

Appendix A

Responsibilities for Flood Risk Management and associated activities

Table A.1: Responsibilities for Flood Risk Management and associated activities

Organisation	Role and Responsibilities
<p>Welsh Assembly Government and Flood Risk Management Wales</p>	<p>The Welsh Assembly Government is responsible for developing flood and coastal erosion risk management policy in Wales and largely funds flood and coastal activities undertaken by operating authorities across Wales.</p> <p>Flood Risk Management Wales is the working name for the Regional Flood Defence committee for Wales established under section 14 of the Environment Act 1995. It is an executive Committee of the Environment Agency, and is responsible for delivering the Environment Agency's flood risk management services in Wales, with the exception of issuing levies, or making drainage charges.</p> <p>The Welsh Assembly Government is responsible for the overall framework of the planning system in Wales. Planning policy is delivered through Planning Policy Wales with Technical Advice Note (TAN) 15 – Development and Flood Risk delivering flood risk policy.</p>
<p>Defra</p> <p>DCLG</p>	<p>Defra has overall policy responsibility for flood and coastal erosion risk in England. Defra funds most of the Environment Agency's flood management activities in England and provides grant aid on a project by project basis to the other flood and coastal defence operating authorities (local authorities and internal drainage boards). This supports their investment in capital improvement projects to manage flood and coastal erosion risk.</p> <p>The Department for Communities and Local Government (formerly the Office of the Deputy Prime Minister) is responsible for the planning system in England, which aims to prevent inappropriate new developments in flood risk areas, and to direct development away from areas at highest risk.</p>
<p>Environment Agency</p>	<p>The Environment Agency takes the lead role in managing flood risk in England and Wales. It has powers to construct and maintain defences against flooding on watercourses designated as “main rivers” and the sea and to implement flood warning schemes.</p> <p>The Environment Agency has an operational role to provide a flood warning service and to support the public in taking action before, during and after a flood - working together with the emergency services and local authorities when flooding occurs.</p> <p>The Environment Agency advises local planning authorities on development in inappropriate places - where it will be at risk of flooding or where it increases the risk of flooding to others</p> <p>The Environment Agency also has a duty to exercise a general supervision over all matters relating to flood risk management.</p>
<p>Internal Drainage Board</p>	<p>Internal Drainage Boards (IDB's) are established for low-lying areas of England and Wales where flood risk management and land drainage measures are necessary on a continually managed basis to sustain agricultural and developed land uses. IDBs have responsibilities for non-main rivers, known as ordinary watercourses, and surrounding land which will derive benefit, or avoid danger as a result of flood risk management and land drainage operations. Where water-dependent habitats exist in these districts, duties regarding conservation and enhancement apply, including if required, the maintenance of high water levels.</p>

Organisation	Role and Responsibilities
	<p>An IDB is required to exercise a general supervision over all matters relating to water level management of land within its district, and to use the powers and to fulfil the duties which are provided for under the Land Drainage Act 1991. Some IDBs may also have other duties, powers and responsibilities under specific legislation for the district. The duties in the Land Drainage Act itself are however surprisingly few:</p> <ul style="list-style-type: none"> - general supervision over all aspects of land drainage within the district; - general duties with respect to the environment, and recreation in respect of the natural and built environment and public access; and - maintenance of a list of all inherited assets <p>The discretionary powers granted to a Board under the Act are much wider and include the powers to:</p> <ul style="list-style-type: none"> - undertake works to alleviate flooding; - improve and maintain the drainage system, including the operation of pumping stations, weed screens and sluices; - regulate and control activities in and alongside the drainage system to ensure that flood risk management and land drainage standards are not impaired by the actions of others. The prime concerns are to ensure that such works do not damage defences, impede flow or reduce access to carry out necessary maintenance work and any future improvements; - create bye-laws; and - raise income through general charging arrangements to cover the costs of flood and water level management schemes and other land drainage work.
<p>Local Authorities</p>	<p>Local Authorities have permissive powers to carry out flood risk management works on non-main watercourses albeit outside those areas covered by IDBs. Local Authorities also have powers to undertake coastal defence measures including both sea defence to prevent flooding and coast protection to protect the land against erosion. If considered appropriate capital assistance is provided by the Welsh Assembly Government/ Defra.</p> <p>The Local Authorities have no legal responsibility to provide assistance during times of flood.</p> <p>Local Authorities assist with the dissemination of Environment Agency flood warnings where appropriate. The Local Authority's Emergency Plan covers the evacuation of houses, provision of temporary accommodation and the like resulting from very serious flooding.</p>
<p>Water Companies</p>	<p>Water companies have responsibility to maintain public water supply networks, reservoirs and sewers. They will also develop their own contingency plans, which would be activated as required.</p> <p>Water companies are responsible for the public sewerage system. Each customer is connected to a drain; this is the responsibility of the property owner. Customers are responsible for their private drains up to the point where they join the public sewer. Customers served by a private sewer are jointly and equally responsible for its repair and maintenance along with all those served by it.</p> <p>Water companies supply water and sewerage and have responsibilities to prevent flooding arising from its operations.</p>
<p>Navigation authorities</p>	<p>The tidal reaches of many rivers have public rights of navigation. Where applicable, harbour authorities may have a degree of control. There is no public right of navigation on most non-tidal watercourses. Some specific larger rivers and canals are administered by navigation authorities, such as British Waterways, private companies, or the Environment Agency.</p>

