records of these assets. The aim of the register is to protect flood mitigation measures and help inform maintenance regimes for minimising flood risk. Key structures, for example, garden walls, culverts, streams and buildings, will then require regular condition surveys to ensure they are maintained to help minimise flooding risks.
- To develop **a robust methodology and priority matrix** for the **investigation of flooding** incidents to ensure that incidents are appropriately investigated in proportion to the incident magnitude. Establish where possible the root causes of flood incidents in order for to develop corrective actions or take mitigation steps where possible. A regional approach is supported by Cardiff and is currently under development.
- Reviewing the need to **designate certain third-party structures** which have an impact on local flood risk. Cardiff Council must to identify and designate (and so safeguard) drainage a**ssets that are owned, maintained or operated** by third parties that assist in managing flood risk. Once designated it will be an offence to alter or remove the features without the consent of the LLFA.
- Act as the **SuDS Approval Body (SAB)** for future development applications following national standards. Sustainable Drainage Systems (SuDS), are to be introduced where practicable in all new developments. The introduction of national standards is aimed at reducing the risk of flood damage and improving water quality. Without SAB consent new developments will not be permitted to commence construction. In addition, the SAB permissions must be granted prior to planning permissions, therefore creating a two stage process for all planning applications.

5. Approach and Policy for Managing Local Flood Risk in Cardiff

5.1. Methodology and guidance

Cardiff Council have developed their approach and policy for managing local flood risk in accordance with guidance[4] published by the Welsh Government and issued to Lead Local Flood Authorities.

This guidance sets out the process to be followed to provide a consistent approach and ensure local strategies are aligned with the National Strategy. The following sections set out how Cardiff have followed the process shown in Figure 5-1 below. The National Strategy sets out a series of Objectives that the strategy is seeking to achieve. There is a responsibility on Cardiff Council as the LLFA to take account of these Objectives, and review if any further local Objectives are considered necessary.

There is a need then to identify ways of assessing that the Objectives can be achieved. This is through a series of Measures. Some Measures may contribute to more than one Objective.

A series of Actions will have to be carried out to ensure Measures are realised. Various Options are available to carry out these Actions to varying levels of effort and resource "on the ground". The level of effort can be dependent on available budgets and the identified level of need / risk for such actions.

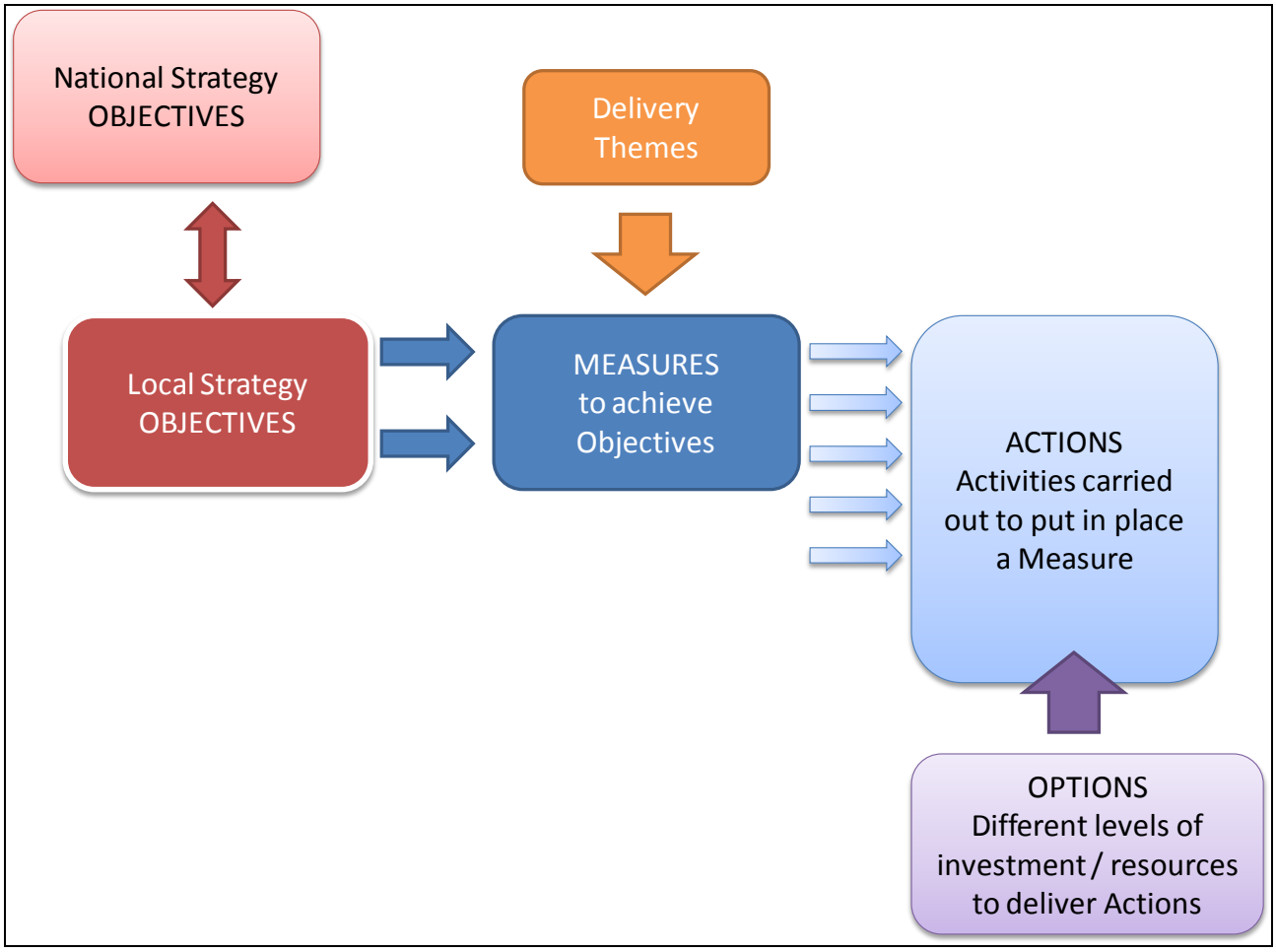


Figure 5-1 Policy approach from National to Local Strategies

[4] Local Flood Risk Management Strategies - Local Strategy (guidance for Lead Local Flood Authorities), Welsh Government, November 2011

5.2. Consultation

In determining the measures Cardiff Council has also worked with adjacent local authorities and other Risk Management Authorities (as listed in Section 2). This includes development of solutions with Dŵr Cymru – Welsh Water and Natural Resources Wales in order to enhance the benefits of partnership working.

Consultation has also been undertaken as part of the SEA process, with Countryside Council for Wales, Environment Agency, Cadw and other consultees. The initial feedback from the consultation exercise and Ask Cardiff survey has also informed these outcomes (further details in Appendix C).

The Post Adoption Statement of Environmental Particulars for the Strategic Environmental Assessment contains details of how the results of the consultations and opinions have been taken into account.

During February to March 2013 Cardiff Council also consulted publically on the Draft Strategy. This final Strategy has incorporated the consultation responses. Details of all consultation comments are included in Appendix C.

5.3. Objectives

An ***objective*** can be defined as an '*outcome'* or a '*target'* to be achieved. For example, an outcome objective may be '*reduce the impact of flooding'*, whilst a target objective could be '*create and implement a monitoring scheme for flood and erosion risk management structures*'.

In developing the objectives for managing local flood risk, Cardiff Council has taken the following into consideration:

- **National Strategy objectives** – Cardiff Council has considered how the objectives contained in the National Strategy (Appendix D) can be practically and meaningfully be delivered in Cardiff.
- The requirements of the Flood Risk Regulations 2009.
- The **level of detail** of the objectives – objectives may be high level and strategic, such as 'increase awareness of flood risk' or more specific and targeted to a certain area or risk.
- The **timescale and timing** of the objectives – objectives may be short, medium term or long term. Objectives may be planned for the 6-year period covered by this first strategy, at some time in the future or they may take place over a long period of time.
- **Prioritisation** of the objectives – which objectives are more important than others, or need to take place before others. This could be due to deadlines set out in legislation, because the risk from flooding or erosion is high, or the consequences of flooding or erosion are very large.
- Objectives are **proportionate** to the identified flood and coastal erosion risk.

Objectives have also considered the three flood risk management elements ***Prevention, Protection*****,** and ***Preparedness*** (and include climate change adaptation). These elements help us understand and consider at what stage an objective may affect the level of flood risk.

5.3.1. National Strategy Objectives

The National Strategy has identified ***four overarching objectives*** with 11 sub-objectives (Appendix D) for managing the flood and coastal erosion risk in Wales;

- **Reducing the consequences** of flooding and erosion for individuals, communities, businesses and the environment from flooding and coastal erosion;
- **Raising awareness** of and engaging people in the response to flood and coastal erosion risk;
- Providing an **effective and sustained response** to flood and coastal erosion events; and
- **Prioritising investment** in the most at risk communities.

5.3.2. Flood Risk Management Objectives

The strategy guidance, issued by the Welsh Government, includes for specific flood risk management objectives in relation to social, economic and environmental risk as developed by the Environment Agency. These are as set out below;

- **Social**
  - Reduce distress (Number of people at-risk of flooding)
  - Reduce community disruption (Number of residential and commercial properties)
  - Reduce risk to life (function of the number of people at risk and flood conditions)
  - Reduce disruption to key infrastructure
- **Economic**
  - Reduce economic damage (e.g. Annual Average Damages AAD)
  - Reduce cost of management (not a risk management outcome for use in appraisal)
- **Environmental**
  - Reduce damages to Natura 2000 / SSSIs / BAP sites (or improve sites)
  - Improve naturalness (reduce modification of channels / waterbodies)

As part of the Strategic Environmental Assessment (SEA) process we have developed the above two environmental objectives to encompass a set of wider Environmental objectives as set out in the following table. These have been used to test the potential impacts of the strategy on environmental receptors .

Table 5.1 - SEA objectives and indicators

SEA topic	SEA Objective code	SEA Objective
Population and human health, including economy	Pop1	Improve and enhance the health and wellbeing of communities
	Pop2	Reduce inequality and social deprivation
Biodiversity, flora and fauna	Bio1	Work with natural processes, improve ecological connectivity and promote healthy functioning ecosystems
	Bio2	Conserve, and where possible enhance important, protected and priority habitats and species
	Bio3	Protect and where possible enhance local biodiversity, flora and fauna
Water	Water1	Protect and improve the water environment, in terms of water quality and quantity, for the benefit of the human and/or natural environment
	Water2	Maintain and enhance hydromorphological function of the water environment by working with natural processes
	Water3	Reduce the effects of flooding from local sources
Air	Scoped out	
Climatic factors	Clim1	Contribute to Cardiff's ability to adapt to climate change
Material assets	Mat1	Conserve and protect important new and existing material assets and infrastructure
Cultural heritage	Cult1	Conserve, and where possible enhance, protected and important cultural heritage assets
Landscape, land use and soil	Land1	Ensure the landscape character of Cardiff is conserved and, where possible, enhanced
	Land2	Protect and conserve soils and soil function, and increase resilience to degradation
	Land3	Reduce the risk to waters from diffuse pollution
	Land4	Reduce the risk to waters from contaminated land

5.3.3. Local Flood Risk Strategy Objectives

The National Strategy sets out a number of measures to achieve each of identified 11 sub-objectives which therefore contribute to achieving the overarching objectives. An extract of the related objectives from the National Strategy is included in Appendix D. Cardiff Council, as the Lead Local Flood Authority is responsible for leading on the delivery of some of these national measures in its area. As a Risk Management Authority, Cardiff Council is also responsible for contributing to other local objectives.

In order to implement the National Strategy Objectives, Cardiff Council has based this Local Strategy upon the following eight local strategy sub-objectives:

National Strategy Main Objective	Local Strategy Sub Objectives (numbering referencing relative to the National Strategy)
1 - Reducing the impacts on individuals, communities, businesses and the environment from flooding and coastal erosion	2 - Provide Strategic Leadership and Direction at a local Level
	3 - Develop policies for effective land use management and enhanced development control procedures where appropriate
	4 - Establish regular maintenance schedules for flood and coastal erosion risk management assets
2 - Raising awareness of and engaging people in the response to flood and coastal erosion risk	5 - Ensure that by 2026 everyone who lives in a flood risk area understands the flood risk they are subject to, the consequences of this risk and how to live with that risk
3 - Providing an effective and sustained response to flood and coastal erosion events	7 - Ensure the preparation and testing of Emergency Plans
	8 - Respond to events in a timely and appropriate manner
	9 - Facilitate recovery from flooding within the shortest possible timescales
4 - Prioritising investment in the most at risk communities	Local 1 - External funding

5.4. Measures

A ***measure*** can be defined as an activity or action(s) that will be carried out to achieve an objective and manage the risk from flood and coastal erosion. Measures are not exclusively about building new flood defence schemes. They could include improving emergency response to flood events, providing advice on what to do in the event of flooding, help to recover from an incident, maintenance and to ensure that structures that manage the risk of flooding are working properly.

In developing the measures for managing local flood risk, Cardiff Council has taken the following into consideration:

- The **timescale and timing** of the measures – measures may be short term (0 – 20 years), medium term (20 – 50 years) or long term (50 – 100 years). They may be planned for to take place during the 6-year period covered by this first strategy, at some time in the future or they may take place over a long period of time. For example a new flood defence scheme may be planned to take place in 15 years' time, while inspection and clearing of highway drains may take place every year.
- Are the measures **structural** or **non-structural** – do they require the building/repair of a particular structure such as a flood wall or drainage system, or do they relate to actions that do not need construction activity, such as research, monitoring, awareness-raising or new planning policies.
- Can the measures achieve **multiple benefits** – efforts have been made to develop actions that will not only help manage the risk of flood and erosion but that will have other benefits e.g. for biodiversity, heritage, health or regeneration.
- Potential impacts of **climate change**
- Actions contained in **other flood and erosion risk management plans** such as Catchment Flood Management Plans (CFMPs) and Shoreline Management Plans (SMPs).

5.4.1. Delivery themes

The Welsh Government guidance for local authorities (S.3.4.4) identifies 7 high level Delivery Themes under which measures should be considered. These are;

- Development planning and adaptation (including both new developments and adaptations to existing developments / landscapes);
- Flood forecasting, warning and response;
- Land, cultural and environmental management;
- Asset management and maintenance;
- Studies assessments and plans;
- High level awareness and engagement (to increase individual and community resilience);
- Monitoring (of the local flood risk issues).

In developing the measures, Cardiff Council has considered how they relate to these Delivery Themes to ensure a wide range of measures, and thus actions are taken into account to manage local flood risk within the county. Appendix E.1 contains the list of measures, and the objectives which they support that have been adopted by Cardiff Council for this initial period of the LFRMS.

5.4.2. Potential Actions

Cardiff Council has undertaken a series of internal workshops to build on the work already done as part of the preliminary flood risk assessments. These workshops were held to identify potential actions which can be carried out to realise the identified measures and objectives. This internal consultation has helped raise awareness of the changes in legislation and related responsibility and duties placed on Cardiff Council. This in turn has increased the understanding of the need to consider the impact of flood risk across the Council's Service Areas.

This process has identified areas where the wider Council services can support the proposed measures through changes in working practises, using existing communication channels to raise awareness and direct consideration of flood risk as part of any decision process.

Measures have been considered against three options which required varying levels of investment and effort;

- **Do-Nothing** – Stop any related existing actions and/or expenditure. This provides a baseline position against which to measure any benefit that an increase in effort provides
- **Business as usual** – This considers a continuation of current actions in the future. Levels of expenditure would be retained with the chance that the flood risk may increase in the future due to further expansion of the local area or climate change.
- **Do-more** – These measures identify new actions that the Council could or will have to undertake due to new legislative duties. The increased level of effort could vary depending on the type of action measure being considered, and the considered benefit of providing the additional resource. They also identify actions which could be undertaken if further funding was available.

An assessment matrix identifying the considered and preferred option for the various measures is included in Appendix E.1.

In developing the Objectives and measures we have sought to assign their achievement to various timescales, as set out in the national guidance:

- Short term (0 – 20 years)
- Medium term (20 – 50 years)
- Long term (50 – 100 years)

To enable more practicable planning Cardiff Council has broken down the short term into the LFRMS review periods as follows;

- 1st LFRMS cycle (up to 2015)
- 2nd LFRMS cycle (up to 2020)
- 3rd LFRMS cycle (up to 2030)

5.4.3. Prioritisation

The adopted measures have been assessed to determine to which of the Local and thus National flood risk strategy objectives they contribute to and weighted based on the timescales in which they need to be achieved to give a 'priority score' to identify the top 3 delivery themes (further details in Appendix E.2).

The following table identifies the priority measures for Cardiff Council under the top 3 delivery themes. The detailed assessment used to inform the prioritisation is set out in Appendix E.2. Cardiff Council will use the supporting assessments to develop their internal processes as well as the proposed measures to deliver the identified short term measures and plan for the delivery of the longer term measures.

Table 5.2 - Priority measures

Delivery Theme	Activity type	Suggested Measure(s)	Cardiff Council Proposed Action	Timescale
Flood Forecasting & Response	Flood Awareness	• Identification of at risk groups within communities, including vulnerable individuals.	• Through Emergency Planning and Corporate Communications we can ensure the businesses are aware of the risk, and the actions they can take to reduce the impact	• Ongoing
	Emergency Response Plans	• Complete emergency plans for all sources of flood risk. • Local level emergency exercises to test response and recovery arrangements over the life of the Strategy. • Early and appropriate response to all emergency events. • Development and implementation of effective evacuation protocols for emergency events • Identification and provision of suitable respite accommodation as appropriate over the life of the Strategy.	• We have an established emergency planning procedure in place for major emergencies, including flooding. • Review within 12 months that the identified changes to our plan are in place and can be built on • We will continue to test and review our plans, and discussion with adjacent local authorities the potential need for mutual support when required • Development and implementation of effective evacuation protocols for emergency events • We will continue to test and review our plans, and discussion with adjacent local authorities the potential need for mutual support when required	• Ongoing • Review Nov 2015 • In place and subject to ongoing review
	Community Flood Plans	• Development of community level emergency plans as required by relevant communities	• Continue working with NRW on the development of community level emergency plans	• ongoing
Asset Management & Maintenance	Asset Management Plans	• Development of a register of natural and manmade structures or features likely to have an effect on flood risk by 2015.	• Develop initial register using available software and update when necessary (passive approach). Use powers, and enforcement where required to manage risk • Implement system to ensure drainage aspects are considered as part of any proposal which affects the highway • Review and confirm coastal waters defined limits • Support schemes such as the Greener Grangetown Project • Provide evidence to	• Commence April 2014

Delivery Theme	Activity type	Suggested Measure(s)	Cardiff Council Proposed Action	Timescale
		• Establishment of a programme of regular and appropriate maintenance for flood and coastal erosion risk management assets.	upstream authorities and highlight the operational issue to try and control debris at source • Review options and include within future Plans / Spatial reviews • "Highway Drainage - review how works are planned and what their Planned Outcome is • Land Drainage - determine level of service and necessary maintenance • Ordinary Watercourse - culvert clearance is carried out at priority sites, review system to assess if this can be updated • Coastal - review potential risk from erosion" • Coastal - review potential risk from erosion, and undertake necessary works • SMP2 action - Ensure environmental issues are taken into account in the design / construction of new defences. Ensure any works adhere to agreed working practices e.g. to prevent disturbance to birds	
	Defence / Structure Management	• Designation of natural and manmade structures or features likely to have an effect on flood or coastal erosion risk over the life of the Strategy. • Development of repair schedules including provision for the installation of resilient measures by 2015.	• Currently planning how the register will be developed working in partnership with other South East Wales Local Authorities. We will need to budget for ongoing inspection and updating of the register • Develop repair schedules including provision for the installation of resilient measures by 2015. • Undertake a coastline survey to assess erosion risks to our coastline communities. • Explore defence schemes for the Penylan, Waterloo Gardens area of the City with Natural Resources Wales.	• Commence 2014/2015
	Channel Maintenance	• Development of procedures for the effective clearance of debris.	• Development of procedures	• In place and subject to ongoing review

Delivery Theme	Activity type	Suggested Measure(s)	Cardiff Council Proposed Action	Timescale
	Culvert Maintenance	• Establishment of a programme of regular and appropriate maintenance for flood and coastal erosion risk management assets.	• Ordinary Watercourse - culvert clearance is carried out at priority sites, review system to assess if this can be updated	• Ongoing review
High Level Awareness & Engagement	Partnership Working	• Implementation of statutory responsibilities including those set out within the Flood and Water Management Act 2010 and the Flood Risk Regulations. • Link with wider work undertaken with regards making Cardiff a more resilient and sustainable area to live • Programme of community based awareness and engagement activities, utilising the Flood Risk Management Community Engagement Toolkit. • Raise awareness internally with regards impact of flood risk on normal operations and post event situations • Contribution funding from third-parties / non-public sources	• We have delivered our PFRA which identifies the key risk areas. • Further actions identified within the LFRMS will help us continue to deliver this objective" • Ensure that Actions are captured which provide synergy across various plans to deliver a more resilient Cardiff. • Support NRW and canvas awareness and feedback from residents that they are aware of their level of flood risk through the "Ask Cardiff" annual questionnaire. • Discuss with insurance industry representative body as to the opportunities available to manage flood risk to ensure insurance remains affordable across the county • Develop Policy for recovery / receipt of funding contributions either directly via Community Infrastructure Levy , or recovery through future rate levy with developer guarantees (TIF etc)	• Flood Hazard Maps by Dec 2013 • Local Flood Risk Management Plans by Dec 2015 • Ongoing • Planned action following consultation response • Commence April 2013

Cardiff Council's current position is that priority should be given to measures that;

- build stronger links with key stakeholders and neighbouring Local Authorities
- continue to build on the work undertaken with regards to community resilience planning
- embed awareness of flooding mitigation measures across all Council functions
- fully understand the coastal erosion risks
- raise awareness across all communities of Cardiff, particularly focusing on those at highest risk of flooding and those that require more support such as low socio-economic standing and vulnerable communities
- reduce the consequences of flooding through the construction of appropriately designed sustainable defences which benefit the local environment


Flood
ROAD
CLOSED

6. Finance

An analysis has been undertaken to determine the costs and benefits (monetary or non-monetary) dependant on the adopted approaches and activity levels as set out in the national guidance (S 3.6).

6.1. Current situation

Cardiff Council currently spends approximately £1M every year on direct activities related to managing flood risk through the services provided by the Highways Drainage teams.

Typical activities include;

- Culvert / screen clearance
- Highway drainage repairs
- Gully cleansing
- Drainage enforcement
- Land drainage
- Investigation of flooding incidents & options for alleviation
- Operational costs of pumping stations and ground water monitoring
- Remedial & reactive works
- Sewer repairs to council owned properties

Cardiff Council are also represented on the Caldicot and Wentlooge Drainage Board and pay a levy to the Internal Drainage Board of approximately £700k a year to support their operation in managing land drainage and local flood risk within the drainage board area.

Cardiff Harbour Authority is an operational part of Cardiff Council, however, its operational budget is provided by the Welsh Government.

Cardiff Council's Emergency Management Unit has a number of emergency plans that can be put in place if a significant flood event was to occur. The cost of maintaining the resources for these plans, as well as the community engagement work, is not included in the above costs.

6.2. Do-nothing situation

The Project Appraisal Guidance (PAG) series and the principles of a cost/benefit analysis as outlined in the Flood and Coastal Defence Project Appraisal Guidance FCDPAG3 (Defra, 2006) have been used to carry out the cost/benefit analysis.

The analysis has assumed that the existing drainage systems are able to accommodate a flood event up to the typical design standard of a 1 in 30 chance event. Above this flooding will occur and affect properties. The Environment Agency's Flood Map for Surface Water (FMfSW), and published data for the predicted economic impact of flooding (FHRC, 2010) has been used to assess the potential damage due to flooding.

The analysis estimates that across Cardiff the following numbers of properties could be affected by local flood risk sources;

- 1 in 30 event - over 10,000 properties
- 1 in 200 event - over 30,000 properties

If Cardiff Council was to stop carrying out the actions listed above, and allow the natural land drainage systems to cope, without maintenance, it is estimated that in any given year the potential economic impact of local flood risk to these properties will be over £11M (see Table 6.1 overleaf).

6.3. Future approaches

Three approaches have been considered as part of developing this Strategy

- Do-Nothing
- Business as usual
- Do-more (reducing the potential likelihood and consequence of flooding)

6.3.1. Economic comparison

The following table sets out the potential economic benefit of the assessed approaches in terms of a reduction in damage due to flooding. The potential economic benefit has been assessed over the short-term (20 years) that may result from delivering measures as suggested in Section 0. (see Appendix E.3 for further detail).

Table 6.1 - Economic impact of local flood risk

Approach	Annual Average Damage (£M)	Present Value Damage over 20 years (£M)	Present Value Benefit (£M)
Do-Nothing	£13.2	£ 194.0	
Business as usual	£9.9	£ 145.4	£ 48.6
Do-more	£3.7	£ 54.2	£ 139.8

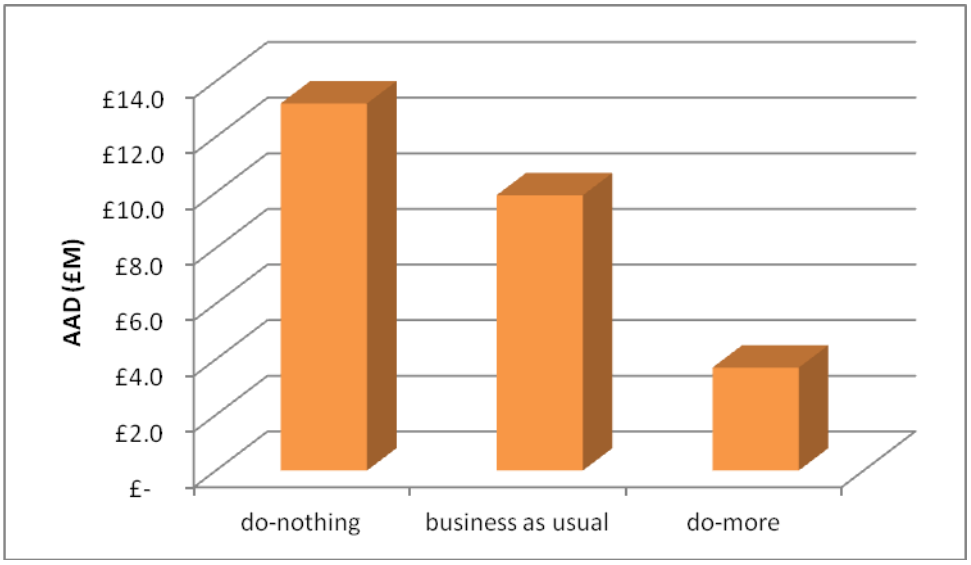


Figure 6-1 Annual Average Damage

The above table and chart highlight the potential annual damage based on our current ("business as usual") approach is approximately £9.9M in comparison with the Do-Nothing situation of £13.2M.

This provides a potential benefit of over £3M a year in comparison with the estimated £1M annual cost of activity currently undertaken.

6.3.2. Preferred approach

In the future Cardiff Council we will need to review available budgets to deliver the required duties.

The **preferred approach** is to take overall actions to **do more to reduce the likelihood of flooding.** The predicted average annual damage would reduce to £3.7M, resulting in a typical benefit (difference between Do-Nothing and Do-More) of £9.5M. Over the short-term this would account for nearly £140M of economic benefit to the county.

Cardiff Council will be proactive in delivering some prioritised measures. Other activities will have the procedures in place for actions to be undertaken in a reactive manner, such as the investigation of flood events or post-event debris clearance. The benefit for managing flood risk to significantly reduce consequences is evident in the above table with the potential to provide nearly £140M of benefit over the next twenty years. However, a decision between affordability and acceptable level of benefit to the communities of Cardiff will need to be considered for each action taken such that not all of these benefits may be realised.

6.4. Funding Risks

The Welsh Government have highlighted that the cost of mitigation measures can be significant and cannot be met by central funding availability. The Welsh Government has set indicative total fund allocations for flood and coastal erosion risk management for Wales as:

- 2012/13 - £35.7million; and
- 2013/14 - £37 million

Funding will be allocated strictly on a risk based priority by the Welsh Government to deliver long term investment plans. They have noted an expectation that Local Authorities will have to find additional expenditure in future budget setting and consideration be given to additional charges, levies and partnership arrangements where ever possible. National and European funding may be available but is insufficient to afford all mitigation measures required across Wales.

6.4.1. Current and future potential funding

Flood Defence Grant in Aid (FDGiA)

Traditionally, flood risk management projects in Wales have been largely funded via the Welsh Governments Flood Defence Grant in Aid mechanism. However, given the pressures on future Welsh Government spending as a whole which will result from the reduction in available funding (as implemented via the UK Government Comprehensive Spending Review) it is likely that there will be a reduction in capital programme spend over the lifetime of the this LFRMS cycle.

European Funding

Funding from the European Union is designed to align the economic prosperity of the various regions of Europe. Over the period 2007-2013 this fund will have provided nearly £50M to support a flood and coastal erosion risk management programme of just over £100m in Wales. Wales may benefit from another round of funding from European financial support, however, it is unclear whether there will be a mechanism for use of these funds for Flood Risk Management activities.

Developer Contributions

Local Authorities can potentially require developers to carry out works on sites (including flood and coastal erosion risk management works) under Section 106 of the Town and Country Planning Act 1990. Following a change in the related legislation, from 6 April 2014 the scope of any agreements will be restricted to make such related infrastructure provision harder to justify.

The Planning Act 2008 makes provision for local planning authorities to prepare and implement a Community Infrastructure Levy (CIL), which can be used to fund those infrastructure elements that will no longer be deliverable through S106 agreements. Cardiff Council is currently considering the scope of a potential CIL Charging Schedule, which identifies what development will be subject to CIL and what the level of the levy is.

Partnerships Fundraising

Partnership funding between public and private sectors and local communities will have to be explored. Also where possible partnership working between Risk Management Authorities may attract funding opportunities to achieve flood risk management objectives which are of mutual interest to key stakeholders and partners.

7. Environmental Assessments

This section sets out how the strategy and the environmental assessments fit together and how they have informed each other over the development of the LFRMS.

There are three assessments of the potential environmental impacts of the Cardiff LFRMS that are required by law and have been integrated into the development of, or carried out on the Cardiff LFRMS. This section provides an overview of the three assessments, their general requirements and where further information on the assessments can be found in the ***Appendices***.

7.1. Strategic Environmental Assessment (SEA)

Strategic Environmental Assessment (SEA) is the systematic appraisal of the possible effects of decisions taken at a high level (such as those in strategies, policies and plans) on the built, natural and historic environments.

The EU SEA Directive[5] sets out the legal requirements for this appraisal in EU countries. The SEA Directive is transposed into law in England and Wales by the Environmental Assessment of Plans and Programmes Regulations 2004 (SI 1633) and the Environmental Assessment of Plans and Programmes (Wales) Regulations 2004 (SI 1656).

The SEA Directive requires that certain plans/programmes are assessed as they are developed to make sure that the potentially significant environmental effects are properly considered and that the possible effects are taken into account before decisions on the final plan/programme are made. It also requires that significant effects are monitored once the plan and programmes are in place. Monitoring required as part of the SEA links into the monitoring and review required for the Cardiff LFRMS as a whole (see ***Section*** 8).

The SEA Directive applies to a range of plans and programmes. It applies in this case because there is a legal requirement for Cardiff Council to develop a flood risk strategy.

7.1.1. The SEA Process

Undertaking an SEA is not a 'one-off' action. Taking account of the possible impacts of decisions on the environment is a step by step process that is part of the whole Cardiff LFRMS development process. The SEA legislation requires that certain actions are taken (e.g. early and on-going stakeholder engagement) and that certain outputs are produced (e.g. an environmental report). The production of the Cardiff LFRMS has met the requirements of the SEA Directive in the following ways:

- **SEA Scoping Report –** this was produced in August 2012. It was circulated to statutory consultees (the Environment Agency for Wales[6], Countryside Council for Wales[6] and Cadw) and relevant departments within Cardiff Council for comment.
- **Stakeholder engagement –** this is an integral part of both the Cardiff LFRMS and SEA processes. The SEA Report and the draft Cardiff flood strategy were published for consultation in December 2012. An overview of stakeholder involvement in the Cardiff flood strategy development is set out in the ***SEA Environmental Report.***
- **Identification of environmental characteristics –** the SEA Scoping Report, describes the environment in terms of '***receptors'*** (Population & human health; Biodiversity; Land use; Geology & soils; Water; Air; Material assets; Historic environment; Landscape; and the interrelationship between them);
- **Identification of environmental protection objectives –** the SEA Scoping Report identified draft environmental protection objectives for the SEA, while the Cardiff flood strategy identified objectives for the strategy itself (see ***Section*** 5). Some of these objectives are the same, while some are specific for the SEA.
- **Assessment of likely significant impacts on the environment and consideration of alternatives –** the evaluation of options, alternatives and their effects, including their effectiveness to meet objectives is an integral part of the SEA. This assessment of policy options fully incorporated possible impacts on the environment and the achievement (or otherwise) of SEA objectives. ***Section 0*** above sets out the

[5] Directive 2001/42/EC on the assessment of the effects of certain plans and programmes on the environment
[6] From April 2013, the Welsh Government established a single environmental body for Wales, National Resources Wales (NRW). This merged the functions of the Environment Agency Wales, the Countryside Council for Wales, the Forestry Commission Wales and some Welsh Government functions.

possible options considered under the Cardiff flood strategy. The SEA assessments can be found in ***Section 7 of the SEA Environmental Report***

- **Measures to prevent, reduce and offset any significant adverse effects –** these measures are set out in the SEA assessment and have been incorporated into the specific programme of measures for the Cardiff flood strategy (see ***Section*** 5).
- **Environmental Report –** an SEA Environmental Report was produced in November 2012. This includes a **non-technical summary** of the information contained within the Environmental Report.
- **Monitoring –** monitoring actions identified in the SEA Environmental Report have been combined with those required to monitor the progress of the Cardiff flood strategy (***Section 8***).
- **Post Adoption Statement –** this document is part of the SEA process. It summarises how environmental issues were integrated into the flood strategy development process; the reasons for choosing the preferred options; the consultation results and the monitoring that is proposed. It is a separate document that will be produced once the Cardiff flood strategy has been formally adopted.

7.1.2. SEA Conclusions

The SEA for the Cardiff flood strategy draws the following conclusions, which are contained in the ***Environmental Report.***

Population and Human Health – The Cardiff flood strategy will result in significant benefits to population and human health, reducing the potential effects of flood risk to the population, businesses and economy of Cardiff. The prioritisation of investment in flood strategy measures and actions incorporates the Welsh Index of Multiple Deprivation to help target actions to areas and communities who are potentially least resilient to flood risk and maximises benefits;

Biodiversity, Flora and Fauna – The implementation of the Cardiff flood strategy could potentially adversely affect biodiversity, flora and fauna, depending on how measures and actions are implemented. In order to ensure actions have a neutral or positive effect, mitigation measures are required. The implementation of some actions under the flood strategy will require project works. Such works have not yet been identified and it will be necessary to consider the need for EIA, HRA and WFD assessments and their findings at a project level;

Water Environment – The Cardiff flood strategy will have an overall beneficial effect on reducing the effects of flooding from local sources but could adversely affect both water quality and hydromorphology, depending on how actions are implemented, requiring mitigation measures.;

Historic Environment – The Cardiff flood strategy will have an overall beneficial effect on cultural heritage, reducing the impacts of flooding to protected sites and historic landscapes;

Air and Climate – Overall, the Cardiff flood strategy will have a significant beneficial effect on Cardiff's ability to adapt to climate change and the resulting impacts;

Landscape – The Cardiff flood strategy could have either a beneficial or adverse effect on landscape, soil and land use, depending on how the actions are implemented.

In order to ensure negative effects of the Strategy are removed and positive effects are maximised, the following mitigation actions are recommended:

- Ensure that updates/changes to climate change advice are taken into account in the operation and performance of Cardiff Barrage;
- CHA annual monitoring of navigation channels should be used to identify large changes or trends in changes to bed morphology and inform the need for a study to determine the effects (if any) of the Cardiff Barrage on sediment transport;
- The need for EIA, HRA, WFD assessments of specific flood and erosion risk management projects / works should be considered. The findings of any assessments should be taken into account when delivering the projects/works;
- Local strategies / action plans should be developed taking account of SEA receptors and any environmental effects that the strategies / action plans may have;
- The SEA report should be circulated within Cardiff Council along with the draft LFRMS for consultation. Final reports should also be circulated and other Service Areas consulted and involved in the implementation of the LFRMS;
- The LDP, land use plans and SPG should be developed taking account of SEA receptors and any environmental effects that they may have;
- Standard Operating Procedures and Emergency Procedures should be reviewed to ensure biosecurity issues are included and addressed;

- Staff to be made aware of need for biosecurity and reducing the risk of spreading non-native species;
- Equipment, clothing, vehicles and vessels to be appropriately cleaned before being used in other watercourses in/outside Cardiff;
- All emergency planning (including testing and review) should consider the potential effects that emergency actions can have on the environment;
- All planning team members to be made aware of the requirements of PPW, TAN14 and TAN15 and to ensure that all planning applications satisfy the requirements of these guidance documents. Updates to PPW, TANs and other planning guidance to be circulated to all planning team members and to be taken into account in planning decisions;
- Awareness raising should include information on how flood events can affect water quality. Preparedness advice and post-event clean up advice should include information on how to reduce the potential impacts to water quality. NRW should ensure they provide appropriate advice to Cardiff to ensure consistent messages from both organisations;
- Ensure nature conservation and geomorphological issues are taken into account in the design / construction of new defences;
- Seek to minimise the footprint of defences;
- Seek to work with natural processes;
- Time works to minimise disturbance to features of the sites e.g. works wNRWill only be permitted at the appropriate time of year (April – September) to avoid disturbance to wintering birds;
- Ensure nature conservation issues are taken into account in the management and maintenance of defences;
- Seek opportunities to improve the condition of the natural environment, where practical;
- Consider the potential for incorporating environmental benefits / bioengineering / 'soft' engineering into schemes at the design level.

7.2. Habitats Regulations Assessment (HRA)

The EU Habitats (92/43/EEC) and Birds (79/409/EEC) Directives aim to protect European birds and species and the habitats that support them. In the UK, the Directives are implemented through the Conservation of Habitats and Species Regulations 2010. These are known as the ***Habitats Regulations***.

The legislation requires '***competent authorities***' to undertake an '***appropriate assessment***' of plans, projects and strategies that may have a significant effect on the site, if those plans, projects or strategies are not directly concerned with the management of the protected sites themselves. The process that includes the 'appropriate assessment' is known as a ***Habitats Regulations Assessment (HRA)***. In the UK, it is also policy to carry out a similar assessment for sites designated under the Ramsar Convention (known as ***Ramsar sites***).

There are a number of EU protected sites in or near to the area covered by the Cardiff flood strategy. The 'competent authority' (in this case, Cardiff Council) is required to carry out an HRA to ensure that damage to the sites does not take place when the actions in the flood strategy are followed. If it is not possible to eliminate all damage to the sites, measures must be taken to compensate for any damage or loss.

The actions and objectives developed for the Cardiff flood strategy have been assessed based on the specific requirements of the HRA process, in consultation with the Countryside Council for Wales (CCW), now Natural Resources Wales (NRW).

Some of the measures identified in the Cardiff flood strategy are projects that will need to undergo an individual HRA as they develop to ensure that the particular actions proposed (e.g. construction activity) do not harm the protected sites or species.

7.2.1. HRA Conclusions

The actions and objectives developed for the flood strategy have been assessed based on the requirements of the HRA process. This assessment concludes that the flood strategy may result in operations capable of adversely affecting the features of protected sites. It has, however, been possible to identify mitigation measures that, if implemented, would remove these effects.

In some cases it has not been possible to rule out the possibility of significant effects because the flood strategy does not include all the detail of how actions might be carried out. In these cases, it is considered more appropriate to determine any significant effects at a project level, when more detail about how actions will be carried out is known. It has been possible to identify mitigation actions that should be taken in order to reduce the potential for projects to have a significant effect on site features.

In order to ensure negative effects of the Strategy are removed and no effects to EU protected sites result, the following mitigation actions are recommended (some of the mitigation measures may be the same as those identified as part of the SEA) :

- Ensure that an EIA/HRA is undertaken at the project or lower tier plan level[7].
- Ensure nature conservation and geomorphological issues are taken into account in the design / construction of new defences.
- Seek to minimise the footprint of defences / working area Avoid / minimise the loss of beech forest in construction / maintenance works.
- Replace any beech trees that may need to be felled with beech.
- Replace any trees that may need to be felled with locally native species.
- Avoid / minimise the clearance of vegetation.
- Replace / relocate cleared vegetation.
- Avoid / minimise the clearance of dead wood.
- Temporarily store and replace any dead wood cleared following completion of works, or relocate dead wood to other areas in the site.
- Consider the potential for incorporating environmental benefits / bioengineering / 'soft' engineering into schemes at the design level.
- Seek to work with natural processes.
- Minimise working within the water column.
- Pollution prevention measures in place to control release of sediment and other pollutants.
- Remove / do not create barriers to migration or integrate migration passage within the design e.g. fish passes for all relevant life cycle stages.
- Use of materials that are appropriate for use in/near water, taking account of relevant advice from NRW in relation to these matters.
- Staff/contractors to be made aware of need for biosecurity and reducing the risk of spreading non-native species.
- Equipment, clothing, vehicles and vessels to be appropriately cleaned.
- Minimise working in the intertidal area.
- Minimise working in areas where historic contaminants may be present. If working in these areas is necessary, appropriate measures must be determined to reduce the risk of remobilising historic pollutants.
- Consider the need for temporary / permanent fish passes.
- Time works to reduce effects to migration.
- Minimise activities capable of producing noise / vibration.
- Use low noise / muffled plant and machinery.
- Switch off machinery when not in use.
- Ensure plant and machinery are well maintained.
- Minimise use of artificial light / night time working.
- Shield lights / use directional lighting
- Time works to minimise disturbance to features of the sites e.g. works will only be permitted at the appropriate time of year (April – September) to avoid disturbance to wintering birds.
- Ensure nature conservation issues are taken into account in the management and maintenance of new defences.
- Seek opportunities to improve the condition of the natural environment, where practical.
- Plans or projects relating to the management of flood risk in / around the Gwent Levels should consider the management of all sources of flood risk, including but not limited to surface water flooding, tidal flooding, storm surges and tide locking, and the interaction of all relevant sources of flooding to the plan / project being developed.
- Work with NRW to ensure design of works are in accordance with conservation objectives.

[7] In developing lower tier plans, consideration should also be given to the need to carry out a Strategic Environmental Assessment (SEA)

7.3. Water Framework Directive (WFD) Assessment

The EU Council Directive 2000/60/EC '*establishing a framework for the Community action in the field of water policy*' is designed to improve and integrate the way bodies of water are managed throughout Europe. It is commonly known as the ***Water Framework Directive (WFD)***. The WFD was transposed into law in England and Wales by the Water Environment (Water Framework Directive) (England and Wales) Regulations 2003.

The aim of the WFD is for all inland and coastal waters in the EU to be in 'good' condition by 2015. This is achieved in part by creating a system of management plans, called ***River Basin Management Plans (RBMPs)***.

The Cardiff flood strategy is within the ***Severn RBMP*** area and next to the ***Western Wales RBMP*** area. There 10 catchments and 859 water bodies within the Severn RBMP. The area of the Cardiff flood strategy is in the ***South East Valleys*** catchment. It is also next to the ***Ogmore to Tawe*** catchment in the Western Wales RMBP.

Many of the aims of the WFD are relevant to the preparation of the Cardiff flood strategy and the flood strategy has the potential to help deliver some of the actions identified in the RBMPs. In order to ensure that the Cardiff flood strategy does not conflict with the Severn RBMP or undermine the aims of the WFD, a WFD assessment of the proposed policies and actions under the flood strategy has been carried out in consultation with the Environment Agency Wales (now Natural Resources Wales).

7.3.1. WFD Assessment Conclusions

The WFD assessment concludes that some of the measures/actions within the Cardiff flood strategy could have a either positive or a negative effect on meeting WFD aims and objectives. In order to ensure negative effects are removed and positive effects are maximised, the following mitigation actions are recommended:

- Consider the need for EIA and HRA for Asset Improvement and Replacement Projects (pre-feasibility studies) (Lower Roath Brook and River Rhymney)
- Consider the potential for incorporating environmental benefits / bioengineering / 'soft' engineering into schemes at the design level
- Ensure nature conservation and geomorphological issues are taken into account in the design / construction of new defences.
- Ensure that an EIA/HRA is undertaken at the project level
- Seek to minimise the footprint of defences
- Seek to work with natural processes
- Time works to minimise disturbance to features of the sites e.g. works will only be permitted at the appropriate time of year (April – September) to avoid disturbance to wintering birds.
- Ensure nature conservation issues are taken into account in the management and maintenance of new defences
- Seek opportunities to improve the condition of the natural environment, where practical

With these measures in place / implemented, it is considered that the Cardiff flood strategy will not adversely affect the WFD aims and objectives.