Organisation	Role and Responsibilities
<p>Transport Wales (Wales)</p> <p>Highways Agency (England)</p>	<p>Transport Wales, established in 2006 delivers the Welsh Assembly Government's transport policy. They are responsible for the maintenance and improvement of over 1,000 miles of trunk road in Wales and 75 miles of motorway. The Roads Network Management (RNM) division operates, manages and maintains the trunk road and motorway network including the associated surface water drainage infrastructure.</p> <p>The Highways Agency is responsible for the construction and maintenance of motorways and major trunk roads in England.</p>
<p>Highways Authorities</p>	<p>Highway drains and road gullies are owned and maintained by the Council Highway Authorities unless the street is unadopted. If the street is unadopted then maintenance of the highway drainage is the responsibility of the property owners on either side of the street.</p> <p>Motorways and Trunk roads are owned by the Welsh Assembly Government and are maintained by Capita Gwent Consultancy on their behalf.</p> <p>Highway authorities are responsible for the maintenance of :</p> <ul style="list-style-type: none"> • all county owned roads & footways; • highway bridges and structures; • street lights & traffic signals; and • highway drainage system. <p>Various powers and duties prescribed by the Highways Act 1980 in order to provide a safe and serviceable highway network.</p> <p>Highways Authorities have powers to clear the highway, drain the highway and keep water off the highway. They have the right to discharge water from their drainage assets but not to pollute the receiving watercourses.</p>
<p>Police</p>	<p>Receiving early warnings, monitoring weather warnings and further warnings from the Met. Office and Environment Agency.</p> <p>The co-ordination of the emergency services, local authorities, media and other interested parties during a flood event.</p>
<p>Public</p>	<p>Anyone who owns land or property adjacent to a river is classed as a riparian owner. A riparian landowner has certain rights and responsibilities in relation to the watercourse flowing through or adjacent to their property. These 'riparian rights' are based on common law and have been defined as a result of legal cases over many years. The rights are:</p> <ul style="list-style-type: none"> • You are presumed to own the land up to the centre of the watercourse, unless it is known to be owned by others • You have the right to receive flow of water in its natural state, without undue interference in quantity or quality • You have the right to protect your property from flooding, and your land from erosion subject to the prior consent of the Environment Agency <p>The public have a responsibility to be aware of the risks to themselves and their property and of the actions they should take to minimise the consequences of flooding.</p>

Appendix B

Environmental Report and Policy Appraisal Tables

Contents

Non-Technical Summary

Section B1 Introduction and Background

- B1.1 The purpose of SEA
- B1.2 The Catchment Flood Management Plan
- B1.3 Structure of the report appendix

Section B2 Consultation

Section B3 Environmental Context

- B3.1 Policy, plan and programme review
- B3.2 Baseline review
- B3.3 Scope of the SEA and environmental objectives

Section B4 Assessment and evaluation of environmental effects

- B4.1 Strategic options and appraisal process
- B4.2 Assessment and evaluation of impacts
- B4.3 Cumulative environmental effects
- B4.4 Mitigation and enhancement
- B4.5 Monitoring requirements

List of Figures

- Figure B1. The location of the Eastern Valleys Catchment Flood Management Plan.
- Figure B2. How the CFMP fits with the wider planning framework

List of Tables

- Table B1 Opportunities and Constraints to the Eastern Valleys CFMP
- Table B2 Summary of consultation undertaken during the development of the CFMP
- Table B3 Review of policies, plans, and programmes and relevance to the CFMP
- Table B4 Scope of the SEA in relation to the CFMP
- Table B5 Definition of policy options
- Table B6 Summary of Appropriate Assessment requirements for Natura 2000 sites
- Table B7 Summary of cumulative issues

List of Forms

- Form 12.1 Purpose of the CFMP
- Form 12.2 Meeting Legal Requirements
- Form 12.3 Summary of Flood Risks
- Form 12.4 CFMP Policy Options
- Form 12.5 Summary of current and future level and response to flood risk
- Form 12.6 Screening of Policy Options against Appraisal Objectives
- Form 12.7 Summary of the Relative Overall Losses and Gains
- Form 12.8 Summary of the Preferred Policy
- Form 12.9 Requirements for further policy development and appraisal
- Form 12.10 Indicators for Monitoring, Review and Evaluation

Non-Technical Summary

We are developing the Eastern Valleys Catchment Flood Management Plan in order to establish long-term (50 - 100 years) policies for sustainable flood risk management. These policies will not set specific measures to reduce flood risk or establish how to manage flooding issues in a catchment. Our policies are at the highest level in our hierarchy of spatial flood risk management plans and are about setting the right strategic direction so that in the future we take the best and most sustainable approach to managing flood risk to people, the environment and the economy.

Although not a legal requirement, we are undertaking Strategic Environmental Assessment (SEA) as part of our planning process in order to demonstrate how our plan takes account of the environment and, in particular, the likely significant environmental effects of the CFMP.

The CFMP involves:

- working with key partners and decision makers to establish long-term policies for sustainable flood risk management;
- carrying out a strategic assessment of current and future flood risk from all sources (such as rivers, sewers, groundwater and the sea) within the catchment, understanding both the likelihood and consequence of flooding and the effect of current ways of reducing risk. We measure the scale of risk in social, environmental and economic terms;
- considering how the catchment works, and looking at other policies, plans and programmes to identify opportunities and constraints to achieving sustainable flood risk management;
- finding ways to work with nature, and manage flood risk to maintain, restore or improve natural and historic assets.

In undertaking the SEA we considered the baseline environment, and how this would evolve without the influence of our plan.

Under the current catchment conditions, we estimate that 1315 people are at risk from a 1% AEP fluvial flood event, where depths exceed 0.5m. In the future, the number at risk will increase significantly to 7175 (+5860). The areas with the greatest level of risk are Caerphilly, Cardiff, Machen, New Tredegar, Ystrad Mynach, Ebbw Vale and Risca. For a 0.5% AEP tidal flood event 173 people are currently at risk. This will increase to 2502 people in the future (+2329).

There are currently 915 properties at risk from a 1% AEP fluvial flood event and 99 at risk from a 0.5% AEP tidal flood event. We estimate that in the future this will increase to 2323 (+1408) properties at fluvial flood risk and 1389 (+1290) at tidal risk.

Flooding can result in extensive community disruption. Within the Eastern Valleys catchment there are currently 1477 residential properties, 137 retail buildings, 6 schools, 6 health services and 6 community centres at risk from a 1% AEP fluvial flood event. In the future we estimate that this will increase to 4966 (+3489) residential properties, 269 (+132) retail buildings, 10 schools, 10 health services, 20 community centres and 2 hospitals. A 0.5% AEP tidal flood event currently affects 192 residential properties, 3 retail buildings and 1 school. In the future this will increase to 1768 (+1576) residential buildings, 13 retail buildings, 2 schools, 1 health services and 3 community centres.

Under current catchment conditions, 2 of the 20 SSSI within the Eastern Valleys Catchment are at risk from a 1% AEP fluvial flood event, with one additional site being at risk from a 0.1% AEP fluvial flood event. In the future these 3 SSSI will be at risk from 1% AEP fluvial flood event.

Currently 40 of the 584 listed buildings within the CFMP area are at risk from a 1% AEP fluvial flood event. In the future we estimate that this will increase to 49. A 0.5% AEP tidal flood event is estimated to affect 1 listed building under current catchment conditions; in the future this will increase to 18.

Our understanding of the future was based on scenarios for the future, where estimated changes to the climate, development and land management could result in changes to flood risk. We used these scenarios to understand what six generic policy options could mean for flood risk to people, the environment and the economy. The options we considered were:

Policy 1 - No active intervention (including flood warning and maintenance). Continue to monitor and advise

Policy 2 - Reduce existing flood risk management actions (accepting that flood risk will increase over time)

Policy 3 - Continue with existing or alternative actions to manage flood risk at the current level (accepting that flood risk will increase over time from this baseline)

Policy 4 - Take further action to sustain current scale of flood risk into the future (responding to the potential increases in flood risk from urban development, land use change, and Climate Change).

Policy 5 - Take further action to reduce flood risk (now and/or in the future)

Policy 6 - Take action with others to store water or manage run-off in locations that provide overall flood risk reduction or environmental benefits, locally or elsewhere in the catchment.

With our Steering Group we established a series of social, environmental and economic objectives for the catchment that drew from other policies, plans and programmes. These catchment objectives are:

- Reduce the risk of harm to life from flooding.
- Reduce community disruption caused by flooding.
- Reduce risk to critical transport routes and critical assets from flooding.
- Reduce economic damages caused by flooding.
- Optimise the level of Flood Risk Management expenditure. Ensure investment is proportional to the risks.
- Manage flood risk to listed buildings and ensure sites which are currently 'safe' do not become at risk of flooding.
- Ensure no deterioration of designated international and national nature conservation sites.
- Protect and improve habitats and species diversity, particularly BAP habitats and those relying on freshwater.

These objectives establish the key aims of the CFMP. We also consulted with the public on our draft objectives, and it was against these that we appraised the alternative policy options, drawing from opportunities and constraints provided from other policies, plans and programme. The most important opportunities and constraints to our CFMP, in relation to the SEA, are detailed in Table B1 below.