8. Monitoring and Review

8.1. Monitoring and Review

This is the beginning of a new stage in flood risk management for Cardiff. There are going to be substantial changes in the next few years to the planning system, sustainable drainage requirements and the provision of flooding related insurance. Innovations in the funding, design of flood prevention schemes and improvements in the knowledge of where the greatest local flood risks will also be addressed.

Consequently it makes sense for the first review of the flood strategy to be relatively soon. It is proposed that a review should take place in 2015 to tie in with the delivery of Flood Risk Management Plans as part of the Flood Risk Regulations. After that the strategy would continue to be reviewed in line with the Flood Risk Regulations, at 6 yearly intervals, with the next review in 2021.

8.2. Environmental Review and Monitoring

Information relevant to the monitoring of the SEA should be collected along with that for the flood strategy reviews and progress on the SEA objectives and targets should be integrated into the flood strategy review process.

The targets and indicators developed for the SEA objectives have taken into account the data that is currently available, data that would become available during the implementation of the Cardiff flood strategy and existing monitoring programmes that are relevant to the SEA objectives. They have also considered the data that would be collected to monitor the progress of the flood strategy itself. The SEA indicators and the data / information that should be collected or referred to in order to monitor the implementation of the flood strategy and effects on the environment are set out in the SEA Environmental Report. Many of the indicators are not direct measures of the effects of the flood strategy on the environment, but are proxies that monitor the implementation of the flood strategy or the pressures that could be exerted on the environmental receptors.

9. References

Defra. (2006). *Flood and Coastal Defence Project Appraisal Guidance FCDPAG3 "Economic Appraisal".* Department for Environment, Food and Rural Affairs.

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FHRC. (2010). *The Benefits of Flood and Coastal Risk Management - A Handbook of Assessment Techniques.* Middlesex University, Flood Hazard Research Centre.

Hyder Consulting (UK) Ltd. (2011). *Cardiff Council Preliminary Flood Risk Assessment Final Report.* Cardiff: Cardiff Council.

Pitt, S. M. (2010). *The Pitt Review: Learning Lessons From The 2007 Floods.* London: HMSO.

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Welsh Government. (2011a). *Local Flood Risk Management Strategies Local Strategy guidance.* Welsh Government.

Welsh Government. (2011b). *National Strategy for Flood and Coastal Erosion Risk Management in Wales.* Welsh Government.

Welsh Government. (2011c). *Adapting to Climate Change: Guidance for Flood and Coastal Erosion Risk Management Authorities in Wales.* Welsh Government.

Welsh Government. (2011d). *Sustainable Development: Guidance to Risk Management Authorities Section 27 – Sustainable Development.* Welsh Government.

Appendices

Appendix A. Adopted Policies

A.1. Culvert policy

POLICY REGARDING CULVERTS

Contents

1. Purpose

This leaflet provides a detailed explanation of Cardiff Council policy with regard to culverts. It is intended for use by Cardiff Council landowners and developers.

2. Introduction

Watercourses fulfil many roles in today's environment. They provide drainage for developed and agricultural land and are vital water resources, while some also have important recreational value. They are important features of the landscape and provide habitats for a wide variety of wildlife. It is therefore important that watercourses and their associated habitats are protected and enhanced for the benefit of present and future generations.

Cardiff Council considers it beneficial for watercourses to remain in an open state for both flood risk management and environmental purposes. Conserving open watercourses is one of Cardiff Council major aims and, where possible, Cardiff Council will encourage and promote the removal of culverts in order to restore a more natural watercourse environment.

In considering new development proposals Cardiff Council objective is to retain open watercourses with a corridor of open land on both sides. This maintains a flood channel and creates a valuable environmental feature which can enhance the site. Cardiff Council will encourage developers to incorporate open watercourses within their site design. Such features are of particular importance to wildlife by providing valuable open land in developed areas.

Culverting can exacerbate the risk of flooding and increase the maintenance requirements for a watercourse. It also destroys wildlife habitats, damages a natural amenity and interrupts the continuity of the linear habitat of a watercourse.

Culverting should not be considered until other options have been thoroughly explored, for example:

- clear open span bridges with existing banks and bed retained;
- revision of site layout to incorporate an open watercourse;
- diversion of the watercourse in an environmentally sympathetic channel and corridor.

It is recognised there are various reasons why in some instances landowners, developers and local authorities believe that open watercourses should be culverted. However, Cardiff Council considers any benefits are usually outweighed by the potential problems in managing the system, the loss of habitats and difficulty in pollution detection.

Nevertheless, there may be cases where culverting may in practice be unavoidable for example, short lengths for access purposes or where highways cross watercourses. In such cases the length involved should be restricted to a minimum, the hydraulic and environmental design fully assessed and appropriate mitigating enhancements to the surrounding environment included in the proposal.

3. Cardiff Council Policy

Cardiff Council is in general opposed to the culverting of watercourses because of the adverse ecological, flood risk and other effects that are likely to arise.

Cardiff Council will therefore only approve an application to culvert a watercourse if there is no reasonably practicable alternative or if the detrimental effects of culverting would be so minor that they would not justify a more costly alternative. In all cases where it is appropriate to do so adequate mitigation must be provided for damage caused.

Wherever practical Cardiff Council will seek to have a culverted watercourses restored to open channels.

3.1. Reasons for the Policy

The Land Drainage Act 1991 as amended by the Flood & Water Management Act 2010 places both general and specific duties on Cardiff Council regarding the consenting and enforcement of structures within an ordinary watercourse.

Cardiff Council must be mindful of these duties in discharging all its functions, including those relating to flood risk management and land drainage.

Consequently, Cardiff Council in general opposed to the culverting of watercourses because of the detrimental effects that are likely to arise. Such effects may be;

• loss of and adverse effects on environmental features and wildlife habitat;
• increased likelihood of flooding due to blockage;
• increased impact of flooding;
• loss of floodwater storage;
• increased difficulties in providing for drainage connections;
• difficulties in the repair, maintenance and replacement of culverts;
• increased health and safety hazards;
• reduced groundwater recharge;
• increased difficulty in detecting the origins of pollution and in monitoring water quality.

3.2. Loss of environmental features

Culverting watercourses have a detrimental impact on the environment. There is a complete loss of environmental features associated with that section of watercourse. The continuity of the watercourse corridor is broken, adversely affecting the landscape and ecological value of the watercourse and inhibiting the migration of some species. An existing or potential amenity is lost for present and future generations.

Culverting results in the removal of species and watercourse features such as pools, riffles, gravel, cobble, sand, silt, marginal/aquatic vegetation, earth banks with associated vegetation, invertebrate communities and fish. Even seasonally dry watercourses provide valuable habitats for many species, such as amphibians and invertebrates.

Culverting is therefore contrary to Cardiff Council responsibility to further conservation in relation to its flood risk management responsibilities and its aim of contributing to sustainable development.

3.3. Increased likelihood of blockages

Compared with an open watercourse there is an increased risk of blockage once a culvert is installed. If the blockage is within the culvert, there is much greater difficulty in removing it. For these reasons many culverts have screens installed at their upstream end. These screens themselves are often prone to blockage and require frequent clearance and robust emergency procedures to ensure that they do not in themselves cause flooding.

It is sometimes argued that culverting will reduce the problem of open watercourses subject to rubbish deposition. Cardiff Council considers that in most cases such short-term advantages are outweighed by the overall disadvantages of culverting and that alternative means should be pursued to address the rubbish problem.

3.4. Increased impact of flooding

The effect of the overland flooding that will occur when a culvert cannot cope with all the flow reaching it is often more serious than flooding from an open watercourse.

3.5. Loss of floodwater storage

Open watercourses generally provide more storage capacity than a culvert and the detriment will be more significant in relation to longer culverts.

3.6. Increased difficulties in providing for drainage connections

Drainage can be provided more easily with open watercourses into which drain connections can readily be made and the performance of drainage systems visually monitored. Outfalls within culverts are prone to blockage or, in the case of flapped outfalls, can seize up. Maintenance of these outfalls is considerably easier in open channels.

3.7. Difficulties in the repair, maintenance and replacement of culverts

Culverts conceal the presence of a watercourse and can lead to development or unacceptable land-use above or near them. In many urban areas buildings have been constructed above or adjacent to culverts. This means that improving standards of flood protection or accommodating run-off from future developments could be impossible or uneconomic due to the cost of replacing or enlarging existing culverts. There have recently been cases of serious flooding caused by culverts collapsing due to large amounts of materials stockpiled above them.

In urban areas consideration must be given to the need to provide alternative means to deal with flood water over and above that which can be accommodated by the culvert under design conditions. This will also provide contingency arrangements in the event of blockage of the culvert, thereby minimising the risks of flooding to property.

The responsibility for the condition and maintenance of a culvert lies with the landowner or the owner of the culvert unless other agreements are in place. The responsible party must therefore ensure that the culvert and any screens remain in good condition and free from obstructions. Failure to do so could result in liability for any damage caused by flooding.

Access to culverts is generally only safe with the use of special procedures and equipment, making inspection and maintenance both difficult and costly.

3.8. Health and safety hazards

There are dangers associated with natural open watercourses but culverted watercourses can be equally dangerous. Culverting does not remove the risk of drowning or injury. Water levels can rise suddenly and without notice, and there can be a lack of oxygen or build-up of potentially toxic or explosive gases in culverts.

All these hazards are a danger both to the public and to operatives when maintenance is required.

3.9. Effect on recharge to groundwater

Culverting creates an impermeable bed to a watercourse and increases the speed of water flow, so reducing recharge to groundwater which can be particularly serious in large developments or areas of permeable geology.

3.10. Pollution and effect on water quality

Culverting a watercourse makes the early detection and tracing of pollution sources more difficult, resulting in the adverse impacts being more serious. There is further impact on water quality due to the loss of the biological processes which are essential for river purification, and there is normally a reduction in oxygenation of water passing through a culvert. Culverting may also result in stagnant water problems, particularly if culvert levels are badly planned or constructed.

(Note: Cardiff Council is not empowered under land drainage legislation to refuse consent purely on the grounds that it makes the detection of pollution more difficult).

4. Exceptions

There are cases where culverting may in practice be unavoidable, such as short lengths for access purposes or where highways cross watercourses. In such cases alternatives such as open span bridges or diversion of the watercourse must have been rigorously considered, the length restricted to the minimum necessary to meet the applicant's objective, and appropriate mitigating environmental enhancements included in the proposal.

Before installing a culvert it is recommended that a risk assessment of the likelihood and consequences of blockage should be carried out and proposals implemented to reduce the risk to acceptable levels.

5. Legal requirements and the need for consent

5.1. Ordinary Watercourse Consent

Any culverting of a watercourse, or the alteration of an existing culvert, requires Ordinary Watercourse Consent from Cardiff Council under Section 23 of the Land Drainage Act 1991. On main rivers consent from Natural Resources Wales is required.

If a culvert is constructed (or altered) on a watercourse without consent, Cardiff Council may serve an abatement notice on the person having the power to remove it. If the notice is not complied with, the person responsible may be prosecuted and Cardiff Council is entitled to carry out the necessary works and recover reasonable costs incurred in doing so.

5.2. Other permissions

Works either within or which would affect a designated site (i.e., a Site of Special Scientific Interest - SSSI) as a result of changes in flow regimes or water levels, require the approval of the Countryside Council for Wales, as appropriate.

Applicants should also check with Cardiff Council whether their culverting proposals require planning permission under the Town and Country Planning Act 1990 and/or consent under the Public Health Act 1936.

6. Consent Procedures

Landowners and developers should seek Cardiff Council advice as early as possible on any proposal, allowing sufficient time before work is to start. Identifying and resolving possible problems before plans reach an advanced stage will minimise costs to all parties and will reduce the time taken by Cardiff Council when the consent application is received. In addition, opportunities for environmental enhancements can be identified, which may not necessarily entail significant expenditure by the developers.

After preliminary details have been agreed, an application must be completed and submitted to Cardiff Council, along with the appropriate fee, for formal consent.

On receipt of a complete and valid application, Cardiff Council has two months in which to determine it.

Each application will be treated on its merits in accordance with Cardiff County Council duties and responsibilities under the Land Drainage Act 1991 and the Flood & Water Management Act 2010, including the impact on the environment. Cardiff Council acknowledges that the establishment of its policy regarding culverts is not in itself sufficient grounds for refusal of an application for consent to culvert a watercourse.

7. Definitions

Bridge

An open span structure that carries a road, footpath, railway etc over a watercourse.

Culvert

A covered channel or pipeline which is used to continue a watercourse or drainage path under an artificial obstruction.

Ordinary Watercourse

The term Ordinary Watercourse, as defined in the LDA1991 is a watercourse that does not form part of a main river, and includes all rivers and streams and all ditches, drains, cuts, culverts, dikes, sluices, sewers (other than public sewers within the meaning of the Water Industry Act 1991) and passages, through which water flows. Cardiff Council has regulatory powers in respect of Ordinary Watercourses within its boundaries.

Main River

Main Rivers are designated as such on maps held by the Department for the Environment, Food and Rural Affairs (DEFRA) and by Natural Resources Wales. Works in or near Main Rivers require the consent of Natural Resources Wales. More information on main rivers can be obtained from local Natural Resources Wales offices.

Sustainable Development

Development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

8. Contacts

Cardiff Council

City Services Drainage Management
Brindley Road
Leckwith
Cardiff
CF11 8TX
Tel: 029 2087 2087 (English) 029 2087 2088 (Cymraeg)

Email: C2C@cardiff.gov.uk

http://www.cardiff.gov.uk

Natural Resources Wales

Rivers House
St Mellons Business Park
Fortran Road
St Mellons
Cardiff
CF3 0EY

Phone Number: 0300 065 3000 (Mon-Fri, 8am - 6pm)
Email: enquiries@naturalresourceswales.gov.uk
Web: http://naturalresourceswales.gov.uk

9. References

Flood & Water Management Act (2010). Available from The Stationary Office Limited

Land Drainage Act (1991). Available from the Stationary Office Limited.

Public Health Act (1936). Available from The Stationary Office Limited.

Town and Country Planning Act (1990). Available from The Stationary Office Limited

A.2. Sandbag Policy

SANDBAG POLICY

In Cardiff the greatest risk of flooding comes from water build up on roads or blocked drains. Due to rapid speed at which any surface water event can occur and the unpredictability of the location or scale of any event, Cardiff Council has developed the following sandbag policy.

The most effective way of protecting property that is at risk is by means of proprietary systems that are available from companies that specialise in flood prevention. Residents can seek advice about flood prevention methods and flood prevention products at http://nationalfloodforum.org.uk

The Council does not have a legal duty to issue sandbags for flooding incidents.

The Council strongly advises residents to take action prior to any flooding event.

The use of sandbags is recognised as a flood prevention method that has limited application, and sandbags will not protect property from flood waters. At best they will delay the impact of rising water. The Council's priority is therefore to provide information to residents on the steps that they can take as householders to prepare for a flooding event. Cardiff Council continues to support the work undertaken by Natural Resources Wales on promoting flood awareness in Cardiff, plus will continue with the on-going work to prepare communities and individuals for a flood events.

During a flood events our resources will be allocated on a risk based approach, in co-ordination with the emergency services if appropriate, will take priority to protect the widest number of properties and key infrastructure.

In the case of a flood event occurring, or a flood event being forecast, the following will apply to the provision of sandbags:

1. Priority of stock will always be given to the emergency services.
2. Where resources allow, sandbags will be made available for collection at the Council's Brindley road depot. (It should be noted that sandbags are widely available to purchase from building merchants and if residents feel their home may be at risk they are encouraged to keep a stock as part of their own flood prevention planning.)
3. A maximum of 5 sandbags per property will be allocated to members of the public from the depot at Brindley Road.
4. The sand bags will be provided free of charge.
5. If collecting on behalf of one or more properties, evidence of the addresses must be presented at time of collection.
6. The sandbags will be provided on a first come, first served basis and once the public supply has been depleted additional bags cannot be supplied. (A normal stock of between 250 and 1000 bags is held)
7. At times of flood risk it will not be possible to provide Sandbags in bulk to local communities as their distribution cannot be controlled effectively to ensure equity of provision.
8. Residents who are not able to collect or place sandbags e.g. elderly, disabled or infirm, will be assisted by the Council subject to the availability of resources. This will only apply where it has been assessed that sandbags will make a positive contribution to protecting a property from flooding.
9. After a flood event the householder should remove and store the sandbags or return them to Brindley Road Depot. Any sandbags found discarded by the Council will be removed.

It must be emphasised that residents of Cardiff Council who live in an identified flood risk area should not rely upon the Council to respond to a threat of flooding to their property, but should have in place their own flood protection plans. Sandbags should not be seen as the primary means of protection.

Appendix B. Risk Management Authorities Contact Details

Risk Management Authority	Contact details
Cardiff Council	County Hall Atlantic Wharf Cardiff CF10 4UW Phone number: (English) 02920 872087 Phone number: (Cymraeg) 02920 872088 Text phone: 02920 872085 Fax: 029 2087 2086 Email address:c2c@cardiff.gov.uk Website: http://www.cardiff.gov.uk
Natural Resources Wales – Regional office	Ty Cambria 29 Newport Road Cardiff CF24 0TP Phone Number: 0300 065 3000 (Mon-Fri, 8am - 6pm) Email: enquiries@naturalresourceswales.gov.uk Web: http://naturalresourceswales.gov.uk Floodline: Phone Number: 0845 988 1188 (24 hour service) Type Talk: 0845 602 6340
Natural Resources Wales – South East Area Office	Rivers House St Mellons Business Park Fortran Road St Mellons Cardiff CF3 0EY Phone Number: 0300 065 3000 (Mon-Fri, 8am - 6pm) Email: enquiries@naturalresourceswales.gov.uk Web: http://naturalresourceswales.gov.uk
Caldicot & Wentlooge Internal Drainage Board	Pye Corner Broadstreet Common Nash Newport NP18 2BE Phone number: 01633 275922 Fax: 01633 281155 Email: admin@caldandwentidb.gov.uk Website: www.caldandwentidb.gov.uk

Dŵr Cymru Welsh Water	Pentwyn Road Nelson Treharris CF46 6LY Phone Number (Head office): 01443 452300 Phone Number (Bill/account and general enquiries): 0800 052 0145 Phone Number (Bill/account / enquiries Cymraeg): 0800 052 6058 Phone Number (Reporting a leak): 0800 281 432 Phone Number (Sewerage services and emergencies): 0800 085 3968 Website: www.dwrcymru.co.uk
Welsh Government - South Wales Trunk Road Agent	12a Llandarcy House The Courtyard Llandarcy Neath SA10 6EJ Phone Number: 0845 602 6020 Email: enquiries@southwales-tra.gov.uk Website: http://www.swtra.co.uk/homepage.htm

Appendix C. Record of Consultation Responses

C.1. Consultation Responses

Consultee	Comments
Adrian Robson Independent Councillor for Rhiwbina and Pantmawr	Support the draft flood strategy
Prescott Jones Insurance Brokers	Welcome the Consultation Document and many of the measures Suggest setting up emergency contact links with the insurance industry (companies, loss adjusters, BIBA) to help get those affected by flooding recover from major incidents quicker.