Table B1: Opportunities and Constraints to the Eastern Valleys CFMP

Receptor		Opportunities for flood risk management	Constraints for flood risk management
People, property and communities	People	<p>Reduce the risk of injury, death and human health from flooding in urban centres and rural communities.</p> <p>The areas where we could potentially reduce river flood risk for the greatest numbers of people include Cardiff, Caerphilly, Ystrad Mynach and Risca.</p>	<p>Some flood protection options may be economically or technically unfeasible in some locations. Maintaining standards of flood defence will be increasingly difficult in areas heavily influenced by sea level rise by 2100. This may include coastal settlements such as Cardiff</p> <hr/> <p>Future increases in flood risk would have the greatest potential impact on more socially vulnerable communities. Areas currently at risk of flooding in Caerphilly and Risca have 'high' social vulnerability.</p>
	Flood warning	<p>Improve and expand our flood warning service and public awareness of flood risks in their area. We are currently working to target warnings at a community level and to provide warning times of 2 to 4 hours in the Eastern Valleys where we can.</p>	<p>Many of the Eastern Valleys rivers are very quick to respond to rainfall, this can affect how quickly we are able to issue warnings to the public. This is particularly true for settlements close to river headwaters such as New Tredegar, Ebbw Vale, Cwm and Abertillery.</p>
	Residential property	<p>Reduce frequency, duration and severity of flooding of residential properties. Reduce economic damages.</p> <p>The greatest numbers of residential properties are currently at risk in Cardiff, Caerphilly, Ystrad Mynach and Risca; these are some of the areas we have shown to have the greatest potential economic damages from flooding.</p>	<p>There is pressure to meet regional housing targets. This could lead to redevelopment and/or proposals for new development in flood risk areas. The greatest development pressure is in Cardiff and Caerphilly.</p>
	Recreation	<p>Maintain and improve Public Rights of Way and access to the water environment for fishing, boating, walking, bird watching and other activities.</p> <p>Creation of additional recreational opportunities as part of wider flood risk management measures, including wetlands, and maintaining good physical and chemical conditions for fish.</p>	<p>Public Rights of Way and popular recreation assets in flood risk areas will be exposed to higher risk in the future. Sea level rise and tidal flooding are the greatest constraints to flood risk management at the coast. Some reaches of the lower Rhymney have important salmonid populations. Increased fluvial flooding in these reaches would have a negative impact on fisheries as a recreational asset.</p>
Material assets	Development & planning	<p>The CFMP will support land use planning by identifying, and discouraging development in existing and future flood risk areas and directing development to other more suitable areas.</p> <p>The CFMP will support planning policy to avoid development in flood risk areas, alongside documents such as TAN15.</p>	<p>Requirements to meet national and regional housing targets will lead to continued pressure to develop in unsuitable locations. Cardiff and Caerphilly have been identified as particularly important development locations.</p>

Receptor		Opportunities for flood risk management	Constraints for flood risk management
	Flood defence infrastructure and asset management	<p>Improve and maintain the condition of our existing flood defences where it is sustainable to do so. Opportunities to increase the SoP of defences will be sought through detailed pre-feasibility studies, and by considering alternative measures as well as defence improvements.</p>	<p>It is not economically feasible to build defences for all areas at risk of flooding in the Eastern Valleys, and this would also worsen the problem in other locations. Other measures should be considered where it is not feasible to build defences, such as flood evacuation plans. Maintaining some defences may not be sustainable in the long-term, as we expect river flows to increase in the future under scenarios of climate change.</p>
		<p>Identify where existing defences are uneconomical and unsustainable and highlight opportunities to reconnect the river with its floodplain and create and restore wetlands.</p>	<p>Realigning/removing existing defences must not increase flood risk to people, property and the environment (where this would have negative impacts) in other locations where avoidable. This is a significant problem in the Eastern Valleys as most defences are protecting significant numbers of people and properties.</p>
		<p>Assess the potential for additional defences to reduce flood risk to people and communities where feasible, alongside other management options. We expect to undertake future works on the River Rhymney in New Tredegar.</p>	<p>Provision of new defences will be constrained by local environmental, economic and social needs. Constraints will be identified for individual defence proposals in consultation with relevant organisations and the public. Alternative options to defences will also be considered.</p>
	Other infrastructure	<p>Reduce frequency, duration and severity of flooding to the important infrastructure and reduce economic and community disruption. In the Eastern Valleys, the A467 and A468, both important transport links that we recognise must be safeguarded for the economic stability of the region.</p>	<p>Some transport routes are located in vulnerable locations. The A468 through Caerphilly and Bedwas is an important road running through the CFMP area which flooded in the October/November 2000 floods.</p>
Economy	Tourism	<p>Protect current tourist assets and promote creation of new recreation opportunities as part of wider flood risk management. The city of Cardiff, for example, is especially important for tourism and the local economy. We can use the CFMP to safeguard these important areas where it is sustainable to do so.</p>	<p>The flood risk management policies we select must not adversely affect the tourism economy. For instance, increasing flooding in an area such as Cardiff would have detrimental impacts on the local economy if local infrastructure is affected.</p>
	Commercial and industrial assets	<p>The CFMP will set policies to protect and reduce flood risk to important industrial and commercial centres from flooding. Cardiff is an important area of economic strength as well as the valuable industrial areas across the CFMP area (such as Caerphilly and Bedwas) that we need to protect.</p>	<p>Certain flood risk management options may be economically and technically unfeasible in some locations. It will be very difficult for us to protect all businesses and industries that are already located in vulnerable areas. Flooding of agricultural land is likely to occur more frequently in the future. Although this could provide environmental gains, it could also lead to disruption of rural businesses and communities.</p>

Receptor		Opportunities for flood risk management	Constraints for flood risk management
Biodiversity	Conservation	Protect, enhance, and reduce flooding of regionally, nationally and internationally important habitats and species as part of wider flood risk management policy (including SPAs, SAC, and Ramsar sites, SSSIs, BAP species and habitats described in section 2.8).	Flood risk to some conservation areas is likely to increase in the future; sites that currently have the greatest risk from fluvial flooding are the Gwent Levels Rumney and Peterstone SSSI, Gwent Levels St Brides SSSI and Plas Machen Wood SSSI. Sites that are protected by national and international policy may limit some flood risk management options which involve reducing standards of protection in the future.
		Creating and restoring wetlands in low-lying and estuarial areas for flood benefit provides opportunities to offset potential loss of protected habitat resulting from sea level rise and coastal squeeze. Actions giving flood risk benefits, such as the creation of new wetlands away from the coast in floodplain areas, would contribute to BAP targets for priority habitats (particularly reedbeds, wet woodlands) and associated species (including the Reed Bunting and the Bittern).	Compensatory habitat must be provided for any loss/damage to sites designated under the EC Habitats Directive, resulting from flooding and coastal squeeze. Compensatory requirements will need to be judged on a case-by-case basis.
	Fisheries	Improve the size, condition and recreational value of natural fish stocks. We could do this by maintaining or reducing the current flood risk to river reaches designated under the FFD, but also by favouring policies that would improve the condition of reaches suffering from low flows. The Rivers Rhymney and Ebbw have the most important reaches for fisheries in the Eastern Valleys.	Needs to protect and defend some areas may conflict with ideal conditions for fish stocks. For example, the tidal barrier at Aberbeeg on the River Ebbw presents an obstacle to the upstream migration of salmon and sea trout.
Landscape	Conservation	Safeguard, enhance, and reduce flooding of regionally, nationally and internationally important landscape features as part of wider flood risk management policy (including the Brecon Beacons National Park, although only a small area of this is within the CFMP boundary).	Requirements to protect important landscape features may limit some flood risk management options, especially where such options are visually intrusive.
	Geomorphology	Restore the natural appearance and processes of rivers e.g. promote natural flooding regimes for flood risk and environmental benefit. There may be opportunities along the Eastern Valleys watercourses to restore natural flow regimes in more rural areas, which would be identified through a detailed geomorphological assessment of the watercourses.	Restoring natural geomorphological processes would involve increasing flood risk in some areas. This may not be possible where this would increase flood risk to people and property.

Receptor		Opportunities for flood risk management	Constraints for flood risk management
Historic Environment	Historic Environment Assets	Safeguard, enhance, and reduce flooding of important historic environment assets as part of wider flood risk management policy (including listed buildings). There are approximately 50 listed buildings at risk of river flooding in the Eastern Valleys which are unlikely to be significantly affected by increases in flood risk.	Increases in the frequency and extent of flooding in the future may present a risk to features not currently at risk. Listed buildings that are close to the current modelled flood extent may be affected by more extreme flood events in the future.
	Damage to agricultural land	Reduce flooding and degradation of important (productive and versatile) soils and agricultural lands. There is a small area of Grade 1 agricultural land just south of Machen that is an important agricultural resource locally.	Other good quality land in the Eastern Valleys is widely distributed in small pockets; protecting this land from flooding is not a long term sustainable target.
Land management	Land management practice	Improve the conservation value of farmland and reduce the risk of agricultural runoff, sediment production and pollution as part of flood risk management policy. Encourage ditch maintenance to prevent excessive build-up of silt and reduced flood conveyance.	There are many uncertainties associated with the future of agriculture and land management in the Eastern Valleys. This makes it difficult for us to predict future flood risk to this land. Ditch and stream maintenance practice needs to be done sensitively as some BAP priority species are specific to these environments.
		Encourage and benefit from the uptake of agri-environmental schemes that reduce flood risks to people and property and provide environment enhancements (such as Tir Gofal, Welsh Assembly Government's flagship scheme).	Funding limitations of the schemes will mean that only areas offering greatest benefits are likely to be funded. Uptake of agri-environmental schemes would have to be catchment-wide to have a notable beneficial effect on flood risk in the Eastern Valleys.
Water environment	Water quality	Help improve chemical and biological water quality in line with regional, national and international targets (including the Habitats Directive, Birds Directive and Water Framework Directive), as part of wider flood risk management measures. E.g. preventing excessive build up of silt in lowland streams and ditches, and maintaining flow and water levels, would be beneficial for both flood conveyance and biodiversity.	Flood risk management options that conflict with water quality objectives will not be acceptable. Although changes in land management practices can have impacts on water quality, the future of agriculture in the Eastern Valleys is not clear which makes it difficult for us to predict. Flood risk management measures must not degrade the quality of the rivers in the Eastern Valleys.

Receptor	Opportunities for flood risk management	Constraints for flood risk management
	<p>Maintain or reduce the current level of flood risk to potential pollution sources. There is not a significant threat of land-fill site flooding in the Eastern Valleys, but there is 1 COMAH site at flood risk in Caerphilly that would benefit from future flood risk management policies.</p>	
	<p>We can support Water Level Management Plans (WLMPs) adopted for important conservation areas by using flood risk management policies that favour maintaining specific water levels in SSSIs. WLMPs for the Wentlooge Levels highlight the benefit of raising water levels and/or converting grazing marsh to reedbed for conservation and flood risk benefit.</p>	<p>Water Level Management Plans outline complex seasonal water level regimes for SSSIs that need to be considered in flood risk management plans. There may be conflicts of interest as many marshland areas are used for seasonal grazing, which would not be possible if water levels are raised or if land is converted to wetlands for conservation and flood risk benefit.</p>

Our preferred policies are as follows:

- **Policy Unit 1 – Cardiff – Policy 5** - Take further action to reduce flood risk (now and/or in the future)
- **Policy Unit 2 – Bedwas and Machen – Policy 3** - Continue with existing or alternative actions to manage flood risk at the current level (accepting that flood risk will increase over time from this baseline)
- **Policy Unit 3 – Rhymney Corridor – Policy 5** - Take further action to reduce flood risk (now and/or in the future)
- **Policy Unit 4 – Upper and Mid Reaches – Policy 2** - Reduce existing flood risk management actions (accepting that flood risk will increase over time)
- **Policy Unit 5 – Upper Ebbw – Policy 4** - Take further action to sustain current scale of flood risk into the future (responding to the potential increases in flood risk from urban development, land use change, and Climate Change).
- **Policy Unit 6 – Ebbw Corridor – Policy 4** - Take further action to sustain current scale of flood risk into the future (responding to the potential increases in flood risk from urban development, land use change, and Climate Change).
- **Policy Unit 7 – Wentlooge Levels – Policy 3** - Continue with existing or alternative actions to manage flood risk at the current level (accepting that flood risk will increase over time from this baseline)

The significant impacts likely to result from the CFMP are as follows:

- The number of people at risk from a 1% AEP fluvial flood event, where depths exceed 0.5m, will be 1189. This will be a decrease of 126 from current baseline conditions and a significant decrease of 5986 from the future baseline.
- The number of people at risk from a 0.5% AEP tidal flood event, where depths exceed 0.5m, will be 803; an increase of 630 from the current baseline, and a decrease of 1699 from the future baseline.
- The number of properties at risk from a 1% AEP fluvial flood event, but not within an existing flood warning area, will be 538. This represents a decrease of 377 from current baseline conditions and 1785 from the future baseline.
- The number of properties at risk from a 0.5% AEP tidal flood event, but not within an existing flood warning area, will be 31; a decrease of 68 from the number currently at risk and a decrease of 1358 from the future baseline.
- The number of residential properties at risk from a 1% AEP fluvial flood event will be 1099, a decrease of 378 from the current baseline and 3867 from the future baseline.
- The number of residential properties at risk from a 0.5% AEP tidal flood event will be 310, an increase of 118 from the current baseline, and a decrease of 1458 from the future baseline.
- In comparison with the current baseline, there will be 71 fewer retail buildings and 2 less schools at risk from a 1% AEP fluvial flood event as a result of the chosen CFMP policies. However, 5 additional community centres will be at risk.
- No community assets will be at risk from a 0.5% AEP tidal flood event. The preferred CFMP policies will mean that those sites currently at risk from tidal flooding will no longer be at risk.
- Three SSSI will be at risk from a 1% AEP fluvial flood event as a result of the preferred CFMP policies. In total, the area of SSSI at risk will be 37.9 ha, an increase of 5.7 ha from the current baseline, but no change from the future baseline. The impacts may be positive or negative depending on the nature of the site and the type of flooding. Periodic inundation is unlikely to have an adverse effect, and may even benefit to water-dependent features. However, prolonged or frequent inundation, particularly by low quality water, may have a negative impact.
- The policies of the CFMP may have positive or negative impacts on BAP habitats and species. Where policies increase flood risk management actions the impact is likely to be

negative. Where actions are reduced BAP habitats and species may benefit, for example through reduced disturbance.

- The number of listed buildings at risk from a 1% AEP fluvial flood event will be 35, a decrease of 5 from the current baseline, and 14 from the future baseline.
- The number of listed buildings at risk from a 0.5% AEP tidal flood event will remain at 1.

As a result of the potential risk to Natura 2000 and Ramsar sites, we have undertaken an appropriate assessment of the plan and found that the plan will have no adverse impact on the Natura 2000 and Ramsar sites within the Eastern Valleys Catchment.

We selected policies to increase or sustain the current level of flood risk management where the current level of flood risk is high. In these areas alternative options would have resulted in a high level of fluvial and tidal flood risk to people, property, infrastructure and environmental receptors. Alternative options would also not satisfactorily address future increases in flood risk, particularly as a result of climate change. We selected policies to continue or reduce current flood risk management in areas where the current level of flood risk is low. In these areas the costs involved in implementing alternative policies to increase flood risk management would not be justifiable, in relation to the level of social, economic and environmental risk involved. A brief justification of the reasons for selecting each of the preferred policies is given below. Further justification of the chosen policies is given in Table 12.8 in the policy appraisal tables.

Policy Unit 1 (Cardiff) – Policy 5 was chosen for Cardiff because our goal is to reduce the currently high tidal flood risk, which in the future would be significantly worse based on our projections of sea level rise as a result of climate change. The chosen policy would also reduce the future fluvial flood risk, which again would significantly increase based on current climate change projections. Taking further action to reduce flood risk now and into the future is important as Cardiff is the main economic centre in the Eastern Valleys.

Policy Unit 2 (Bedwas and Machen) – The flood risk in the Bedwas and Machen is considered to be managed appropriately and should not change in the future. We have therefore selected Policy 3 for this unit, and accept that flood risk will increase in time from the current level of risk. We consider that the additional risk that will be present in the future can be minimised through influencing and informing.

Policy Unit 3 (Rhymney Corridor) – Policy 5 has been selected for the Rhymney Corridor in order to reduce the currently high fluvial flood risk, which in the future would also be significantly worse based on our projections of water level rise as a result of climate change. Taking further action to reduce flood risk now and into the future is important as Caerphilly is an important growth area in the Eastern Valleys.