C.2. Statutory Consultees

Consultee	Comments
EAW	Develop opportunities for green infrastructure and the connectivity of networks
	Delivery of measures relies heavily on other production and implementation of other activities e.g. actions in Flood Risk Management Plans, updating guidance and partnership working of others – consider other aspects / gaps and incorporate in the Strategy.
	Natural Resources Wales references
	S3.2 does not appear to include Ordinary Watercourses
	Existing culverts should wherever practicable be restored to open channels. Refer to EAW Culverting Policy.
	Exec Summary piii / s5.2.3 Priorities – reduce the consequences of flooding through hard engineering and design schemes Make reference to the preference of sustainable defences which benefit the local environment including soft engineering solutions.
	Consider an earlier review of the Strategy in 2017 instead of 2021 – to coincide with National FCERM Strategy.
EAW comments on WFD assessment	WFD assessment – appendix H table 1 Cardiff Bay is UWWT protected area
	WFD assessment – conclusions Mitigation measures are key to implementation of schemes
CCW comments on Strategy (via EAW response)	The Local Strategy documents do not take into account the historic landscape of the Gwent Levels.
	Consideration for protected species is a major omission and we recommend they be assessed as part of this document
CCW comments on SEA	4.2.2 – green spaces and biodiversity Please note that this resource is also important for biodiversity and ecological connectivity. We very much welcome the reference to protected species. However, the paragraph about species ends mid-sentence
	4.8 – landscape, land use and soil We encourage reference to the role that soil sealing can have in exacerbating flood risk (see also next comment)

Consultee	Comments
	Table 5.1 – key issues and trends Human health – As well as 'safeguarding' open space, we suggest that the LFRMS has the potential to contribute to the **creation** of open space that could be used for recreation purposes. Green spaces and local biodiversity – The importance of connectivity between green space/habitats should also be recognised, as should the need to consider the spread of non-native invasive species. Landscape, Land Use and Soil – As well as conserving and enhancing 'landscape character', the LFRMS should seek opportunities regarding conserving and enhancing designated landscapes. There are constraints missing for 'Soil' – these include soil sealing, loss of agricultural land and soil degradation with resulting loss of soil function
	7.2 – testing the measures and actions Opportunities for additional measures that focus more directly on working with the natural environment, such as provision of advice and guidance on land use management, environmental enhancement, habitat restoration and creation.
	7.3 – environmental effects of the preferred strategy Reassurance that the proposed mitigation measures are being incorporated into the Strategy, measures and actions
	8.0 – mitigation measures Same as above
	Table 9.1 – data requirements and monitoring 'All LFRMS measures to have considered the effects on natural processes and biodiversity' is not currently specific or measurable Suggest the following additions/amendments:- Biodiversity, flora and fauna – in order to cover the full scope of the SEA Objective, it would be helpful to include a species indicator. Landscape, Land Use and Soil – we suggest an indicator that focuses on designated landscapes (as well as landscape character).
	Appendix C - Record of consultation responses We look forward to seeing a record of consultation responses when available.
Changes to SEA	Need to consider if changes to SEA are 'significant' and would require the production of a revised Environmental Report. This is a required part of the SEA Directive. CC must make this decision as they are the competent authority.
CCW comments on HRA	Formatting issues Executive summary – not included Appendix G appears in the body of the document and not as an appendix

Consultee	Comments
	There is no consideration of surface water flooding within the Gwent Levels. This should be included in in-combination considerations
	Introduction References to legislation are not up to date
	2 – purpose of LFRMS Consideration should be given to the role of coastal processes (tides and storm surges) on flood risk and hazard from terrestrial sources and the potential implications of surface water flooding and riparian flood events on water quality in coastal areas
	3 – Cardiff beech woods SAC, not Garth Wood SSSI is bisected by the A470 and the River Taff
	Appendix G table 3 – Severn Estuary Ramsar Recommend table is replaced by table 5 from the R33 advice
	Note that sea trout and eel are part of the species assemblage feature of the Severn Estuary SAC. Flood measures that might compromise the life cycle of eel or sea trout should be included in the HRA
	Note and concur with the intention to consider impacts at the project stage. The HRA should identify those issues that need to be considered at the project stage. CCW agrees that for certain operations of the LFRMS EIA and HRA should be carried out on each scheme to identify project specific risks and mitigations. CCW advises that it is acceptable and desirable to include appropriate avoidance and/or mitigation in this HRA. This may include policy caveats to the strategy, including deferring statutory assessments to lower tier plans and projects.
	Regulation 33 advice reference – this is now Regulation 35 in the new Regulations
	An assessment of the potential effects has been carried out... We have concerns about this approach. The assessment of potential effects has been carried out against operations that may cause deterioration/disturbance to the features of the protected sites rather than against the relevant conservation objectives Appendix G table 9 – as above Assessment should consider effects on the individual features of the site not just the site as a whole
	Mitigation measures based on the assumption that mitigation and compensation under SMP2 and SEFRMS are implemented as planned. SMP2 has not been signed off and HRA for FRMS has not been agreed. We advise that it is not appropriate to rely on mitigation and/or compensation relating to other yet to be agreed/adopted plans in respect of the HRA of the CC LFRMS 7 – conclusion – concerns about relying on mitigation for other as yet unadopted plans and deferring assessment down to lower tier plans of the CC LFRMS at this time with respect to the Severn Estuary sites
	Appendix G table 8 Measures listed in the table do not correlate with the measures in the draft LFRMS

Consultee	Comments
	6 - in combination effects / conclusion Background graphic makes text difficult to read
	6 – in combination effects Recommend other relevant plans and their associated projects are included namely: water companies' water resource plans, drought plans, relevant LDPs and flood plans from neighbouring LAs

Appendix D. National Strategy Objectives

Table 1. National Strategy Objectives

Main Objective	Sub Objective	Measure	Lead delivery body
Reducing the impacts on individuals, communities, businesses and the environment from flooding and coastal erosion	**Provide Strategic Leadership and Direction at a local Level**	Development of Local Flood Risk Management Strategies.	Lead Local Flood Authorities
		Implementation of statutory responsibilities including those set out within the Flood and Water Management Act 2010 and the Flood Risk Regulations.	Risk Management Authorities
		Appropriate mapping of all sources of flood risk. (includes local flood risk mapping)	Welsh Government
	Develop policies for effective land use management and enhanced development control procedures where appropriate	Development of Local Development Plans that include adequate provisions in respect of flood and coastal erosion risk.	Local Planning Authorities
		Compliance with the requirements of Planning Policy Wales and relevant Technical Advice Notes.	Local Planning Authorities
		Appropriate undertaking of Strategic Flood Consequence Assessments and their use to inform Local Development Plans.	Local Planning Authorities
		Approval and adoption of SuDS drainage systems by the SuDS Approving and Adopting Body.	SuDS Approving and Adopting Body (Local Authorities)
	Establish regular maintenance schedules for flood and coastal erosion risk management assets	Development of a register of natural and manmade structures or features likely to have an effect on flood risk by 2015.	Lead Local Flood Authorities
		Establishment of a programme of regular and appropriate maintenance for flood and coastal erosion risk management assets.	Risk Management Authorities (in relation to their own assets)
		Designation of natural and manmade structures or features likely to have an effect on flood or coastal erosion risk over the life of the Strategy.	Lead Local Flood Authorities
Raising awareness of and engaging people in the response to flood and coastal erosion risk	**Ensure that by 2026 everyone who lives in a flood risk area understands the flood risk they are subject to, the consequences of this risk and how to live with that risk**	Programme of community based awareness and engagement activities, utilising the Flood Risk Management Community Engagement Toolkit.	Environment Agency, Lead Local Flood Authorities
		Identification of at risk groups within communities, including vulnerable individuals.	Lead Local Flood Authorities
Providing an effective	**Ensure the preparation**	Complete emergency plans for all	Category 1 and 2 responders

and sustained response to flood and coastal erosion events	**and testing of Emergency Plans**	sources of flood risk.	under the Civil Contingencies Act
		Local level emergency exercises to test response and recovery arrangements over the life of the Strategy.	Category 1 and 2 responders under the Civil Contingencies Act
	Respond to events in a timely and appropriate manner	Early and appropriate response to emergency events for all events.	Category 1 and 2 responders under the Civil Contingencies Act
		Development and implementation of effective evacuation protocols for emergency events	Category 1 and 2 responders under the Civil Contingencies Act
		Development of mutual aid protocols for resources, equipment and respite for emergency events.	Category 1 and 2 responders under the Civil Contingencies Act
		Identification and provision of suitable respite accommodation as appropriate over the life of the Strategy.	Category 1 and 2 responders under the Civil Contingencies Act
	Facilitate recovery from flooding within the shortest possible timescales	Development of procedures for the effective clearance of debris.	Lead Local Flood Authorities
		Development of repair schedules including provision for the installation of resilient measures by 2015.	Lead Local Flood Authorities
		Investigations into the causes of flooding to be undertaken where necessary within one month.	Lead Local Flood Authorities

Appendix E. Local Flood Risk Strategy Appraisal Tables

E.1. Objectives v Measures assessment matrix

Main Objective	Sub Objective	Measure	Action ref	Current Actions	Planned Actions	Do-Nothing	Business As Usual	Do More	Preferred Approach	Related Strategy Delivery Activity this would support (see Delivery Themes)	Short Term Current LFRMS 2012-2016	Short Term LFRMS 2 2016-2021	Short Term LFRMS 3 2021-2031	Medium Term	Long Term
1 - Reducing the impacts on individuals, communities, businesses and the environment from flooding and coastal erosion	**2 - Provide Strategic Leadership and Direction at a local Level**	Delivery of the second round of Shoreline Management Plans by 2012 with proportionate implementation over the life of the Strategy	**1.2.1**		SMP2 Action - Encourage Cardiff Harbour Authority to undertake an assessment of climate change impacts on the operation and performance of Cardiff Barrage taking account of the impacts on flood risk management. The costs of maintaining the Barrage should be included in any investigation	Continue Barrage operation without review of climate change impacts	Current Barrage operation includes an assessment of global sea level rise. Advice and consultation with EA is that there are no current issues with respect to climate change	Review of forecast change in sea levels from Barrage Construction to current-day and current guidance in comparison with advice provided when the Barrage permissions were granted	**Business As Usual**	**5.3**					
			1.2.2		SMP2 Action - Carry out a study to determine the effects (if any) of the Cardiff Barrage on sediment transport in adjacent units (SMP1 recommendation).		Sediment and bathymetry surveys are carried out annualy to monitor the changes in the bed morphology on the navigable approaches to the barrage.	Commission ongoing monitoring and reporting of the wider estuary system possibly with support from Wales Coastal Monitoring Centre	**Business As Usual**	**5.3**					
		Development of Local Flood Risk Management Strategies.	**1.2.3**	The work being undertaken as part of this assessment is the development of the Local Flood Risk Strategy			Development of Local Flood Risk Management Strategies.		**Business As Usual**	**5.3**	**x**				
		Implementation of statutory responsibilities including those set out within the Flood and Water Management Act 2010 and the Flood Risk Regulations.	**1.2.4**	We have delivered our PFRA which identifies the key risk areas. Further actions identified within the LFRMS will help us continue to deliver this objective			We have delivered our PFRA which identifies the key risk areas. Further actions identified within the LFRMS will help us continue to deliver this objective		**Business As Usual**	**6.1**	**x**				
		Appropriate mapping of all sources of flood risk.	**1.2.5**	PFRA has been completed and our local risk areas identified	NRW are currently supporting all LLFA across Wales to deliver Hazard mapping of Local Flood Risk - June 2013 We will use these maps to help plan options to manage that risk - Dec 2015 (in line with the programme set out in the Flood Risk Regulations)		NRW are currently supporting all LLFA across Wales to deliver Hazard mapping of Local Flood Risk - June 2013 We will use these maps to help plan options to manage that risk - Dec 2015 (in line with the programme set out in the Flood Risk Regulations)		**Business As Usual**	**5.6**	**x**				

Main Objective	Sub Objective	Measure	Action ref	Current Actions	Planned Actions	Do-Nothing	Business As Usual	Do More	Preferred Approach	Related Strategy Delivery Activity this would support (see Delivery Themes)	Short Term Current LFRMS 2012-2016	Short Term LFRMS 2 2016-2021	Short Term LFRMS 3 2021-2031	Medium Term	Long Term
		Proportionate implementation of the Catchment Flood Management Plans over the life of the Strategy.	1.2.6		CFMP Action - Roath Park Lake, undertake an assessment of climate change impacts on the operation and performance of the reservoir system with particular consideration of the impacts on flood risk management.		Reporting and assessment in accordance with the requirements of the Reservoirs Act	Review current operations and the potential need for change to allow for climate change	Do More	5.6		x			
			1.2.7		CFMP Action - Develop a Cardiff East Flood Risk Management Strategy to identify short, medium and long term actions, identifying where investment should be targeted to ensure sustainable growth of the area.			Support NRW in developing a sustainable FRM strategy which encompasses all flooding sources	Do More	5.3		x			
			1.2.8		CFMP Action - Asset / Flood Warning System Improvement and Replacement Project (pre-feasibility studies) to assess the viability of flood mitigation measures through Cardiff (Lower Roath Brook and River Rhymney)			Support NRW in understanding and developing proposed solutions which provide the most cost-effective benefit to Cardiff	Do More	2.2	x	x			
		reduction of number of properties identified at risk of flooding from Local Flood Risk sources	1.2.9	Pre-feasibility studies Post flood reports Identified Schemes include - Rhiwbina Flood Defence Scheme - Grangetown SW reduction - Riverside Flood Awareness	Review output from Hazard Mapping and prepare Medium Term Plan for potential schemes		Continue to investigate and identify potential schemes with schemes being delivered on an ad-hoc basis	Contnue to investigate and identify potential schemes with schemes annual budget provided to deliver to identified programme - delivers requirements of Flood Risk Regulations	Do More	5.6	x				
		Link with wider work undertaken with regards making Cardiff a more resilient and sustainable area to live	1.2.10	Existing plans in place which can interact with this Strategy include - One Planet - City Vision - CC Carbon Lite	The SEA for the Strategy records the integral process how the wider plans can impact and influence decisions in developing this strategy		Use the SEA process to record how other plans have influenced this Strategy	Ensure that Actions are captured which provide synergy across various plans to devlier a more resilient Cardiff. Specifics include -	Do More	6.1	x				
			1.2.11		Ensure all Services Areas are aware of the potential impact of flood risk and consider its impact within their decision making process		ad-hoc process for some Service Areas. No evidence provided of recorded decision	All Service Areas to document how flood risk affects their operations, and decision process to manage the risk	Do More	3.2					

Main Objective	Sub Objective	Measure	Action ref	Current Actions	Planned Actions	Do-Nothing	Business As Usual	Do More	Preferred Approach	Related Strategy Delivery Activity this would support (see Delivery Themes)	Short Term Current LFRMS 2012-2016	Short Term LFRMS 2 2016-2021	Short Term LFRMS 3 2021-2031	Medium Term	Long Term
		Reduce Corporate liability to Cardiff Council related to the impact of flood risk (and related aspects such as climate change)	**1.2.12**		Include flood risk as part of any review process	Corporate liability could increase such that it is not an accepted "insurable risk" resulting in financial ocnsequence to the county	Current level of action appears to be minimal and based on historic control measures. Uncertain at present what the financial consequence may be.	Include flood risk (and related changes over time due to climate change) within the development and review of all the Council's actions such that they can be altered if necessary	**Do More**	**3.2**		**x**			
	3 - Develop policies for effective land use management and enhanced development control procedures where appropriate	Preparation of Supplementary Planning Guidance to help manage flood risk	**1.3.1**	Our LDP is currently being prepared and a SFCA has been developed which has informed the spatial planning allocations within the LDP	We will prepare & update our Supplementary Planning Guidance to account for - Climate Change - SuDS Systems (as below) - Design standards (as below) - Localised issues where applicable - Funding contributions for wider investments in FRM infrastructure		Continue to recieve planning submissions and provide retrospective guidance on an ad-hoc basis	Prepare SPG as detailed within the planned action leading to better informed and quicker planning application process	**Do More**	**1.1**		**x**		
		Compliance with the requirements of Planning Policy Wales and relevant Technical Advice Notes.	**1.3.2**	Our Planning teams ensure proposed developments satisfy the requirements of PPW and relevant TAN's, namely TAN14 & TAN15			Our Planning teams ensure proposed developments satisfy the requirements of PPW and relevant TAN's, namely TAN14 & TAN15	Planning teams will deliver SAB duties as well	**Business As Usual**	**1.1**	**x**				
		Appropriate undertaking of Strategic Flood Consequence Assessments and their use to inform Local Development Plans.	**1.3.3**	Our LDP is currently being prepared and a SFCA has been developed which has informed the spatial planning allocations within the LDP			Our LDP is currently being prepared and a SFCA has been developed which has informed the spatial planning allocations within the LDP		**Business As Usual**	**1.2**		**x**			
			1.3.4	SMP2 action - SMP2 is taken into account in Strategic Flood Consequence Assessments for Council development / land use plans			SMP2 action - SMP2 is taken into account in Strategic Flood Consequence Assessments for Council development / land use plans		**Business As Usual**	**5.3**		**x**			

Main Objective	Sub Objective	Measure	Action ref	Current Actions	Planned Actions	Do-Nothing	Business As Usual	Do More	Preferred Approach	Related Strategy Delivery Activity this would support (see Delivery Themes)	Short Term Current LFRMS 2012-2016	Short Term LFRMS 2 2016-2021	Short Term LFRMS 3 2021-2031	Medium Term	Long Term
		Approval and adoption of SuDS drainage systems by the SuDS Approving and Adopting Body.	1.3.5		We will prepare & update our Supplementary Planning Guidance to account for the National Standards which are currently being drafted. We will need to have in place a process and staff to review applications	Legislative requirement - not an option	Allow Planning to process applications following similar system fo current day - ad-hoc response, potential delays in processing or acceptance of long-term poor quality systems	Require potentially 2- 4 FTE to review and monitor applications - allows for follow up enforcement	Do More	1.6	x				
	4 - Establish regular maintenance schedules for flood and coastal erosion risk management assets	Development of a register of natural and manmade structures or features likely to have an effect on flood risk by 2015.	1.4.1		We are currently planning how the register will be developed working in partnership with other S East Wales Local Authorities. **We will need to budget for ongoing inspection and updating of the register**	Legislative requirement - not an option		Develop initial register using available software and update when necessary (passive approach). Use powers, and enforcement where required to manage risk	Do More	4.1	x				
			1.4.2	Alterations to the highway by all parts of the Council are poorly recorded and controlled. Poor record keeping and updating of corporate systems / dept co-ordination leads to inefficent budget spending		Business as usual	Contine to need to carry out defect repairs / alterations to works to manage drainage issues	Implement system to ensure drainage aspects are considered as part of any proposal which affects the highway	Do More	4.1	x				
			1.4.3		review and confirm defined extents of Coastal Act defined waters and those defined within the Barrage Act	uncertainty with regards operational liability of coastal frontage erosion risk	uncertainty with regards operational liability of coastal frontage erosion risk	Review and confirm coastal waters defined limits	Do More	4.1					
			1.4.4	Removal of debris removal from Cardiff Bay that has been washed down from upstream - results in large expenditure liability to CHA	Review upstream LLFA actions to manage debris from entering the rivers in the first place		Continue to remove debris from the Bay on a visual amenity basis.	Provide evidence to upstream authorities and highlight the operational issue to try and control debris at source	Do More	4.1	x				

Main Objective	Sub Objective	Measure	Action ref	Current Actions	Planned Actions	Do-Nothing	Business As Usual	Do More	Preferred Approach	Related Strategy Delivery Activity this would support (see Delivery Themes)	Short Term Current LFRMS 2012-2016	Short Term LFRMS 2 2016-2021	Short Term LFRMS 3 2021-2031	Medium Term	Long Term
			1.4.5		SMP2 action - Identify how the Wales Coastal path could be re-routed under MR options			review options and include within future Plans / Spatial reviews	Do More	4.1				x	
		Establishment of a programme of regular and appropriate maintenance for flood and coastal erosion risk management assets.	1.4.6	We currently have a maintenance programme in place which reviews our land and highway drainage assets.	We propose to review how the maintenance programme is established to see if there are more efficient approaches that we can adopt	Business as usual	continue carrying out maintainance and repairs following ad-hoc systems / routine that have been in place without review since the council was established	Highway Drainage - review how works are planned and what their Planned Outcome is Land Drainge - determine level of service and necessary maintance Ordinary Watercourse - culvert clearance is carried out at priority sites, review system to assess if this can be updated Coastal - review potential risk from erosion	Do More	4.2	x				
			1.4.7		SMP2 action - Identify where new defences will need to be, when they will need to be replaced, how they should be constructed			Coastal - review potential risk from erosion, and undertake necessary works	Do More	5.1	x - review	x - works			
			1.4.8		SMP2 action - Ensure environmental issues are taken into account in the design / construction of new defences. Ensure any works adhere to agreed working practices e.g. to prevent disturbance to birds		SMP2 action - Ensure environmental issues are taken into account in the design / construction of new defences. Ensure any works adhere to agreed working practices e.g. to prevent disturbance to birds		Business As Usual	5.1	x				

Main Objective	Sub Objective	Measure	Action ref	Current Actions	Planned Actions	Do-Nothing	Business As Usual	Do More	Preferred Approach	Related Strategy Delivery Activity this would support (see Delivery Themes)	Short Term Current LFRMS 2012-2016	Short Term LFRMS 2 2016-2021	Short Term LFRMS 3 2021-2031	Medium Term	Long Term
			1.4.9		SMP2 action - Ensure environmental issues are taken into account in the management of the Cardiff Barrage. Ensure any works adhere to agreed working practices e.g. to prevent disturbance to birds		Environmental issues are taken into account in the management of the Cardiff Barrage.	Continue to review Barrage operation	Business As Usual	5.1		x			
		Designation of natural and manmade structures or features likely to have an effect on flood or coastal erosion risk over the life of the Strategy.	1.4.10		We are currently planning how the register will be developed working in partnership with other S East Wales Local Authorities. We will need to budget for ongoing inspection and updating of the register	Legislative requirement - not an option		We are currently planning how the register will be developed working in partnership with other S East Wales Local Authorities. We will need to budget for ongoing inspection and updating of the register	Do More	4.2	x				
2 - Raising awareness of and engaging people in the response to flood and coastal erosion risk	5 - Ensure that by 2026 everyone who lives in a flood risk area understands the flood risk they are subject to, the consequences of this risk and how to live with that risk	Programme of community based awareness and engagement activities, utilising the Flood Risk Management Community Engagement Toolkit.	2.5.1	CFMP Action - We have recently prepared a Community Flood Plan for **Rhiwbina.**We are working in partnership with EA Wales Flood Awareness team.- Grangetown- Riverside- Wentlooge Levels (planned)	We will review if there are other communities who could benefit from a community plan. This will be informed by the hazard mapping being completed to define local flood risk following on from the PFRA.This is also a CFMP Action	Do not continue to support NRW at a local level	Continue to support NRW at a Local Level	Support NRW and canvas awareness and feedback from residents that they are aware through the "Ask Cardiff" annual questionnaire	Do More	6.1	x				
		Identification of at risk groups within communities, including vulnerable individuals.	2.5.2	We identified the number of properties of key types within our PFRA.	We will review these groups and working with our public bodies identify approaches which will assist in getting the message to the identified people	Level of economic impact due to flooding to Cardiff would increase	Whilst we would be aware of the properties at-risk, there will remain an economic impact due to flooding that we could potentially avoid	Through Emergency Planning and Corporate Comms we can ensure the businesses are aware of the risk, and the actions they can take to reduce the impact	Do More	2.1	x				
		Raise awareness internally with regards impact of flood risk on normal operations and post event situations	2.5.3	informal discussion on an ad-hoc basis	Development of specific awareness and review programme across all service areas to be carried out by Emergency Planning Unit	Operational cost due to flooding to Cardiff Council would increase	Operational cost due to flooding to Cardiff Council would increase	informal discussion on an ad-hoc basis - would lead to likely reduction in operational cost	Do More	6.1	x				

Main Objective	Sub Objective	Measure	Action ref	Current Actions	Planned Actions	Do-Nothing	Business As Usual	Do More	Preferred Approach	Related Strategy Delivery Activity this would support (see Delivery Themes)	Short Term Current LFRMS 2012-2016	Short Term LFRMS 2 2016-2021	Short Term LFRMS 3 2021-2031	Medium Term	Long Term
		Continuation and expansion of Floodline Warning Direct Service of the life of the Strategy	2.5.4	How do we make the people of Cardiff aware of the Floodline Service??	Work with NRW to promote the system	Level of economic impact due to flooding to Cardiff would increase	Work with NRW to promote the system		Business As Usual	2.2	x				
3 - Providing an effective and sustained response to flood and coastal erosion events	7 - Ensure the preparation and testing of Emergency Plans	Complete emergency plans for all sources of flood risk.	3.7.1	We have an established emergency planning procedure in place for major emergencies, including flooding.			We have an established emergency planning procedure in place for major emergencies, including flooding.		Business As Usual	2.4	x				
		Development of community level emergency plans as required by relevant communities	3.7.2	We are working with NRW on the development of community level emergency plans for identified key risk areas such as Grangetown, Butetown and Rhiwbina	others???		We are working with NRW on the development of community level emergency plans for identified key risk areas such as Grangetown, Butetown and Rhiwbina		Business As Usual	2.5	x				
		A pan-Wales emergency exercise to test reponse and recovery arrangements by 2016	3.7.3	We are working with the Welsh Government to plan for and carry out this exercise before 2016			We are working with the Welsh Government to plan for and carry out this exercise before 2016		Business As Usual	2.6	x				
		Local level emergency exercises to test response and recovery arrangements over the life of the Strategy.	3.7.4	We completed an exercise early in 2012 to test our proposed actions. This was successful in identifying some improvements we can apply to our plans.			Carry out the exercise again in 5 years	Review within 12 months that the identifed changes to our plan are in place and can be built on	Do More	2.4	x				
	8 - Respond to events in a timely and appropriate manner	Early and appropriate response to emergency events for all events.	3.8.1	We completed an exercise early in 2012 to test our proposed actions. This was successful in identifying some improvements we can apply to our plans.	we will continue to test and review our proposed plans, and discussion with adjacent local authorties with regards the potential need to mutual support when required		we will continue to test and review our proposed plans, and discussion with adjacent local authorties with regards the potential need to mutual support when required		Business As Usual	2.4	x				

Main Objective	Sub Objective	Measure	Action ref	Current Actions	Planned Actions	Do-Nothing	Business As Usual	Do More	Preferred Approach	Related Strategy Delivery Activity this would support (see Delivery Themes)	Short Term Current LFRMS 2012-2016	Short Term LFRMS 2 2016-2021	Short Term LFRMS 3 2021-2031	Medium Term	Long Term
		Development and implementation of effective evacuation protocols for emergency events	3.8.2	We have an established emergency planning procedure in place for major emergencies, including flooding.			Development and implementation of effective evacuation protocols for emergency events		Business As Usual	2.4	x				
		Development of mutual aid protocols for resources, equipment and respite for emergency events.	3.8.3		we will continue to test and review our proposed plans, and discussion with adjacent local authorties with regards the potential need to mutual support when required		we will continue to test and review our proposed plans, and discussion with adjacent local authorties with regards the potential need to mutual support when required		Business As Usual	2.6	x				
		Identification and provision of suitable respite accommodation as appropriate over the life of the Strategy.	3.8.4	We have an established emergency planning procedure in place for major emergencies, including flooding.	we will continue to test and review our proposed plans, and discussion with adjacent local authorties with regards the potential need to mutual support when required		we will continue to test and review our proposed plans, and discussion with adjacent local authorties with regards the potential need to mutual support when required		Business As Usual	2.4	x				
	9 - Facilitate recovery from flooding within the shortest possible timescales	Development of procedures for the effective clearance of debris.	3.9.1				Development of procedures for the effective clearance of debris.		Business As Usual	4.3	x				
		Development of repair schedules including provision for the installation of resilient measures by 2015.	3.9.2				Development of repair schedules including provision for the installation of resilient measures by 2015.		Business As Usual	4.2	x				
		Investigations into the causes of flooding to be undertaken where necessary within one month.	3.9.3	we investigate on an ad-hoc basis	we will prepare a publically available policy that sets out our proposed investigation (detail of) in the event of flooding to properties by sources within our control.			Working with adjacent LLFA we are developing a policy / report template such that there is a consistent adopted approach across SE Wales	Do More	5.1	x				

Main Objective	Sub Objective	Measure	Action ref	Current Actions	Planned Actions	Do-Nothing	Business As Usual	Do More	Preferred Approach	Related Strategy Delivery Activity this would support (see Delivery Themes)	Short Term Current LFRMS 2012-2016	Short Term LFRMS 2 2016-2021	Short Term LFRMS 3 2021-2031	Medium Term	Long Term
		Post flood-event recovery plan in place	3.9.4		Recovery plan in plans and adopted by Strategic Management Team. Test exercise required involving all service areas and outside key agencies		Outline plan prepared but not adopted by SMT. No testing of the plan to review its effectiveness	Recovery plan in plans and adopted by Strategic Management Team. Test exercise required involving all service areas and outside key agencies	Do More	3.4	x				
4 - Prioitising investment in the most at risk communities	Local 1 - External funding	Contribution funding from third-parties / non-public sources	4.L1.1		Use SFCA findings to leverage funding contributions where investment could release development sites andreduce level of flood risk to existing areas		Continue to seek investment from public purse with minimal third-party contribution	Develop Policy for recovery / receipt of funding contributions either directly via S106 agreements, or recovery through future rate levy with developer guarantees (TIF etc)	Do More	6.1	x	x			

E.2. Delivery Themes & Measures priority assessment

Approach

Prioritisation has been assessed based on the following criteria

- Delivery Activities are grouped within related Delivery Themes (Table 2 in the published guidance)
    - the number of Objectives a potential Delivery Activity may support (see first two tables on the following pages for assessment of contributing Objectives) has been counted
    - the average number of Objectives a Delivery Theme contributes to has been determined. Higher score equates to contributing to more Objectives

- The delivery timescale for the activities has been scored based on the following criteria (see the third table on the following pages for allocation of time period).
        - Short term = 5
        - Medium term = 3
        - Long term = 1
    - these weighted scores were then also averaged by Delivery Theme. Higher score equates to earlier actions

- The priority "score" for each Delivery Theme has been taken as the product of the two averaged values, with the top 3 scores selected to identify the top 3 Delivery Themes

- A separate exercise has identified the Delivery Activity and Measure is associated with (see the matrix included in Appendix E1)
    - The related Measures have then been identified as the priority ones based on their contribution to the assessed priority Delivery Themes.

The following tables set out the above assessments

LFRM Objectives & Activities

Delivery Theme	Ref	Activities	Activity Type	National Objectives (N)			
				Reducing the Consequences (N1)	Raising Awareness & Engaging People (N2)	Providing Effective & Sustained Response (N3)	Prioritising Investment (N4)
Development Planning and Adaptation	1.1	Sustainable & Strategic Development Planning, LDP	Prevention	Y			
	1.2	SFRA / SFCA	Prevention	Y			
	1.3	Water Cycle Strategy	Prevention	Y (N/A in Wales?)			
	1.4	Relocation	Prevention	Y			
	1.5	Minerals & Waste Plan	Prevention	Y			
	1.6	Sustainable Urban Drainage (SUDS)	Prevention	Y			
Flood Forecasting & Response	2.1	Flood Awareness	Preparedness	Y	Y		
	2.2	Flood Warning	Preparedness	Y	Y		
	2.3	Flood Forecasting	Preparedness	Y	Y	Y	
	2.4	Emergency Response Plans	Preparedness	Y		Y	
	2.5	Community Flood Plans	Preparedness	Y	Y	Y	
	2.6	Multi Agency Flood Plans	Preparedness	Y		Y	
Land, Cultural & Environmental Management	3.1	Land Management	Prevention	Y			
	3.2	Resilience	Preparedness	Y		Y	
	3.3	Resistance	Protection		Y	Y	
	3.4	Restoration	Prevention			Y	
	3.5	Environmental Enhancement	Prevention				Y
	3.6	Water Level Management Plans	Protection	Y			
	3.7	Habitat Creation	Protection				Y
Asset Management & Maintenance	4.1	Asset Management Plans	Protection				Y
	4.2	Defence / Structure Management	Protection	Y			Y
	4.3	Channel Maintenance	Prevention	Y			
	4.4	Culvert Maintenance	Prevention	Y			
Studies, Assessments & Plans	5.1	Investigation	Preparedness	Y			Y
	5.2	Risk Assessments	Preparedness	Y	Y		Y
	5.3	Strategy Plan	Preparedness	Y			
	5.4	Local Property level flood mitigation - resilience	Preparedness	Y	Y	Y	
	5.5	Local Property level flood mitigation - resistance	Protection	Y	Y	Y	
	5.6	Pre Feasibility Studies / Feasibility Studies	Preparedness	Y			Y
	5.7	Project Plans - Option Appraisals	Preparedness	Y			Y
	5.8	SWMPs linking to SMPs	Preparedness	Y			Y
High Level Awareness & Engagement	6.1	Partnership Working	Preparedness	Y	Y	Y	Y
Monitoring	7.1	Monitoring - Waves, Beaches, Aerial Photography and Topographical Surveys	Preparedness	Y			Y
	7.2	Habitats Monitoring	Preparedness	Y			
	7.3	Topographic survey	Preparedness			Y	
	7.4	Aerial surveys	Preparedness				Y

				Flood Risk Objectives								
				Social (S)				Economic EC)		Environmental (EN)		
Delivery Theme	**Ref**	**Activities**	**Activity Type**	**Reduce Distress (S1)**	**Reduce Community Disruption (S2)**	**Reduce Risk to Life (S3)**	**Reduces Disruption to Critical Services (S4)**	**Reduce Economic Damage (EC1)**	**Reduce Cost of Management (EC2)**	**Reduces Damages to SSSIs etc (EN1)**	**Improve Naturalness (EN2)**	**WFD Objectives met (EN3)**
Development Planning and Adaptation	1.1	Sustainable & Strategic Development Planning, LDP	Prevention	Y	Y	Y	Y	Y	Y			
	1.2	SFRA / SFCA	Prevention	Y	Y	Y	Y	Y	Y			
	1.3	Water Cycle Strategy	Prevention	Y	Y	Y	Y	Y	Y			
	1.4	Relocation	Prevention		Y	Y	Y	Y				
	1.5	Minerals & Waste Plan	Prevention	Y	Y	Y	Y	Y				
	1.6	Sustainable Urban Drainage (SUDS)	Prevention	Y	Y	Y	Y	Y		Y	Y	Y
Flood Forecasting & Response	2.1	Flood Awareness	Preparedness	Y	Y	Y	Y	Y	Y			
	2.2	Flood Warning	Preparedness	Y	Y	Y	Y	Y	Y			
	2.3	Flood Forecasting	Preparedness	Y	Y	Y	Y	Y	Y			
	2.4	Emergency Response Plans	Preparedness	Y	Y	Y	Y	Y		Y		
	2.5	Community Flood Plans	Preparedness	Y	Y	Y	Y	Y		Y		
	2.6	Multi Agency Flood Plans	Preparedness	Y	Y	Y	Y	Y				
Land, Cultural & Environmental Management	3.1	Land Management	Prevention		Y	Y	Y	Y		Y	Y	Y
	3.2	Resilience	Preparedness	Y	Y	Y	Y	Y				Y
	3.3	Resistance	Protection	Y	Y	Y	Y	Y		Y		Y
	3.4	Restoration	Prevention	Y	Y		Y	Y		Y		Y
	3.5	Environmental Enhancement	Prevention					Y		Y	Y	Y
	3.6	Water Level Management Plans	Protection	Y	Y	Y	Y	Y		Y	Y	Y
	3.7	Habitat Creation	Protection							Y	Y	Y
Asset Management & Maintenance	4.1	Asset Management Plans	Protection		Y	Y	Y	Y		Y	Y	Y
	4.2	Defence / Structure Management	Protection		Y	Y	Y	Y				
	4.3	Channel Maintenance	Prevention	Y	Y	Y	Y	Y		Y	Y	Y
	4.4	Culvert Maintenance	Prevention	Y	Y	Y	Y	Y				Y
Studies, Assessments & Plans	5.1	Investigation	Preparedness	Y	Y	Y	Y	Y				
	5.2	Risk Assessments	Preparedness	Y	Y	Y		Y		Y		Y
	5.3	Strategy Plan	Preparedness	Y	Y	Y	Y	Y	Y	Y	Y	Y
	5.4	Local Property level flood mitigation - resilience	Preparedness	Y	Y	Y	Y	Y				
	5.5	Local Property level flood mitigation - resistance	Protection	Y	Y	Y	Y	Y				
	5.6	Pre Feasibility Studies / Feasibility Studies	Preparedness	Y	Y	Y	Y	Y		Y		Y
	5.7	Project Plans - Option Appraisals	Preparedness	Y	Y	Y	Y	Y		Y		Y
	5.8	SWMPs linking to SMPs	Preparedness	Y	Y	Y	Y	Y		Y		Y
High Level Awareness & Engagement	6.1	Partnership Working	Preparedness	Y	Y	Y	Y	Y	Y	Y	Y	Y
Monitoring	7.1	Monitoring - Waves, Beaches, Aerial Photography and Topographical Surveys	Preparedness		Y		Y	Y	Y	Y		Y
	7.2	Habitats Monitoring	Preparedness					Y		Y		Y
	7.3	Topographic survey	Preparedness						Y			
	7.4	Aerial surveys	Preparedness							Y	Y	Y

Delivery Theme	Ref	Activities	Activity Type	Timescales				
				0-5	5-10	10-20	20-50	50-100Yrs
				Prioritisation - Short Term (Current LFRMS) 2012-2016	Prioritisation - Short Term (LFRMS 2) 2016-2021	Prioritisation - Short Term (LFRMS 3) 2021-2031	Medium Term	Long Term
Development Planning and Adaptation	1.1	Sustainable & Strategic Development Planning, LDP	Prevention	**0-5yrs**				
	1.2	SFRA / SFCA	Prevention	**0-5yrs**				
	1.3	Water Cycle Strategy	Prevention		**5-10yrs**			
	1.4	Relocation	Prevention					**50-100Yrs**
	1.5	Minerals & Waste Plan	Prevention		**5-10yrs**			
	1.6	Sustainable Urban Drainage (SUDS)	Prevention		**5-10yrs**			
Flood Forecasting & Response	2.1	Flood Awareness	Preparedness	**0-5yrs**			**20-50Yrs**	
	2.2	Flood Warning	Preparedness		**5-10yrs**			
	2.3	Flood Forecasting	Preparedness		**5-10yrs**			
	2.4	Emergency Response Plans	Preparedness	**0-5yrs**				
	2.5	Community Flood Plans	Preparedness	**0-5yrs**				
	2.6	Multi Agency Flood Plans	Preparedness		**5-10yrs**	**10-20yrs**		
Land, Cultural & Environmental Management	3.1	Land Management	Prevention		**5-10yrs**	**10-20yrs**	**20-50Yrs**	
	3.2	Resilience	Preparedness	**0-5yrs**	**5-10yrs**	**10-20yrs**		
	3.3	Resistance	Protection	**0-5yrs**	**5-10yrs**	**10-20yrs**		
	3.4	Restoration	Prevention	**0-5yrs**	**5-10yrs**	**10-20yrs**	**20-50Yrs**	
	3.5	Environmental Enhancement	Prevention	**0-5yrs**	**5-10yrs**	**10-20yrs**	**20-50Yrs**	
	3.6	Water Level Management Plans	Protection		**5-10yrs**	**10-20yrs**	**20-50yrs**	
	3.7	Habitat Creation	Protection		**5-10yrs**	**10-20yrs**	**20-50yrs**	
Asset Management & Maintenance	4.1	Asset Management Plans	Protection	**0-5yrs**	**5-10yrs**	**10-20yrs**		
	4.2	Defence / Structure Management	Protection	**0-5yrs**	**5-10yrs**	**10-20yrs**	**20-50Yrs**	
	4.3	Channel Maintenance	Prevention	**0-5yrs**	**5-10yrs**	**10-20yrs**		
	4.4	Culvert Maintenance	Prevention	**0-5yrs**	**5-10yrs**	**10-20yrs**		
Studies, Assessments & Plans	5.1	Investigation	Preparedness	**0-5yrs**	**5-10yrs**	**10-20yrs**		
	5.2	Risk Assessments	Preparedness				**20-50Yrs**	
	5.3	Strategy Plan	Preparedness		**5-10yrs**	**10-20yrs**		
	5.4	Local Property level flood mitigation - resilience	Preparedness				**20-50Yrs**	
	5.5	Local Property level flood mitigation - resistance	Protection				**20-50Yrs**	
	5.6	Pre Feasibility Studies / Feasibility Studies	Preparedness	**0-5yrs**	**5-10yrs**	**10-20yrs**		
	5.7	Project Plans - Option Appraisals	Preparedness				**20-50Yrs**	
	5.8	SWMPs linking to SMPs	Preparedness				**20-50Yrs**	
High Level Awareness & Engagement	6.1	Partnership Working	Preparedness	**0-5yrs**	**5-10yrs**	**10-20yrs**		
Monitoring	7.1	Monitoring - Waves, Beaches, Aerial Photography and Topographical Surveys	Preparedness	**0-5yrs**	**5-10yrs**	**10-20yrs**	**20-50Yrs**	
	7.2	Habitats Monitoring	Preparedness	**0-5yrs**	**5-10yrs**	**10-20yrs**		
	7.3	Topographic survey	Preparedness		**5-10yrs**	**10-20yrs**	**20-50yrs**	
	7.4	Aerial surveys	Preparedness		**5-10yrs**	**10-20yrs**	**20-50yrs**	

E.3. Economic Assessment

Project:	Cardiff Local Flood Risk Management Strategy	**To:**	Project Team
Subject:	Economic assessment	**From:**	K Owen
Date:	29 July 2012 Updated March 2013	**cc:**	

This technical note sets out the approach followed in developing the strategic level economic assessment for the LFRMS.

Methodology

Key aspects within the assessment

The assessment follows the principles of the guidance Flood and Coastal Defence Project Appraisal Guidance FCDPAG3 (Defra, 2006). This guidance follows the Government principles for financial assessment as set out in the HM Treasury Green Book and assesses the impact of damages and benefit of actions at a national level.

Transfer Cost - Benefit–cost analysis is concerned with national economic efficiency where efficiency is, in effect, the ratio of the value of outputs (consumption) to inputs (resources). These inputs are both from stock (e.g. engineering plant, buildings, beaches) and from flows (e.g. electricity, labour). A transfer payment occurs when a change simply affects either who gets the consumption or who provides the resources, but there is no change in the national total of either all consumption or all the resources required to generate that consumption.

Test for transfer payment; Will there be any change either or both in the total value of UK consumption, or in the resources required to provide that consumption? If not, then only a transfer payment is involved and no damage is accounted for.

Damage values

The extents shown in the Environment Agency's Flood Map for Surface Water (FMfSW) has been used to assess the number of properties affected. These extents map the;

- 1 in 30 shallow flood event
- 1 in 30 deep (greater than 0.3m depth) flood event
- 1 in 200 shallow flood event
- 1 in 200 deep flood event

Numeric values are based on rounded values from data included within The Benefits of Flood and Coastal Risk Management: A Handbook of Assessment Techniques – 2010, published by the Flood Hazard Research Centre, Middlesex University.

The following assumptions / parameters used are;

Shallow Flooding Event

- Short Duration Flooding – flood depth of 0.1m affecting a typical residential property = £11,952

Deep Flooding Event

- Short Duration Flooding – flood depth of 0.3m affecting a typical residential property = £22,944

These values have been adjusted based on change in the CPI (Consumer Price Index) between 2010 and 2012.

- April 2010 = 114.9
- April 2012 = 122.9

- Change = +6.9%

Values used within the analysis

- Shallow Flooding = £12,000
- Deep Flooding = £24,000

The analysis has assumed that the existing drainage systems are able to accommodate a flood event up to the typical design standard of a 1 in 30 chance event. Above this flooding will occur and affect properties.

The probabilistic values for the damages have been assessed based on the annual chance of the event occurring to determine an average value in any typical year (Average Annual Damage, AAD).

In order to test the economic efficiency of different options on a comparable basis, it is necessary to discount all of the costs and benefits of any investment , from the time when they arise in the future, to their present value. The Government (HM Treasury) sets the Test Discount Rate that shall be used to appraise public sector projects such as flood alleviation and coast protection schemes. This is currently 3.5% for the next 20 years, reducing to 2.5% thereafter. We have taken our assessment period to consider the next 20 years to align with the short term phase of the LFRMS lifecycles.

The difference between the projected level of damages and the baseline (do-nothing) situation is the predicted level of benefit that approach can provide.

Assessed conditions

Three conditions have been considered to align with those assessed as part of the Objectives and Measures assessment;

- Do-nothing - baseline condition aligned with the guidance. This considers the situation that Cardiff Council do not undertake and actions (including those that they are currently doing). In reality this will not occur, however, it provides an agreed common baseline against which to compare actions across different authorities / departments as required.
- Business as usual - the level of action here is assumed to prevent flood damage upto the 1 in 30 event. Above this damages will begin to occur. This could be considered the “current day” situation
- Do-more - - the assumption taken here is that works will improve the situation such that the level of damage for the current 1 in 30 flood event would not occur unless a 1 in 200 event (lower probability) happens.

Output

The following tables set out the outcome of those calculations.

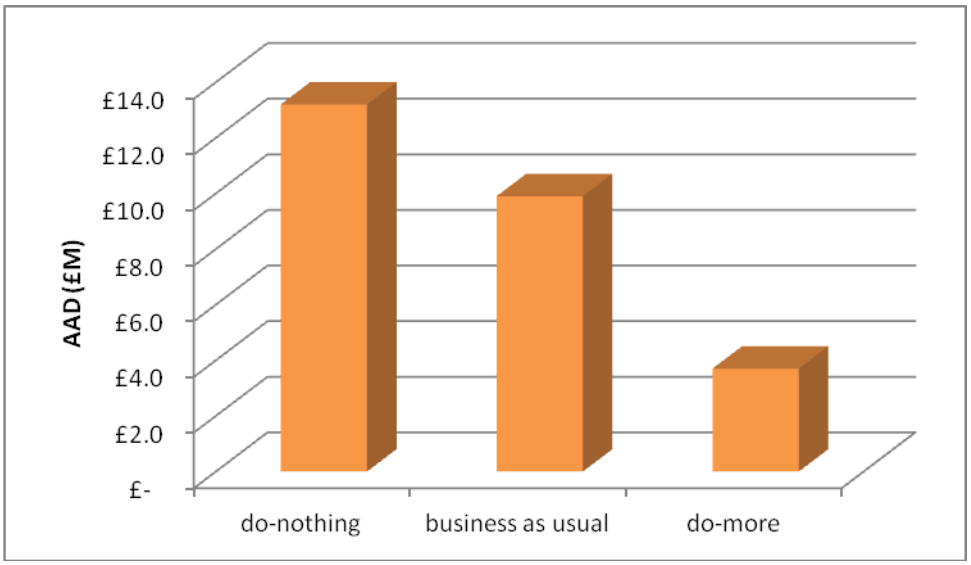
Table 2 Predicted damages for assessed flood events

discreet event	*net no of props affected*	*typical property damage*	*event damage*	*Total Event Damage*
1 in 30 shallow	7963	£ 12,000	£ 95,556,000	
1 in 30 deep	2141	£ 24,000	£ 51,384,000	£146,940,000 (£146.9M)
1 in 200 shallow	25047	£ 12,000	£ 300,564,000	
1 in 200 deep	8046	£ 24,000	£ 193,104,000	£493,668,000 (£493.7M)

Table 3 Predicted Present Value damages (£M)

Event Situation	*1 in 20 5%*	*1 in 30 3.33%*	*1 in 200 0.5%*	*"infinity"*	*AAD*	*Present Value*	
						Damages (PVd)	**Benefits (PVb)**
do-nothing	0	£146.9	£ 493.7	£ 661.8	£13.2	£194.0	
business as usual	0	£ -	£ 493.7	£ 661.8	£9.9	£145.4	£48.6
do-more	0	£ -	£ 146.9	£ 493.7	£3.7	£54.2	£139.8

Figure 2 AAD Summary chart



Appendix F. Glossary

— A —

Act

a Bill approved by both the House of Commons and the House of Lords and formally agreed to by the reigning monarch (known as Royal Assent).