Policy Unit 4 (Upper and Mid Reaches) – The flood risk in Mid and Upper Reaches policy unit is considered to be low and we should be looking to reduce our existing flood risk management in areas not at flood risk. We have therefore selected Policy 2 for this unit. This policy accepts that flood risk will increase now and into the future. This will need to be a managed process and does not mean that where flood defences are protecting a large number of properties (Ynysddu) these should be removed. Most of the additional flood risk will be in areas where there is little flood risk to people, property and the environment.

Policy Unit 5 (Upper Ebbw) – Policy 4 has been selected for the Upper Ebbw in order to reduce the high future fluvial flood risk to the current level. The current flood risk should be managed through influencing and informing.

Policy Unit 6 (Ebbw Corridor) – Our goal for selecting Policy 4 for the Ebbw Corridor is to reduce the high future fluvial and tidal flood risk to the current level. The current flood risk should be managed through influencing and informing.

Policy Unit 7 (Wentlooge Levels) – Policy 3 has been selected for the Wentlooge Levels as we are accepting that flood risk will increase in time from the current level of risk. We consider that the additional risk that will be present in the future can be minimised through influencing and informing.

Our mitigation and enhancement measures are included within the appraisal of alternative but these will be cascaded down through our subsequent and more detailed plans as we decide the flood risk management measures we need to implement the policies. More detail on monitoring of the CFMP is included in section B4.5 and the policy appraisal tables in Annex 1.

B.1 Introduction and Background

B.1.1 The purpose of SEA

This appendix documents the strategic environmental assessment (SEA) process undertaken for the Eastern Valleys Catchment Flood Management Plan (CFMP).

Strategic environmental assessment is a systematic process for anticipating and evaluating the environmental consequences of plans and programmes prior to decisions being made. The purpose of SEA is to provide for a high level of protection of the environment and to contribute to the integration of environmental considerations into the preparation and adoption of plans and programmes with a view to promoting sustainable development. There is no legal requirement for us to undertake SEA for CFMPs because they are not required by legislation, regulation or administrative provision. However they clearly help set the framework for future planning decision, and have the potential to result in significant environmental effects. As a result Defra guidance (Defra, September 2004¹) and our own internal policy have identified a need to undertake a SEA approach.

In developing our CFMP, we consider the environment alongside social and economic issues. This appendix demonstrates how we have gone about undertaking the SEA for our CFMP. The contents of this Environmental Report have been broadened to include the social and economic effects also considered in our plan making process.

B.1.2 The Catchment Flood Management Plan

Figure B1 shows the location of the Eastern Valleys CFMP with the various Policy Units identified.

¹ <http://www.defra.gov.uk/enviro/fcd/policy/sea.htm>

Figure B1: Location of Eastern Valleys Catchment Flood Management Plan



Catchment Flood Management Plans are planning documents that we are preparing for all surface water river catchments across England and Wales. In developing the CFMPs, we are working with other key decision-makers to help us to establish policies to manage flood risk for the next 50-100 years. We know we cannot reduce flood risk everywhere, so we need to target efforts to where they are needed most: this is the purpose of our CFMP. They will not set specific measures to reduce flood risk or establish how to manage flooding issues in a catchment. Our policies are at the highest level in our hierarchy of spatial flood risk management plans and are about setting the right strategic direction so that we take the best and most sustainable approach in the future. To do this, we need to understand the extent, nature and scale of current and future flood risk to people, the environment and the economy across the whole catchment before choosing certain policies. We need to decide at this stage where to take further action to reduce or sustain flood risk, where we need to change the way we currently manage flood risk, or where we need to take little or no action.

The main body of the CFMP provides a more detailed introduction to the CFMP, including the contents, aims and objectives of the plan: see Section 1.1 ([Background](#)) and Section 1.2 ([Aims and Scope](#)).

The CFMP involves:

- carrying out a strategic assessment of current and future flood risk from all sources (such as rivers, sewers, groundwater and the sea) within the catchment, understanding both the likelihood and consequence of flooding and the effect of current ways of reducing risk. We measure the scale of risk in social, environmental and economic terms;
- identifying opportunities and constraints within the catchment to reduce flood risk through changes in land use, land management practices and/or the flood defence infrastructure;
- finding ways to work with nature, and manage flood risk to maintain, restore or improve natural and historic assets;
- working out priorities for studies or projects to manage flood risk within the catchment, and identifying responsibilities for the Environment Agency, other operating authorities, local authorities, water companies or other key interested groups.

B.1.3 Structure of the report appendix

This appendix documents the SEA process we have undertaken throughout our CFMP planning process and covers:

Section B2 – Consultation: setting out information on how we have engaged interested parties, including the SEA consultation bodies, through CFMP development and the SEA process.

Section B3 – Environmental Context: The relationship between the CFMP and relevant plans and programmes; a summary of the relevant environmental baseline in the catchment. It also sets out the environmental issues scoped into the SEA process and the environmental objectives used to carry out the assessment in Section B4.

Section B4 – Assessment and Evaluation of Environmental Effects: Setting out the environmental effects of the different options available to the CFMP, cumulative effects of the CFMP as a whole and with other relevant plans in the catchment. It also sets out how mitigation and enhancement are considered at this strategic scale and the future monitoring requirements.

Note: hyperlinks have been provided to the main stage plan to allow the reader to appreciate the broader context of our plan-making process.

B.2 Consultation

Section 1.6 Involving others in the main CFMP provides information about the consultation undertaken to date. This information is repeated below.