Agri-environment schemes

Schemes under EC Regulation 1257/99 which offer grants for measures to conserve and enhance the countryside.

Tir Cynnal Agri-environment Scheme

The National Assembly for Wales are responsible for Tir Cynnal, a new 'entry level' agri-environment scheme that acts as a precursor to Tir Gofal (see below). It is a mechanism for farmers to receive incentive payments for converting at least 5% of their total land areas to semi-natural wildlife habitat, for example through river corridor works.

Tir Cymru

The Tir Cymru agri-environment scheme includes the Tir Gofal and Tir Cynnal programmes. Tir Gofal is WAG's flagship agri-environment scheme that was introduced in 1999 to replace the Environmentally Sensitive Area (ESA) and Tir Cymen schemes. It is a whole farm scheme, available on farmed land throughout Wales. It rewards farmers for caring for the environmental, historical and cultural features on their land and is designed to support the farming community in protecting and enhancing the environmental and cultural landscapes of Wales. It provides the opportunity to encourage landowners in the CFMP area to pursue more sustainable land use management. The Tir Cynnal scheme was introduced by WAG in 2005. It is a whole farm, entry-level scheme which aims to give Welsh farmers more opportunities to protect areas and features of environmental importance on their land, in return for payment. This scheme requires greater levels of environmental protection than the SPS Cross Compliance requirements, but is not as demanding as Tir Gofal. Participants in this scheme must identify the risks to soil, water and air on their farm arising from current farming practices, and ensure that 5 per cent of the total area is set aside for wildlife habitats.

Tir Gofal Agri-environment Scheme

Tir Gofal, for which the National Assembly for Wales are also responsible for, is a whole farm initiative which aims to encourage agricultural practices that will protect and enhance the landscapes of Wales, and their cultural features and associated wildlife, through the provision of incentive payments.

Agricultural Land Classification

A grading system for agricultural land based on the analysis of long-term physical limitations for agricultural use. Climate, site and soil characteristics and the interactions between them can affect the classification.

Average Annual Damages (AAD)

Depending on its size (or severity), each flood will cause a different amount of flood damage. The average annual damage is the average damage in pounds per year that would occur in a designated area from flooding over a very long period of time. In many years there may be no flood damage, in some years there will be minor damage (caused by small, relatively frequent floods) and, in a few years, there will be major flood damage (caused by large, rare flood events).

Annual Exceedence Probability (AEP)

This is the statistical chance of a flood of a given size happening in any one year. For example, a flood with a 1% AEP will happen, on average, every 100 years. This can also be expressed as a 1/100 chance of happening in any one year or a 100 year return period. A flood with an AEP of 10% will happen, on average, once every 10 years and has a 1/10 chance of happening in any one year or a 10 year return period.

Appraisal

The process of defining objectives, examining options and evaluating costs, benefits, risks, opportunities and uncertainties before making a decision.

Aquifer

An aquifer is an underground layer of water-bearing permeable rock, or unconsolidated materials (gravel, sand silt or clay) from which groundwater can be extracted.

ArcView

A Geographical Information System (GIS) computer software package.

Area of Outstanding Natural Beauty (AONB)

AONBs were formally designated under the National Parks and Access to the Countryside Act of 1949 to protect areas of the countryside of high scenic quality that cannot be selected for National Park status owing to their lack of opportunities for outdoor recreation (an essential objective of National Parks). The Natural Resources Wales is responsible for advising the National Assembly for Wales regarding the designation of AONBs. Further information on AONBs can be found at: http://www.aonb.org.uk

Attenuation

In relation to flooding, the impact of the floodplain on the shape of a flood hydrograph (reducing flood peak and increase flood duration) due to a combination of storage and resistance. Flood attenuation provided by 'natural storage' has increasingly been considered as a useful complement to conventional flood defences in certain situations, e.g. flood attenuation areas that can be used to cope with overflow when river levels rise. By allowing floodwaters on to these open spaces, downstream properties can be better protected.

Automated Voice Messaging (AVM) System

Natural Resources Wales's system for providing information regarding imminent flooding, for example to: local authorities, emergency services, householders and businesses – either by

telephone, fax or pager. In addition, Natural Resources Wales operates 'Floodline', which is a nationally available public information scheme. 'Floodline' telephone number is 0845 988 1188

— B —

Benefits

Those positive quantifiable and unquantifiable changes that a plan, policy or action will produce, including flood damages avoided.

Biodiversity Action Plan (BAP)

An agreed plan for a habitat or species, which forms part of the UK's commitment to biodiversity. BAPs are statutory documents. For further information, consult the BAP website: http://www.ukbap.org.uk

Bill

A proposal for a new law, or a proposal to change an existing law that is presented for debate before Parliament.

Birds Directive

European Community Directive (79/409/EEC) on the conservation of wild birds. Implemented in the UK as the Conservation (Natural Habitats, etc.) Regulations (1994). For further information, consult the Office of Public Sector Information website: http://www.opsi.gov.uk or Her Majesty's Stationary Office (HMSO) website: http://www.hmso.gov.uk/si/si1994/Uksi_19942716_en_1.htm

Boulder Clay

Residue deposited by glaciers as they retreated at the end of the ice ages. It consists of a mixture of rock fragments, clay, sand and gravels. Boulder clay is variously known as till or ground moraine.

— C —

Cadw

Cadw is the Welsh Assembly Government's historic environment division. Its aim is to promote the conservation and appreciation of Wales's historic environment. The prime source of information on recorded archaeological remains will be the Sites and Monuments Record (SMR) and the National Monuments Record (NMR). The SMR should contain information about all known archaeological remains. Further details are available either on the Royal Commission on the Ancient and Historical Monuments of Wales website: http://www.rcahmw.org.uk/ or via Cadw's website: www.cadw.wales.gov.uk

Calcareous

Of, or containing, carbonate of lime or sandstone.

Capital Investment Programme

Details of proposed flood defence schemes and planned improvements within a catchment as approved by the appropriate bodies (Flood Risk Management Wales committee since April 2006).

Catchment

The area drained by a particular river or watercourse. A surface water catchment is the area defined by the highest boundary between two catchments whilst a groundwater catchment is the area that contributes to the groundwater component of the river flow.

Catchment Abstraction Management Strategy (CAMS)

Environment Agency strategy document outlining the availability and pressures on water resources in a catchment.

Catchment Flood Management Plan (CFMP)

A CFMP is a large scale, long-term (50 to 100 years) strategic planning framework that provides an overview of the flood risk across each river catchment and estuary. They recommend ways of managing those risks now and over the next 50 – 100 years.

Catchment Opportunities and Constraints

Important catchment issues that we identify using a combination of catchment characteristics (e.g. designated areas that need protecting or improving), Government policy/targets and/or catchment initiatives (e.g. existing local authority strategies). Catchment policies/measures should aim to 'take account of constraints' and 'promote opportunities' through the CFMP appraisal framework (economic, environmental and technical). Designated sites have Water Level Management Plans (WLMPs) that set out water level management needs in certain parts of the catchment and some floodplain areas have nature conservation or heritage interests that benefit from increased flooding.

Catchment Policies

The outputs of the CFMP, which are the stated policies for flood risk management within a defined area of the CFMP called a 'policy unit'.

Catchment Sensitive Farming

Government initiative aimed at reducing diffuse water pollution from agriculture in England and Wales. The programme seeks to help meet Water Framework Directive water quality targets. The project aims to improve the environment and reduce farming's impact on local streams, rivers and lakes.

Centre for Ecology and Hydrology (CEH)

CEH (Wallingford), formerly the Institute of Hydrology (IoH).

Chainage

Distance downstream from the upstream model extent

Climate Change

The change in average conditions of the atmosphere near the Earth's surface over a long period of time.

Coastal erosion

The wearing away of coastline, usually by wind and/or wave action.

Coastal Habitat Management Plan (CHaMP)

Strategic plans that quantify habitat change (loss and gain) over a 30-100 year timescale and recommend measures to prevent future losses. Measures include modifying flood and coastal defence options to avoid damage, or identifying the necessary habitat restoration or recreation works to compensate for unavoidable losses. CHaMP actions are delivered through Shoreline Management Plans (SMPs) and other flood and coastal defence strategies and schemes.

Living with the Sea - CHaMPS - What are they?

Coastal erosion risk

Measures the significance of potential coastal erosion in terms of likelihood and impact.

Coastal erosion risk management

Anything done for the purpose of analysing, assessing and reducing a risk of the wearing away of coastline.

Coastal Flooding

Occurs when coastal defences are unable to contain the normal predicted high tides that can cause flooding, possible when a high tide combines with a storm surge (created by high winds or very low atmospheric pressure).

Common Agricultural Policy (CAP)

The CAP is a system of EU agricultural subsidies and programmes. The subsidies guarantee a minimum price to producers by direct payment of a subsidy for crops planted. Reforms of the system are currently underway, including a new Single Payment Scheme for direct farm payments that is being introduced in the UK.

Communication Plan

A plan that sets out the CFMP consultation programme, and specific arrangements for consulting both internal teams and external organisations.

Conservation areas

These are areas of special architectural or historic interest whose character or appearance is worth of preserving or improving. Local authorities in England and Wales have the power to designate Conservation Areas in any area of “special architectural or historic interest”, whose character or appearance is worth protecting or enhancing. This “specialness” is judged against local and regional criteria, rather than national importance, as is the case with listing buildings.

Consultation Group

A group of consultees, representative of the stakeholders, with an interest in the development of the CFMP and its final policies.

Conveyance

Conveyance is a measure of how well a channel or structure, such as a bridge or culvert, allows water to pass through. It depends on the physical characteristics of the channel or structure, including its size, shape and surface roughness.

Countryside and Rights of Way Act (CRoW)

The Countryside and Rights of Way (CRoW) Act 2000 came into force on 30 January 2001. The Act applies in England and Wales and has five parts:

1. Access to the Countryside.
2. Public Rights of Way and Road Traffic.
3. Nature Conservation and Wildlife Protection.
4. Areas of Outstanding Natural Beauty.
5. Miscellaneous and Supplementary.

Of these, Part 3 is the most relevant in terms of catchment flood management as it gives biodiversity a statutory basis, revises SSSI notification procedures, greatly increases protection for SSSIs and strengthens the advisory role of EN / CCW, increases the scope of some wildlife offences and increases penalties. For further information, refer to the Office of Public Sector Information website: http://opsi.gov.uk or Her Majesty’s Stationery Office (HMSO) website: www.hmso.gov.uk/acts/acts2000/20000037.htm

Countryside Character Areas

Non-statutory sub-divisions of England, as defined under the Countryside Agency’s Countryside Character Initiative. There are 159 Character Areas in England, each with a broadly cohesive countryside character and specific ecological and landscape issues.

Countryside Council for Wales / Cyngor Cefn Gwlad Cymru

Until April 2013, the Countryside Council for Wales was the Welsh Government's statutory adviser on sustaining natural beauty, wildlife and the opportunity for outdoor enjoyment in Wales and its inshore waters. From April 2013 CCW has not existed, with its duties being carried out by Natural Resources Wales.

Home Page - Countryside Council for Wales

County Wildlife Site (CWS) / Site of Nature Conservation Importance (SNCI)

CWSs and SNCIs are designated at a local level through inclusion within local or unitary development plans due to their regional or local conservation interest. These sites are usually adopted by local authorities for planning purposes but have no statutory protection. Further information on these designations can be found at the following website: http://www.naturenet.net/status/sinc.html

Critical Ordinary Watercourses (COWs)

Stretches of non-main watercourses that have been defined as critical in terms of flood risk management through consultation between the Environment Agency (at the time), Local Authorities and Internal Drainage Boards (IDBs).

Culvert

A covered structure under road, embankment etc, to direct the flow of water.

— D —

Department for Communities and Local Government (DCLG)

The successor to the Office of the Deputy Prime Minister Is responsible for promoting community cohesion and equality, housing, urban generation, planning and local government.

http://www.communities.gov.uk

Defra

Department for Environment, Food and Rural Affairs. The department of central Government responsible for flood management policy in England.

Defra, UK - About Defra

Defra/WAG FCDPAG documents – now superseded (see FCERM-AG)

Defra's/WAG FCDPAG (flood and coastal defence project appraisal guidance) documents set out the criteria which determine whether or not a scheme is eligible for grant aid.. The PAG documents are;

PAG1. Overview

PAG2. Strategic planning and appraisal

PAG3 Economic appraisal

PAG4. Approaches to risk

PAG5. Environmental Appraisal

Defra, UK - Flood Management - Project Appraisal Guidance

Development Advice Maps

In July 2004, the Welsh Government published development advice maps to accompany the latest version of TAN 15 – Development and Flood Risk. The development advice maps are used by the Local Planning Authority to determine when flood risk issues need to be taken into account in planning future development. Three development advice zones are described on the maps, to which are attributed different planning actions.

Welsh Government | Technical Advice Note (TAN) 15: Development and Flood Risk (2004) ...

DG5 Register

Register held by water companies of the frequency of actual flooding of properties from the public sewerage system by foul water, surface water or combined sewage.

Digital Elevation Model (DEM)

A dataset representing the topography of an area, usually in the form of an electronic map. A DEM includes ground cover and structures, such as buildings, or man made structures and vegetation.

Digital Terrain Model (DTM)

A dataset representing the bare earth topography of an area, usually in the form of an electronic map. A DTM is processed to remove all ground cover and structures, such as buildings, or man made structures and vegetation.

Drift

In geology, drift is transported rock debris overlying the solid bedrock. The transport mechanisms can include rivers and glaciers. Glacial drift is a general term for the coarsely graded and extremely heterogeneous sediments of glacial origin. In the UK the term drift is commonly used to describe any deposits of quaternary age.

— E —

Environment Agency

Non-departmental public body responsible for the delivery of UK Government policy relating to the environment and flood risk management in England and Wales.

Environment Agency Wales (EAW)

Until April 2013 a Welsh Government sponsored Public Body responsible to the Welsh Ministers and an Executive Non-departmental Public Body responsible to the Secretary of State for Environment, Food and Rural Affairs. April 2013 EAW has not existed, with its duties being carried out by Natural Resources Wales.

Environment Agency Vision

The Environment Agency's 'vision' for the environment and a sustainable future is: 'A healthy, rich and diverse environment in England and Wales, for present and future generations' To achieve the targets that will make the 'vision' a reality the Environment Agency have identified nine main 'themes' or frameworks for change', for a more sustainable future.

1. A better quality of life: We will work with all sectors to improve the quality of the environment and the services we provide – for business, anglers, the boating community and other people who use the waterways, farmers, planners and all sections of the community.
2. An improved environment for wildlife: we will make sure that our work and the work of those we authorise does not threaten important species and habitats.
3. Cleaner air for everyone.
4. Improved and protected inland and coastal waters: we will work to clean up polluted waters and to reduce the risk of further pollution.
5. Restored protected land with healthier soils.
6. A 'greener' business world.
7. Wiser sustainable use of natural resources.
8. Limiting and adapting to climate change.
9. Reducing flood risk: we will improve flood defences and information on flood risks.

For further information refer to our website: Environment Agency - Our Vision

Environmental Impact Assessment (EIA)

The process by which the likely impacts of a project or development upon the environment are identified and assessed to determine their significance. EIA are statutory for many developments likely to have an adverse environmental impact, and for any plan affecting a European designated site for conservation.

Environmentally Sensitive Areas (ESA)

Introduced by the Ministry of Agriculture, Fisheries and Food (MAFF; predecessor to DEFRA) in 1987 and are designated under the provisions of sections 18 and 19 of the 1986 Agriculture Act and Environmentally Sensitive Area (Stage II) Designation (Amendment)(No2) Order 2001. They are governed by DEFRA and offer incentives (on a 10 year agreement with a 5 year break clause) to encourage farmers to adopt agricultural practices, which would safeguard and improve parts of the country of particularly high landscape, wildlife or historic value. DEFRA introduced the Environmental Stewardship Scheme in March 2005 which supersedes (with enhancements) the Environmentally Sensitive Areas and Countryside Stewardship Schemes. Further details can be found on the DEFRA website: http://www.defra.gov.uk/erdp/schemes/esas/default.htm

Environmental Stewardship Scheme (ESS)

ESS is a new agri-environmental scheme, launched in March 2005, which provides funding to farmers and other land managers in England who deliver effective environmental management on their land. The scheme is intended to build on the recognised success of the ESA and Countryside Stewardship schemes.

Eutrophication

Eutrophication is a process whereby water bodies, such as lakes, estuaries, or slow moving streams receive excess nutrients that stimulate excessive plant growth. Dissolved oxygen in the water is reduced when dead plant material decomposes and can cause other organisms to die. Nutrients can come from many sources, such as fertilizers applied to agricultural fields; erosion of soil containing nutrients; and sewage treatment plant discharges.

Eutrophic Standing Water

Eutrophic standing water is nutrient rich and is found in field ponds, lakes, canals, gravel pits and reservoirs.

Evaporation

The process where a liquid (water) changes into a gas (water vapour).

— F —

Fisheries Action Plan

A document setting out a vision for rivers, canals and stillwater fisheries within a catchment and an actions plan to address the main issues affecting them. Potential funding is also identified where possible. The Environment Agency are developing FAPs in partnership with representatives of the local fisheries community. The production of FAPs was proposed in the Salmon and Freshwater Fisheries Review 2000 and has since been supported by the Government. More information and existing FAPs are available on our website: http://www.environment-agency.gov.uk

Flood Alleviation Scheme (FAS)

A scheme designed to reduce the risk of flooding in a specific area.

Flood Consequences Assessment (FCA)

An assessment of flood risk which is required under TAN 15 (planning guidance for Wales) for developments proposed in flood risk areas.

FCERM

Flood and Coastal Erosion Risk Management.

FCERM Function

Defined by Sections 4 and 5 of the Flood and Water Management Act 2010 as being a function, which may be exercised by a risk management authority for a purpose connected with either flood risk management or coastal erosion.

Flood

Any case where land not normally covered with water becomes covered by water.

Flood and coastal erosion risk management appraisal guidance (FCERM-AG)

FCERM-AG gives guidance on how to put the Defra Policy Statement: Appraisal of Flood and Coastal Erosion Risk Management, June 2008 into practice. It replaces the Defra Project Appraisal Guidance (PAG). http://www.environment-agency.gov.uk/research/planning/116705.aspx

Flood and Water Management Act 2010

An Act of Parliament updating and amending legislation to address the threat of flooding and water scarcity, both of which are predicted to increase with climate change.

Flood Damages

Flood damages are worked out from the estimated flood depth and extent data obtained from hydraulic modelling. By combining the information on the type and value of properties shown to be within the modelled flood outline, it is possible to calculate the overall damage the flooding would cause. Flood damage figures can be given for a range of specified magnitudes of flood event, for example, the 1% annual probability flood event.

Flood Defence

A structure (or system of structures) for the alleviation of flooding from rivers or the sea. Flood defences only reduce the likelihood of flooding and not the consequences of flooding when they are overtopped. Flood risk is a combination of likelihood of the event occurring and the consequences when it does.

Flood Estimation Handbook (FEH)

Produced in 1999 by the Institute of Hydrology (now Centre for Ecology and Hydrology, Wallingford), the FEH provides currently accepted standard methodologies for the estimation of flood flows within the UK.

Flood Event

An occurrence of flooding.

Flood Map

Shows flooding from rivers and sea, with a 1 % and 0.5 % chance respectively of happening in any one year. The extreme flood outline (EFO) is also shown for both river and tidal flooding with a 0.1 % annual chance. The flood map also displays flood defences and the areas that benefit from them. It can be found on our website at www.environment-agency.gov.uk/flood . These maps are sometimes referred to as Section 105 maps, or Indicative Flood Maps.

Floodplain

Any area of land over which water flows or would flow if there were no flood defences. It can also be a place where water is stored during a flood event.

Flood Risk

Flood risk is the product of the likelihood (or frequency) of flood events and their consequences (such as property loss or damage, physical harm or distress and social and economic disruption).

Flood Risk Assessment

An assessment of flood risk which is required under PPS25 (planning guidance for England) for developments proposed in flood risk areas.

Flood Risk Management

The activity of understanding the probability and consequences of flooding, and seeking to modify these factors to reduce flood risk to people, property and the environment. This should take account of other water level management and environmental requirements, and opportunities and constraints.

Flood Risk Management Measures

The way in which flood risks are to be managed either through changing the frequency of flooding, or by changing the extent and consequences of flooding, or by reducing the vulnerability of those exposed to flood risks.

Flood Risk Management Scheme(s)

A range of actions to reduce flood frequency and/ or the consequences of flooding to acceptable or agreed levels.

Flood Risk Management Wales

Established under Section 14 of the Environment Act 1995, Flood Risk Management Wales is the statutory flood defence committee for Wales, (replacing the Regional Flood Defence Committee Wales). It is an executive committee of Natural Resources Wales (previously Environment Agency Wales) with responsibility for managing flood risk management functions. Under arrangements, which came into effect from 1st April 2006, Flood Risk Management Wales comprises eighteen members, eight of which are Assembly appointments (including the Chairman and Conservation Member), eight by, or on behalf of, local authorities and two by Natural Resources Wales.

Flood Risk Maps

See Flood Map

Flood Risk Regulations 2009

Regulations which transpose the EC Floods Directive (Directive 2007/60/EC on the assessment and management of flood risks) into domestic law and to implement its provisions.

Flood Risk Study

Assesses flood risk within a defined area and suggests possible flood risk management measures.

Flood Warning Levels of Service (FWLOS)

The Flood Warning Levels of Service study provides an indication of the levels of service provided at locations within the catchment and possibilities and reasons for improving them.

Floodline Warnings Direct

is a free service that provides flood warnings direct to you by telephone, mobile, email, SMS text message and fax.

Fluvial

Relating to a watercourse (river or stream)

Fluvial Geomorphology

Processes and forms associated with the erosion, transport and deposition of river sediment.

Forestry Commission Wales

Until April 2013 Forestry Commission Wales acted as the Welsh Government's department of Forestry and directly as stewards of the 38% of welsh woodlands owned by the National Assembly. Their mission and corporate plan is to help deliver Better Woodlands for a Better Wales. Since April 2013 their duties have been carried out by Natural Resources Wales.
Forestry Commission Wales

Freshwater Fisheries Directive Designation

An EC Directive (78/659/EEC) aiming to protect and improve water quality and forming part of the

Environment Agency's water quality monitoring programme. The Directive sets standards to safeguard freshwater fisheries, mainly relating to the quality of the water, and requires that certain designated stretches of water meet these standards in order to enable fish to live or breed.
Environment Agency - Freshwater Fish Directive

— G —

General Quality Assessment

Natural Resources Wales assesses river quality annually using a survey called the General Quality Assessment (GQA) scheme. This measures four aspects of river quality – biology, chemistry, nutrients and aesthetic quality.

Geographical Information System (GIS)

A GIS is a computer-based system for capturing, storing, checking, integrating, manipulating, analysing and displaying data that are spatially referenced.

Geomorphology

Geomorphology is concerned with the structure, origin and development of the topographical features of the earth's crust. Fluvial Geomorphology is concerned with the physical processes that create sediment erosion and deposition and which define the shape of a river and its floodplain.

Glacial Till

Till is an unsorted glacial sediment. Glacial till is that part of glacial drift which was deposited directly by the glacier. It may vary from clays to mixtures of clay, sand, gravel and boulders.

Groundwater

Water occurring below ground in natural formations (typically rocks, gravels and sands). The subsurface water in the zone of saturation, including water below the water table and water occupying cavities, pores and openings in underlying soils and rocks.

Groundwater Flooding

Occurs when water levels in the ground rise above the natural surface. Low lying areas underlain by permeable strata are particularly susceptible.

— H —

Habitats Directive

European Community Directive (92/43/EEC) on the Conservation of Natural Habitats and of Wild Flora and Fauna. Implemented in the UK through the Conservation (Natural Habitats, etc.) Regulations (1994) and known as the 'Habitats Directive'. It establishes a system to protect certain fauna, flora and habitats deemed to be of European conservation importance. For further information refer to the Office of Public Sector Information website: http://www.opsi.gov.uk/si/si1994/Uksi_19942716_en_1.htm

Habitats Regulation Assessment (HRA)

The Conservation of Habitats and Species Regulations (SI 490, 2010), Termed the 'Habitats Regulations', implements the EU 'Habitats Directive' (Directive 92/43/EEC) on the Conservation of natural habitats and of wild flora and fauna) and certain elements of the 'Birds Directive' (2009/147/EC). This legislation provides the legal framework for the protection of habitats and species of European importance in Wales.

Headwaters

The source of a river may be a lake, a marsh, a spring, or a collection of headwaters. Headwaters are small streams that create the river.

HEC-RAS

A hydraulic modelling program which will perform one-dimensional steady and unsteady flow calculations for a stretch of watercourse.

Historic Character Areas

The historic landscape characterisation process (see below) divides each landscape area on the Register into a number of smaller, more discrete, geographical areas of broadly consistent historic character.

Historic Environment

Encompassing all elements of designated or un-designated archaeological sites, historic buildings and historic landscapes. It also includes sites of palaeoenvironmental interest that provide information about the nature of past landscapes, climate and environments.

Historic Landscapes

Cadw and CCW have been working to identify historic landscape throughout Wales. They have been collected into the two-volume Register of Landscapes of Historic Interest in Wales. This advisory and non-statutory document highlights what are considered to be the best examples of different types of historic landscape in Wales, either in Part 1 – Parks and Gardens or Part 2 – Historic Landscapes. For further information refer to the Cadw website: http://www.cadw.wales.gov.uk

Historic Landscape Characterisation

A programme undertaken by Cadw and the Welsh Archaeological Trusts running in parallel with the Register of Landscapes of Historic Interest in Wales. The programme provides more detailed information about each area on the Register in order to provide information for landscape conservation and management as, for example, may be required by agri-environment schemes.

Historic Landscapes Register

The Historic Landscapes Register provides a national overview of the historic content of the Welsh landscape. It is a non-statutory, advisory Register which aims to provide information and raise awareness on important historic landscape areas in Wales, in order to aid their protection and conservation and to give the historic environment equal weight alongside more traditional issues of nature conservation, wildlife protection and scenic amenity. Part 1 of the Register identifies ‘landscapes of outstanding historic interest’ and Part 2 identifies ‘landscapes of special historic interest’.

Historic Parks and Gardens

Starting in 1992, Cadw has undertaken a comprehensive survey of historic parks and gardens in Wales. Parks and gardens thought to be of national importance have been included on the Cadw/ICOMOS Register of Parks and Gardens of Special Historic Interest in Wales. The Register was compiled in order to aid the informed conservation of historic parks and gardens by owners, local planning authorities, developers, statutory bodies and all concerned with them. It is non-statutory.

Hydraulic Model

A model of a watercourse, or portion of a watercourse (usually digital) which allows estimates to be made of water level in the watercourse for a given flow.

Hydrograph

Hydro- meaning water, and -graph meaning chart.

· a record through time of discharge (flow) in a river, or

· a record through time of water level in an aquifer, measured in a well.

Hydrological Model

A method of estimating the flow in a river or catchment arising from rainfall falling into the catchment. Models typically account for factors such as catchment area, topography, soils, geology and land use.

— I —

Impermeable

Used to describe materials, natural or synthetic, which have the ability to resist the passage of fluid through them.

Indicative Standard of Protection

The range of level of protection to be considered for flood defences, based upon the use of the land being protected. They do not represent any entitlement to protection or minimum level to be achieved.

Internal Drainage Boards

IDBs are long established bodies operating predominantly under the Land Drainage Act 1991 and have permissive powers to undertake work to secure drainage and water level management of their districts and undertake flood risk management works on ordinary water courses within their districts (i.e. watercourses other than ‘main river’). Much of their work involves the maintenance of rivers, drainage channels and pumping stations, facilitating drainage of new developments and advising on planning applications. They also have statutory duties with regard to the environment and recreation when exercising their permissive powers.

Inundation

To cover with water - especially flood waters

— L —

Land Management

A scheme, plan or other project deliberately using particular practices to affect the character, quality or value of an area. Land Management is subject to UK legislation and may require authorisation from a competent authority where it results in a change in Land Use, may require planning permission.

Land Use

The use to which an area of land is put (e.g. residential, agriculture, forestry, etc.). The term Land Use is used in many contexts and is controlled by the town and country planning system.

Landscape Character Areas (LCAs)

Landscape Character Areas are developed by the Countryside Agency under the Countryside Character Initiative, and have a strong social, historical and cultural element. The Countryside Character Initiative is a programme of information and advice on the character of the English countryside. It includes systematic descriptions of the features and characteristics that make the landscape and guidance documents on how to undertake Landscape Character Assessment.

Lead Local Flood Authority (LLFA)

(in Wales) The County Council or the County Borough Council for the area.

Local Flood Risk:

Defined within the Flood and Water Management Act 2010 as including surface runoff, groundwater and ordinary watercourses.

Local Flood Risk Strategy:

Required in relation to Wales by Section 10 of the Flood and Water Management Act 2010 local flood risk strategies are to be prepared by lead local flood authorities and must set out how they will manage local flood risks within their areas.

Less Favoured Area (LFA)

Areas in Wales that are difficult to farm due to their climate, where they are situated or features of the landscape. These areas are classified as Severely Disadvantaged Area (SDA) land and Disadvantaged Area (DA) land. Both of these classifications are within the Welsh Less Favoured Area (LFA). For further information, please refer to

http://www.countryside.wales.gov.uk/fe/master.asp?n1=4&n2=205

LiDAR

Light Detection and Ranging (LiDAR) is an airborne mapping technique, which uses a laser to measure the distance between the aircraft and the ground surface or vegetation cover.

Listed Buildings

English Heritage (EH) and CADW are the national bodies responsible for protecting historic buildings by identifying those which should be listed. There are three grades of listed buildings:

- Grade I buildings are those of exceptional interest;
- Grade II* buildings are particularly important buildings of more than special interest; and
- Grade II buildings are of special interest, warranting every effort to preserve them.

Local Biodiversity Action Plan (LBAP)

A local agenda (produced by a Local Authority) with plans and targets to protect and enhance biodiversity and achieve sustainable development. The Environment Agency and Natural Resources Wales are committed to BAPs and works with UK Government (Rio Earth Summit, 1992) to realise LBAP objectives.

Local Development Documents

These are statutory plans providing information used to decide planning applications for land use development in England. The system currently consists of Local Development Plans (produced by District Councils and Unitary Authorities) and Structure Plans (produced by County Councils and Metropolitan Councils). The Planning and Compulsory Purchase Act 2004 replaces these documents with Regional Spatial Strategies (e.g. for south east England) and Local Development Frameworks.

Local Development Plans

These are statutory plans providing information used to decide planning applications for land use development in Wales now required under the Planning & Compulsory Purchase Act 2004.

Local Environment Agency Plan (LEAP)

An Environment Agency non-statutory plan based on a river basin (or group of sub-catchments / smaller catchments). LEAPs provide environmental baseline information and actions / objectives for river basins and largely superseded the National Rivers Authority's (NRA) Catchment Management Plans (CMPs).

Local Flood Risk Management Strategy (LFRMS)

The "Strategy" produced by the LLFA in response to the requirement under Section 10 of the Flood and Water Management Act.

Local Nature Reserve (LNR)

Designated under the National Parks and Access to the Countryside Act 1949 by local authorities (which must have some legal control over the site), in consultation with Countryside Council for Wales, for their locally important wildlife or geological features. They are generally meant for education and recreation as well as conservation. For further information, refer to the Countryside Council for Wales website: http://www.ccw.gov.uk

For further information refer to the English Nature website:

http://www.english-nature.org.uk/special/lnr/lnr_search.asp

— M —

Macro Invertebrate

Animal lacking a backbone which is retained on a 0.5mm sieve.

Macrophytes

Any plant observed by the naked eye and nearly always identifiable. This definition includes all higher aquatic plants together with groups of algae which can be seen to be composed predominantly of a single species.

Main River

Main rivers are usually larger streams and rivers, but also include smaller watercourses of strategic drainage importance. A main river is defined as a watercourse shown as such on a main river map, and can include any structure or appliance for controlling or regulating the flow of water in, into or out of the main river. Our powers to carry out flood defence works apply to main rivers only. Main rivers are designated by the Welsh Government and Defra.

Major Incident Plan

A Major Incident Plan for flooding can be defined as: A plan which describes the multi agency response arrangements for dealing with major floods, occurring in exceptional circumstances, in locations with significant populations, where special measures are deemed necessary.

Mean High Water Springs (MHWS)

The average of the spring tides, which happen every two weeks.

Ministry of Agriculture, Fisheries and Food (MAFF)

Predecessor Government Department to Defra

Morphology

The study of form or shape e.g. the shape of river channels and how this changes overtime by processes of erosion and sedimentation.

— N —

National Assembly for Wales (NAW)

The National Assembly for Wales is the representative body with legislative powers in devolved areas. It has sixty elected members and meets in the Senedd. http://www.wales.gov.uk/organipo/index.htm .

The role of the National Assembly for Wales is to scrutinise and monitor the Welsh Assembly Government

National Farmers Union (NFU)

The National Farmers' Union represents the farmers and growers of England and Wales. Its central objective is to promote successful and socially responsible agriculture and horticulture, while ensuring the long term viability of rural communities. http://www.nfuonline.com/x286.xml. NFU Cymru represents the farmers of Wales. NFU Cymru - National Farmers Union of Wales - Welsh Farming and Agriculture

National Flood and Coastal Defence Database (NFCDD)

The NFCDD is intended to be the primary source of information on flood defences. The aim is that the information contained on each asset should be spatially correct and include the type, location of the defences, estimated replacement cost, design standard, age, next inspection data, height and length. The database aims to contain all flood defence assets including those that are the responsibility of local authorities.

National Flood Forecasting System

As part of a wider national programme, Natural Resources Wales is developing a computer based system from which various flood-forecasting models can be operated. This system has the potential of improving the flow and flood forecasting capability for all areas at risk of fluvial, tidal or coastal flooding across the region.

National Monuments Record and Historic Environment Records

In England, the prime sources of information on recorded historic environment assets will be English Heritage's National Monuments Record (NMR) and local authority Historic Environment Records (HER) or Sites and Monuments Records (SMR). In Wales HER's are maintained by a number of regional Archaeological Trusts. The NMR will be the source for current GIS polygon data for designated historic buildings, monuments, historic parks and gardens etc. This data is freely available for Environmental Assessment purposes. SMRs contain information about all known archaeological remains, whilst HERs (which most Trusts and local authority SMRs are changing to) aim to provide information on all known historic environment assets.

National Nature Reserve (NNR)

National Nature Reserves are designated under the National Parks and Access to the Countryside Act 1949 or the Wildlife and Countryside Act 1981 (as amended) primarily or nature conservation, but can also include sites with special geological or physical features. They were established to

protect the most important areas of wildlife habitat and geological formations in Britain, and as places for scientific research. They are usually owned or leased by Countryside Council for Wales, or managed in accordance with a Nature Reserve Agreement with the landowner or occupier.

National Park

A National Park Authority's duties and powers are derived from a number of Acts of Parliament and statements of Government Policy, most recently the Environment Act (1995). The statutory purposes of National Parks, which the National Park Authority has the duty to pursue, are to:

• to conserve and improve the natural beauty, wildlife and cultural heritage of the area;

• to promote opportunities for the public to understand and enjoy the area's special qualities.

In pursuing these purposes National Park Authorities also have a duty to seek to foster the economic and social well being of the communities within the National Park, but without incurring significant expenditure in doing so. Further information can be found on the National Park Authorities' website: http://www.anpa.gov.uk/

National Rivers Authority (NRA)

The National Rivers Authority was one of three predecessor bodies to the Environment Agency.

National Strategy

The "National Strategy for Flood and Coastal Erosion Risk Management: Wales" produced by the Welsh Government in response to the requirement under Section 8 of the Flood and Water Management Act.

National Salmon Strategy

We have taken over implementation of the National Salmon Strategy, which was launched by the National Rivers Authority in February 1996. It sets out objectives for the management of salmon fisheries in England and Wales to preserve fish stocks for the future whilst protecting sustainable exploitation and recognising the economic value of fisheries. Implementation takes the form of Salmon Action Plans which are local documents produced at a catchment scale.

Natura 2000 Network

European network of protected sites which represent areas of the highest value for natural habitats and species of plants and animals which are rare, endangered or vulnerable in the European Community. The Natura 2000 network will include two types of area. Areas may be designated as Special Areas of Conservation (SAC) where they support rare, endangered or vulnerable natural habitats and species of plants or animals (other than birds). Where areas support significant numbers of wild birds and their habitats, they may become Special Protection Areas (SPA). SACs are designated under the Habitats Directive and SPAs are classified under the Birds Directive. Some very important areas may become both SAC and SPA.

Natural Area Profiles

Natural Areas are developed by Natural England, each area having a characteristic association of wildlife and natural features. There are 120 Natural Areas in England and each has a unique identity resulting from the interaction of wildlife, landforms, geology, land use and human impact.

Natural England

Natural England works for people, places and nature, to enhance biodiversity, landscapes and wildlife in rural, urban, coastal and marine areas; promoting access, recreation and public well-being, and contributing to the way natural resources in England are managed so that they can be enjoyed now and in the future.

Natural Resources Wales

From April 2013, the Welsh Government established a single environmental body for Wales, National Resources Wales. This merged the functions of the Environment Agency Wales, the Countryside Council for Wales and the Forestry Commission Wales.

Non-main River

See Ordinary watercourses

Non-Statutory Plans

Since about 1990, there have been a number of initiatives in regard to non-statutory plans dealing, in particular with coastal issues. Many of these contain policies and proposals that have land-use planning implications. Non-statutory plans include: CFMPs, SMPs, CHaMPs, Estuary management plans, River Basin management Plans, Local Environment Agency Plans and Water Level Management Plans.

— O —

Offline / Online storage

Offline storage: the deliberate creation of a separate flood area (or areas) adjacent to a river, linked to the river through a sluice, weir or other control mechanism. Depending on the frequency of flooding all or part of the flood storage area may be maintained for farming (grazing or arable) or for wildlife or environmental benefits. On-line: river and storage areas are directly connected by removing embankments thereby creating a permanently wet area that fills further during flood events. On-line areas flood more frequently and in a loss controlled manner than off-line storage, this means they are less efficient and consequently a larger area is required for the same return period.

Office of the Deputy Prime Minister (ODPM)

The former department of central Government responsible for policy on planning and other related issues. Formerly DTLR. Has been replaced by the Department for Communities and Local Government (DCLG).

The Office of Water Services (OFWAT)

The economic regulator of water and sewerage services in England and Wales.

Ordinary Watercourses

All watercourses not designated as 'main rivers'. Operating authorities, such as Local Authorities have powers and duties to maintain ordinary watercourses within their boundaries. Riparian owners (land owners) are responsible for maintaining ordinary watercourses.

Ordnance Datum Newlyn (ODN)

A traditional vertical coordinate system, consisting of a tide gauge datum with its origin (0,0) located at Newlyn (Cornwall) and a Terrestrial Reference Frame observed by spirit levelling between 200 fundamental benchmarks across Britain. Each benchmark has a vertical height only (not ellipsoid height or accurate horizontal position). This coordinate system is important because it is used to describe vertical positions of features on British maps (for example, spot heights and contours) in terms of height above average sea level.

Outfall

The outlet of a river, drain or a sewer where it discharges into the sea, a lake etc.

— P —

Permeable

Able to be penetrated by water

Phytoplankton

Plankton is the collective name for drifting organisms at any depth in the sea or fresh water. The phytoplankton is the plant part of the plankton.

Planning and Compulsory Purchase Act (2004)

Legislation promoted by the Office of the Deputy Prime Minister, which substantially reformed the town planning and compulsory purchase framework in Great Britain. It amended and recalled significant parts of the existing planning and compulsory purchase legislation and introduced reforms such as the abolition of Local Plans and Structure Plans, and their replacement with Local Development Frameworks.

Planning Policy Statement 25: Development and Flood Risk (PPS25) – England Only

One of a series of Planning Policy Statements notes (PPSs) issued by DTLR to advise local planning authorities and developers. While PPSs are not statutory, planning authorities have to consider them when they prepare plans and determine planning applications. PPs25, issued in July 2001, raises the profile of flood risk, which should be considered at all stages of the planning and development process and across the whole catchment. It emphasises the need to act on a precautionary basis and to take account of climate change. It provides advice on future urban development in areas at risk of flooding. It assesses proposals according to the amount of risk and promotes the concept of Sustainable Drainage Systems (SuDS) in new developments or

redevelopments. For further information please refer to the Office of the Deputy Prime Minister's planning website: http://www.planning.odpm.gov.uk/pps25/

Planning Policy Wales

Planning Policy Wales sets out the land use planning policies of the Welsh Assembly Government. It is supplemented by a series of Technical Advice Notes (TANs). Together they comprise national planning policy which should be taken into account by local planning authorities in Wales in the preparation of unitary development plans (UDPs) and Local Development Plans (LDPs).

Policy Appraisal

Process of evaluating chosen policies against catchment objectives and scenarios of catchment change.

Policy Unit

Areas within the CFMP area where the same flood management policies apply. These have similar characteristics and features.

Pre-feasibility Study

A pre-feasibility study is a preliminary study to determine if a feasibility study or project appraisal is needed.

Priority Action

Urgent needs that require priority attention (e.g. urgent repairs or stand-alone improvements that should be addressed immediately and should not wait until the CFMP process has been completed).

Preliminary Flood Risk Assessment (PFRA)

Initial assessment of local flood risk as required by the Flood Risk Regulations 2009.

Probability of Occurrence

The probability of a flood event being met or exceeded in any one year (usually expressed as a return period – e.g. 1% AEP).

Problem Areas

Areas within the catchment identified as being at significant risk from flooding.

Professional Partners

Other professional bodies, agencies and organisations that we work with

Programme of Measures

A list or timetable of intended actions

Project Appraisal

The process of defining objectives, examining options and evaluating costs, benefits, risks, opportunities and uncertainties before making a decision.

Project Appraisal Report (PAR)

The document that sets out the appraisal process and business case for a flood defence project, up to the point where approval is obtained from the funding authority. For Environment Agency schemes this is an internal approval, whilst for Local Authorities this will be WAG.

Project Team

Responsible for producing the CFMP, made up of our staff assisted by consultants.

— Q —

QMED

Median annual maxima flood which has an annual exceedance probability of 0.5 and a return period of two years.

— R —

Ramsar site

The Ramsar Convention on Wetlands of International Importance, especially as Waterfowl Habitat (1971) requires the UK Government to promote using wetlands wisely and to protect wetlands of international importance. This includes the designation of certain areas as Ramsar sites, where their importance for nature conservation (especially with respect to waterfowl) and environmental sustainability meet certain criteria. Ramsar sites receive SSSI designation under The Countryside and Rights of Way (CRoW) Act 2000 and The Wildlife and Countryside Act 1981 (as amended).Further information can be located on the RAMSAR convention on wetlands website: http://www.ramsar.org/

Receptor

Asset, people or environmental, cultural or landscape resource that is at risk of flooding.

Registered parks and gardens

English Heritage and CADW maintain national Registers of Parks and Gardens of special historic interest in England and in Wales respectively. The register seeks to ensure that the features and qualities that make these landscapes of national importance are safeguarded but does not give extra protection. These are graded in the manner of listed buildings, with Grade 1 being the highest and of international importance (c10%), G2* of exceptional historic interest standard, G2 of

national importance. Many others occur as G3, on an inventory held by local authorities and maintained by the gardens trusts. These are of regional importance and not relevant to high level strategy.

Regional Flood and Coastal Committee (**RFCC)**

An Environment Agency committee, responsible for consenting medium and long term plans and operational plans to the Agency's Board and Head Office. Monitors and reports on progress. In Wales there is only one RFCC and this is the FRMW (Flood Risk Management Wales) group.

Registered Landscapes of Historic Interest in Wales.

CADW maintain a Register of Landscapes of Historic Interest in Wales as a means of identifying , and to provide information on the most important and best-surviving historic landscapes in Wales. These landscapes are considered to be of national importance. Designation is designed both to help add weight to historic landscape issues and to help in the management of landscape change. There are two degrees of landscape designation; 'Outstanding Historic Interest' for expansive landscapes and 'Special Historic Interest' for more discrete areas. Both categories should receive equal weight in the decision making process.

Reservoir

An artificial lake where water is collected and stored until needed. Reservoirs can be used for irrigation, recreation, providing water for municipal needs, hydroelectric power or controlling water flow.

Return Period

The average interval in years between events of similar or greater size (e.g. a flow with a return period of 1 in 100 years will be equalled or exceeded on average once in every 100 years). This does not mean that they will happen regularly however. To be more accurate, the 100 year flood should be expressed as an event that has a 1 % chance of being met or exceeded in any one year.

Riffle

A shallow area in a river where the substrate is composed of gravel and the flow is faster.

Riparian

Land or habitat connected with, or immediately adjacent to, the banks of a river or stream.

Riparian landowners

Have various rights and obligations under common law with regard to watercourses.

Risk

Measures the significance of a potential event in terms of likelihood and impact. In the context of the Civil Contingencies Act 2004, the events in question are emergencies.

Risk Assessment

A structured and auditable process of identifying potential significant events, assessing their likelihood and impacts and then combining these to provide an overall assessment of risk to inform further decisions and actions

Risk Assessment for Strategic Planning (RASP)

The aim of RASP is to develop and demonstrate supporting methods for dealing with systems of flood defences. RASP is funded by the Environment Agency within the joint Agency / Defra Flood and Coastal Defence Research and Development Programme in Risk Evaluation and Understanding of Uncertainty.

Risk Management – anything done for the purpose of analysing, assessing and reducing a risk

Risk Management Authority – A Welsh risk management authority is defined in Section 6 of the Flood and Water Management Act 2010 as the Environment Agency (now Natural Resources Wales), a lead local flood authority, a district council for an area for which there is no unitary authority, an IDB for an internal drainage district that is wholly or mainly in Wales and a water company that exercises functions in relation to an area in Wales.

Risk Management Scheme(s)

See Flood Risk Management Scheme(s)

River flooding –

River of fluvial flooding occurs when water levels in a river channel overwhelms the capacity of the channel.

River Basin Management

Maintaining a balance between human activities and demands and ecological and hydrological status within river basin catchments. River Basin Management requires an understanding of all the elements of catchment management and the legislation that drives them such as the EU Water Framework and Habitats Directives.

River Basin Management Plan

Part of the Water Framework Directive and implemented in 2009. They describe the unique characteristics of each river basin, and the pressures it faces from pollution and over-use. The Environment Agency has developed a programme of measures, which sets out the WFD directives for each river basin.

River Habitat Survey (RHS)

RHSs offer a semi-objective method of assessing the physical character and quality of river habitats. The system uses standard field survey methods with full accreditation controls, a computer database for rapid analysis and includes outputs for expressing habitat quality and artificial channel modification. However, the approach was developed and tested within fluvial sections of rivers, without a clear definition of the point downstream at which the morphological characteristics and processes influencing habitat and the ecophysiological conditions are modified

by tidal flows. For further information consult the Environment Agency's website: www.environment-agency.gov.uk//gui/dataset3/3leg.htm

Riverine

Relating to a watercourse (river or stream) and its floodplain.

River Quality Objective (RQO)

A classification system developed to monitor the Environment Agency's duty to achieve specific water quality standards set by the Secretary of State. Currently, RQOs are classified using a River Ecosystem (RE) Classification, which is based on a set of chemical water quality parameters defined within the EC Freshwater Fish Directive (78/659/EEC). RQOs have no specific legal basis.

Run-off

That part of rainfall which finds its way into streams, rivers etc and flows eventually to the sea

— S —

Salmon Action Plan (SAP)

Local plan for the management of salmon, prepared by Natural Resources Wales.

Scenario

A possible future situation, which can influence either catchment flood processes or flood responses. Scenarios will usually comprise combinations of the following: urban development (both in the catchment and river corridor); change in land use and land management practice (including future environmental designations); or climate change.

Scheduled Monuments, Scheduled Ancient Monuments (SM)

To protect archaeological sites for future generations, the most significant of them may be "scheduled". Scheduling is the process through which nationally important sites and monuments are given legal protection by being placed on a list, or 'schedule'. English Heritage identifies sites in England, which should be placed on the schedule by the Secretary of State for Culture, Media and Sport. CADW identify and designate sites in Wales. The current legislation, the Ancient Monuments and Archaeological Areas Act 1979, supports a formal system of Scheduled Monument Consent for any work affecting a designated monument.

Scoping Report

Report that will gather information on catchment characteristics and flood risk. It will test how sensitive the CFMP area is to future changes in climate and land use and develop draft catchment objectives.

Section 105

The Section of the Water Resources Act under which Flood Plain Mapping is carried out. Level A was the initial Section 105 modelling, whilst level B modelling has been undertaken to look at key areas in more detail.

Sedimentation

The process of depositing sediment.

Sewer

An artificial conduit, usually underground, for carrying off sewage off sewage (a foul sewer) or rainwater (a storm sewer) or both (a combined sewer).

Sewer Flooding

Sewer flooding happens when the sewer is full and overflows occur outside of the building at manholes or drains in gardens (known as external flooding), or even inside of the building from toilets and drains (called internal flooding).

Shoreline Management Plans (SMPs)

These are a large-scale assessment of the risks associated with coastal processes and helps reduce these risks to people and the developed, historic and natural environments. These are prepared by the Environment Agency or maritime local authorities, individually or as part of coastal defence groups.

Single Payment Scheme (SPS)

An agri-environment scheme that came into force in January 2005 and replaced most of the individual Common Agricultural Policy (CAP) subsidy payments previously made to farmers. Farmers claiming the SPS must be actively farming and/or maintaining the land in Good Agricultural and Environmental Condition.

Site of National Conservation Interest (SNCI)

SNCIs are designated at a local level through inclusion within local or unitary development plans for their regional or local conservation interest. They are usually adopted by Local Authorities for planning but have no statutory protection.

Site of Special Scientific Interest (SSSI)

Sites notified under the Wildlife and Countryside Act 1981 (as amended by the Countryside and Rights of Way (CRoW) Act 2000) for their flora, fauna, geological or physiographical features. Notification of a SSSI includes a list of activities that may be harmful to the special interest of the site. Section 28 of the Wildlife and Countryside Act 1981 (provisions relating to SSSIs) has been replaced by a new Section 28 in Schedule 9 of the CRoW Act. The new Section 28 provides significantly improved protection for SSSIs. All SACs, SPAs and Ramsar sites are designated as SSSIs. For further information, refer to CCW's website: http://www.ccw.gov.uk/

Social Flood Vulnerability Index

Recognising that flooding can have different impacts on different groups of people, the social flood vulnerability index takes data from population statistics such as age, health disability, parental status, and financial deprivation to provide an index that can be mapped against flood probability. This can be used at the large scale planning stage to show where there may particularly vulnerable areas or communities.

Special Area for Conservation (SAC), Candidate Special Area for Conservation (cSAC)

An internationally important site for habitats and/or species, designated as required under the European Community 'Habitats Directive' (92/43/EEC). SACs are protected for their internationally important habitat and non-bird species. A cSAC is a candidate site, but is afforded the same status as if it were confirmed. SACs and cSACs also receive SSSI designation under The Countryside and Rights of Way (CRoW) Act (2000) and The Wildlife and Countryside Act (1981) (as amended). For further details refer to the Joint Nature Conservation Committee website: http://www.jncc.gov.uk/ProtectedSites/SACselection/UK_SAC_map.htm

Special Protection Area (SPA), Proposed Special Protection Area (pSPA)

A site of international importance for birds, designated as required by the EC Birds Directive. A pSPA is a proposed site, but has the same status as a confirmed site. SPAs are designated for their international importance as breeding, feeding and roosting habitat for bird species. The Government has to consider the conservation of SPAs in all its planning decisions. SPAs receive SSSI designation under The Countryside and Rights of Way (CRoW) Act 2000 and The Wildlife and Countryside Act 1981 (as amended). For further details refer to the European Commission: website: http://europa.eu.int/comm/environment/nature/spa/intro_en.pdf and The Joint Nature Conservation Committee website at: http://www.jncc.gov.uk/ukspa/sites/spalistA-C.htm

Squeeze

In relation to costal squeeze, is the term used to describe what happens to coastal habitats that are trapped between a fixed landward boundary, such as a sea wall and rising sea levels and/or increased storminess. The habitat is effectively 'squeezed' between the two forces and can diminish in quantity and or quality.

Standard of Protection (SoP)

The standard of flood defence afforded to a location or community, expressed as the chance of a flood event causing flooding to an area or overtopping of defences. A SoP of 0.1% (1 in 100 chance of occurrence in any given year) means that the location will not flood until this or greater events occur.

Standard Percentage Run-off

Dimensionless variable (range 0 to 100 %) that represents the percentage of rainfall that causes the short-term increase in flow at the catchment outlet seen after a storm event.

Steering Group

The Steering Group oversees the production of the CFMP and is made up of our staff together with staff from other operating authorities or major interested groups, where appropriate.

Strategic Environmental Assessment (SEA)

A legal requirement in the UK for certain plans and programmes stipulated by the SEA Directive (2001/42/EC), to undergo Strategic Environmental Assessment (SEA). The SEA Directive is implemented in Wales by the Environmental Assessment of Plans and Programmes (Wales) Regulations 2004 (SI 2004No. 1656, W170). The purpose of SEA is to provide for a high level of protection of the environment, to ensure the integration of environmental considerations into the preparation and adoption of plans and programmes, and to contribute to the promotion of sustainable development and environmental protection.

Strategic Flood Consequence Assessment (SFCA) – Wales only

A broad scale assessment of flood risk carried out by a Local Authority to support and inform the production of Local Development Plans.

Sub Catchment

Either a smaller catchment within a larger one (i.e. the area drained by a tributary of the main catchment), or an area of the catchment identified for the purpose of improving the CFMP process.

Surface Water Flooding

In the urban context, usually means that surface water runoff rates exceed the capacity of drainage systems to remove it. In the rural context, it is where surface water runoff floods something or someone.

Surface water runoff

This occurs when the rate of rainfall exceeds the rate that water can infiltrate the ground or soil.

Sustainability

A concept, which deals with man's effect on the environment through development. Sustainable development is 'development which meets the needs of the present without compromising the ability of future generations to meet their own needs' (Bruntland, 1987). In the case of flood risk, sustainability is about how much flood risk management options avoid tying future generations into inflexible or expensive options for flood defence. This usually includes considering other defences and likely developments as well as processes within a catchment. It should also take account of, for example, the long-term demands for non-renewable materials.

Sustainability Appraisal (SA)

Sustainability Appraisal (SA) is a form of assessment that is broader in scope than SEA. It extends to considering the social and economic, as well as the environmental, effects of a strategy or plan, and evaluates these in relation to the aims of sustainable development. Under the Planning & Compulsory Purchase Act 2004.

Sustainable Drainage Systems (SuDS)

A sequence of management practices and control structures designed to minimise the impact of surface water on flood risk and the environment. Techniques include the use of porous materials and soak-away systems to increase the time taken for water to enter the river network.

Sustrans

A sustainable transport charity which works on practical projects to encourage people to walk, cycle and use public transport to reduce motor traffic and its adverse effects.

— T —

Technical Advice Note 15 (TAN 15): Development and Flood Risk

One of a series of Technical Advice Notes (TANs) issued by the Welsh Government to advise local planning authorities and developers. In conjunction with Planning Policy Wales it provides advice on development and flood risk as this relates to sustainability principles, and provides a framework within which risks from both river and coastal flooding, and from additional run-off from development in any location can be addressed. For further information, please refer to the Welsh Assembly Government's website: Welsh Government | Technical Advice Note (TAN) 15: Development and Flood Risk (2004) ...

Telemetry

The means by which a data signal is transferred to a remote control centre via the telephone network.

The Country Land and Business Association

With almost one hundred years experience, the Country Land and Business Association (CLA) is the premier organisation safeguarding the interests of those responsible for land, property and business throughout rural England and Wales. Country Land & Business Association

Topography

Physical features of a geographical area.

Transport Wales, Welsh Assembly Government

Transport Policy of the National Assembly for Wales. Responsible for maintenance and improvement of trunk roads and motorways in Wales. Administration of grants to local authorities and other bodies to fund a range of capital transport schemes and transport services.

— U —

UK Climate Change Impacts Programme (UKCIP)

UKIP02 developed future emissions scenarios to study climate change. It was updated in 2005, and is due for its next update in 2008. The programme is funded by the Department for Environment, Food and Rural Affairs (Defra) and modelled by the Hadley Centre for Climate Prediction and Research (part of the Met Office), and are a key component of UK national and regional climate impacts assessment.

Unitary Development Plans

These are statutory plans providing information used to decide planning applications for land use development. UDPs sit alongside Local Plans (produced by District Councils and Unitary Authorities) and Structure Plans (produced by County Councils and Metropolitan Councils). The Planning and Compulsory Purchase Act 2004 replaces all these documents with Local Development Frameworks, to include Local Development Plans, which are currently being completed by Local Authorities across Wales.

— W —

Wales Spatial Plan

The Wales Spatial Plan is a 20 year plan for the sustainable development of Wales. The plan goes further than traditional land use planning by providing a consistent basis for the spatial integration of all policy in Wales, including those Welsh Government policies that are not directly associated with the land use planning system.

Water company

A company which hold an appointment under Chapter 1 of Part 2 of the Water Industry Act 1991 or a licence under Chapter 1A of Part 2 of that Act. Dwr Cymru-Welsh Water operating area covers the majority of Wales

Water Courses

Water features include rivers, lakes, ponds, canals and coastal waters.

Water Framework Directive (WFD)

European Community Directive (2000/60/EC) on integrated river basin management. The WFD sets out environmental objectives for water status based on: ecological and chemical measures; common monitoring and assessment strategies; arrangements for river basin administration and planning; and a programme of measures to meet the objectives. For further details consult the European Commission website: http://europa.eu.int

Water Level Management Plan (WLMP)

A document setting out the needs for managing water levels in a defined flood plain area (usually a SSSI). The aim of this document is to achieve a balance between different needs for drainage.

Water Table

The natural level of underground water, used as a standard of measurement in the process of conserving water. Where the water table meets the ground surface springs, streams, rivers and lakes occur.

Welsh Local Government Association (WLGA) –

Represent the interests of Local Authorities in Wales. The three fire and rescue authorities, four police authorities and three national park authorities are associate members.

Welsh Government (WAG)

The Welsh Government (pre April 2011 known as the Welsh Assembly Government) is the devolved government for Wales. Led by the First Minister, it is responsible for many issues, including health, education, economic development, culture, the environment and transport. http://new.wales.gov.uk/?lang=en

Wildlife and Countryside Act 1981 (as amended)

The principle mechanism for the legislative protection for wildlife in Great Britain. This legislation is the means by which the EC Habitats Directive and EC Birds Directive are implemented in Britain.

Woodland for Wales

Woodlands for Wales sets out the National Assembly's strategy for trees and woodlands in Wales. It presents a Vision for forestry and woodland policy over the next 50 years and sets a direction for the way in which trees and woodlands will contribute to a sustainable future for the people of Wales. http://www.forestry.gov.uk/forestry/INFD-5NLKT7

World Heritage Sites

World Heritage Sites receive designation from the United Nations Educational, Scientific and Cultural Organisation (UNESCO). These sites must be protected or safeguarded but receive no additional statutory protection from such designation, although there is an assumption that they will already be of such importance to receive protection from their status alone, if not from existing statutory arrangements and laws (such as Heritage, Conservation, Environmental, Planning, etc. at national and local level). Planning authorities regard the status of World Heritage Sites as a material consideration in determining planning applications and applications for permission for development affecting listed buildings and their setting. For further details refer to the UNESCO website: http://whc.unesco.org/toc/mainf13.htm

Appendix G. List of abbreviations

— A —

AAD	Annual Average Damage
AEP	Annual Exceedence Probability
AGLV	Area of Great Landscape Value
ALC	Agricultural Land Classification
ALTBAR	Mean Catchment Altitude
AMAX	Annual Maximum
AMP	Asset Management Plan
AOD	Above Ordnance Datum
AONB	Area of Outstanding Natural Beauty
ASA	Archaeologically Sensitive Area
ASMP	Asset System Management Plan
AVM	Automated Voice Messaging

— B —

BAP	Biodiversity Action Plan
BFI	Base Flow Index
BGS	British Geological Survey

— C —

Cadw	Welsh word meaning ‘to keep’ – Historic monument service of the Welsh Government
CAMS	Catchment Abstraction Management Strategy
CAP	Common Agricultural Policy
CCW	Countryside Council for Wales
CEH	Centre for Ecology and Hydrology
CFMP	Catchment Flood Management Plan
CHaMP	Coastal Habitat Management Plan
CoMAH	Control of Major Accident Hazards
COWs	Critical Ordinary Watercourses
CroW	Countryside and Rights of Way
cSAC	Candidate Special Area of Conservation
CSF	Catchment Sensitive Farming

CWS	County Wildlife Site

— D —

DAM	Development Advice Map
DCWW	Dwr Cymru Welsh Water
Defra	Department for Environment, Food and Rural Affairs
DEM	Digital Elevation Model
DETR	Department for the Environment, Transport and the Regions
DF	Debris Factor
DTLR	Department for Transport, Local Government and the Regions
DTM	Digital Terrain Model

— E —

EC	European Commission
EFO	Extreme Flood Outline
EH	English Heritage
EIA	Environmental Impact Assessment
ES	Environmental Stewardship
ESA	Environmentally Sensitive Area
EU	European Union

— F —

FAP	Fisheries Action Plan
FAS	Flood Alleviation Scheme
FCA	Flood Consequence Assessment
FCERM-AG	Flood and coastal erosion risk management appraisal guidance
FCW	Forestry Commission Wales
FDMS	Flood Defence Management System
FDMS	Flood Defence Management Strategy
FEH	Flood Estimation Handbook
FFD	Freshwater Fisheries Directive
FHRC	Flood Hazard Research Centre
FIM	Flood Incident Management
FRM	Flood Risk Management
FRMP	Flood Risk Management Plan

FRMW	Flood Risk Management Wales
FW	Flood Warning
FWA	Flood Warning Area
FWLOS	Flood Warning Levels of Service
FWMA	Flood and Water Management Act 2010

— G —

GAEC	Good Agricultural and Environmental Condition
GGAT	Glamorgan-Gwent Archaeological Trust
GIS	Geographical Information System
GQA	General Quality Assessment

— H —

ha	Hectares
HAP	Habitat Action Plan
HCA	Historic Character Area
HEP	Hydro-Electric Power
HER	Historic Environment Records
HLC	Historic Landscape Classification

— I —

ICOMOS	International Council on Monuments and Sites
IDB	Internal Drainage Board
IDD	Internal Drainage District
IFM	Indicative Flood Map
IoH	Institute of Hydrology
IPCC	Inter-Governmental Panel on Climate Change
I*TE*	Institute of Terrestrial Ecology

— J —

Jcn	Junction

— K —

km^2	Square Kilometres

— L —

LaMIS	Land Management Information System
LBAP	Local Biodiversity Action Plans
LCA	Landscape Character Area
LCM2000	Land Cover Map 2000
LDF	Local Development Framework
LDP	Longest Drainage Path
LDP	Local Development Plan
LEAP	Local Environment Agency Plan
LFA	Less Favoured Area
LiDAR	Light Detection And Ranging
LLFA	Lead Local Flood Authority
LNR	Local Nature Reserve

— M —

m	Metres
MAFF	Ministry of Agriculture, Fisheries and Food
MAGIC	Multi-Agency Geographic Information for the Countryside
mAOD	Meters Above Ordnance Daturm
MHWS	Mean High Water Spring
MIPs	Major Incident Plans
mm*/yr*	Millimetres per year
m^3/s	Cubic metres per Second

— N —

NAW	National Assembly for Wales
NFCDD	National Flood and Coastal Defence Database
NFFS	National Flood Forecasting System
NFU	National Farmers Union
NGR	National Grid Reference
NMR	National Monument Record
NNR	National Nature Reserve
NRA	National Rivers Authority
NRFA	National River Flow Archive

NRW	Natural Resources Wales
NSFRM	National Strategic Flood Risk Management
NSRI	National Soil Resources Institute
NWA	National Water Archive

— O —

OFS	Organic Farming Scheme
OFWAT	The Office of Water Services
ODPM	Office of the Deputy Prime Minister
OS	Ordnance Survey

— P —

PAG	Project Appraisal Guidance
PAR	Project Appraisal Report
POT	Peaks Over Threshold
PPG	Planning Policy Guidance notes
PPG25	Planning Policy Guidance Note 25: Development and Flood Risk
PPS25	Planning Policy Statement 25: Development and Flood Risk
PPW	Planning Policy Wales
PSA	Public Service Agreement
pSPA	Proposed Special Protection Area

— Q —

Q_{MED}	Median Annual Maxima Flood

— R —

RASP	Risk Assessment for Strategic Planning
RBMP	River Basin Management Plan
RBP	River Basin Plan
RE	River Environment
RHS	River Habitat Survey
RMA	Risk Management Authority
RPG	Regional Planning Guidance
RQO	River Quality Objective

RSPB	Royal Society for the Protection of Birds
RSS	Regional Spatial Strategy
RTNIP	Regional Telemetry Network Improvements Programme
RTP	Regional Transport Plan

— S —

SAAR	Standard Average Annual Rainfall
SAC	Special Area for Conservation
SAM	Scheduled Ancient Monument
SAP	Salmon Action Plan
SAP	Species Action Plan
SAR	Synthetic Aperture Radar
SC	Sub Catchment
SDA	Strategic Development Area
SEA	Strategic Environmental Assessment
SEWTA	South East Wales Transport Alliance
SFRA	Strategic Flood Risk Assessment
SFVI	Social Flood Vulnerability Index
SINC	Sites of Importance for Nature Conservation
SMP	Shoreline Management Plan
SMR	Sites and Monuments Record
SNCI	Site of Nature Conservation Interest
SNPA	Snowdonia National Park Authority
SoP	Standard of Protection
SPA	Special Protection Area
SPARQ	Spatial Pressures Analysis of River Quality
SPR	Standard Percentage Runoff
SPS	Single Payment Scheme
SPZ	Source Protection Zone
SSSI	Site of Special Scientific Interest
SuDS	Sustainable Drainage Systems
STW	Sewage Treatment Works

— T —

TAN	Technical Advice Notes
TAN15	Technical Advisory Note 15: Development and Flood Risk

ToR	Terms of Reference
Tp	Time to Peak

— U —

UDP	Unitary Development Plan
UK	United Kingdom
UKCIP	UK Climate Impacts Programme
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organisation

— W —

WAG*/WG*	Welsh Assembly Government, now Welsh Government
WFD	Water Framework Directive
WIMD	Welsh Index of Multiple Deprivation
WLMP	Water Level Management Plan

Kevin Owen
Atkins
West Glamorgan House
12 Orchard Street
Swansea
SA1 5AD

water@atkinsglobal.com