We cannot manage flood risk on our own. All key organisations and decision-makers in a catchment must work, plan and act together to manage the risk of flooding.

We started the CFMP in Spring 2006. At the outset we established a Steering Group to help us develop the Plan. The Steering Group was involved throughout the process, guiding the development of the CFMP and providing technical input on wider issues. The Steering Group is made up of technical officers, planners and representatives from key organisations. The composition of the Steering Group is shown in table B1.

Table B1 The composition of the Steering Group

Steering Group Members	
Blaenau Gwent County Borough Council	Countryside Council for Wales
CADW (corresponding members)	Dwr Cymru Welsh Water
Caerphilly County Borough Council	Environment Agency Wales
Caldicot and Wentlooge Levels Internal Drainage Board	Forestry Commission Wales
Cardiff Council	Newport City Council
Country Land and Business Association	NFU Cymru (National Farmer Union Wales)

The Inception Stage involved producing an Inception Report based largely on readily available data and current understanding of the catchment. The Inception Report was completed in September 2006. It was distributed to the Steering Group. The Inception Report facilitated data collection from key stakeholders who had further information on issues relevant to the production of the CFMP.

The Scoping Stage identified the scope of the Plan. This focused the CFMP process, ensuring the approach taken, information used and analysis undertaken effectively fulfilled the broad aims of the CFMP process and the requirements of stakeholders. The Scoping Report was completed in September 2007. The Scoping Report consultation period began during September 2007 for 3 months. The Scoping Report was distributed to the Steering Group, our key stakeholders and decision-makers, the Consultation Group and was made available for the public to request via our website. The consultation responses were collated and incorporated into the Main Stage as appropriate.

The Main Stage commenced during November 2007, developing the draft Plan. The purpose of the draft Plan was to present relevant information to stakeholders to enable them to comment on the findings of the studies undertaken. The draft Plan was produced August 2008. The draft Plan consultation period began during September 2008 for 3 months. The draft plan formed the basis of the CFMP we and others will use to guide flood risk management activities in the catchment in the future. The consultation responses were collated and have been incorporated into the CFMP where appropriate or will form the basis of further discussions with partners as we move forward. For further details of the draft Plan consultation process please refer to Appendix D.

Implementation of the CFMP is key in the delivery of future flood risk management. This will require integrated and partnership working. Therefore, it is essential all parties involved in the

development of the CFMP continue to work together, using the CFMP to help them make future decisions on the main issues relating to flood risk management.

The CFMP document, together with the responses we have received from the consultation process, represent a significant step forward for flood risk management and provide a foundation for moving ahead. However, we are still at the beginning of a process of change and adaptation. We will continue to work with our partners to develop the flood risk management actions and discuss local delivery.

During the consultation on the Scoping stage of the Eastern Valleys CFMP the Steering Group raised several specific issues relating to the SEA. The following are examples of comments raised by consultees during the Scoping stage, in relation to the SEA, and how these were addressed during the production of the final stage of the CFMP:

- The Caldicot and Wentlooge Levels IDB requested that the Water Level Management Plan (WLMP) for the SSSIs in there area was reviewed. This plan has now been fully reviewed (see Table B3).
- The Caldicot and Wentlooge Levels IDB also requested that the significant environmental constraints in the Wentlooge Levels area were considered further, along with the importance of maintenance for these environmental features. The policy appraisal process considers the two SSSI within the Gwent Levels area specifically and this was used to inform policy choice.
- CCW commented that they would have expected climate change effects to feature more prominently in the report. The effects of climate change have been fully assessed as part of the modelling undertaken.
- CCW were concerned that the scoping report focussed predominantly on fluvial flooding. They would like more recognition of the risk from surface water, groundwater and sewer flooding. The main report now has greater emphasis on the flood risk from surface water, groundwater and sewer systems.
- CCW requested clarification as to why the internationally important sites have been excluded from the tables detailing current and future flood risk. Discussion of how international sites are not at flood risk is provided in sections 3.3.5 and 4.3.4 of the main report. Table B6 provides summary of potential upstream impacts on Severn Estuary cSAC, SPA and Ramsar Site.
- CCW were concerned that it may be quick to scope out the three Natura 2000 sites in the catchment and that there may be effects on sites, particularly the Severn Estuary that originate much further upstream (e.g. water quality impacts during maintenance/construction). The upstream impacts on the Severn Estuary, highlighted in the Habitats Regulations Assessment, are discussed in Table B6 of this SEA summary report.

B.3 Environmental context

B.3.1 Policy, plan and programme review

The SEA considers the relationship between the CFMP and other relevant plans and programmes. A review was undertaken at the scoping stage and updated during the main stage assessment, in order to:

- help collate additional environmental baseline information for developing the CFMP;
- identify environmental issues relevant to the SEA (e.g. existing environmental problems / protection objectives);
- identify influences of the CFMP on existing plans and programmes and vice versa;
- understand these relationships to help evaluate the significance of environmental effects;
- help identify any further assessment required.

A diagram setting out our view of the relationship between CFMPs and other key policies, plans and programmes is illustrated in Figure B2. Section 1.4 Links with other plans discusses the relationship with other plans. Those plans that we have drawn into the development of the CFMP are listed in Table B3.

Figure B2: How the CFMP fits with the wider planning framework

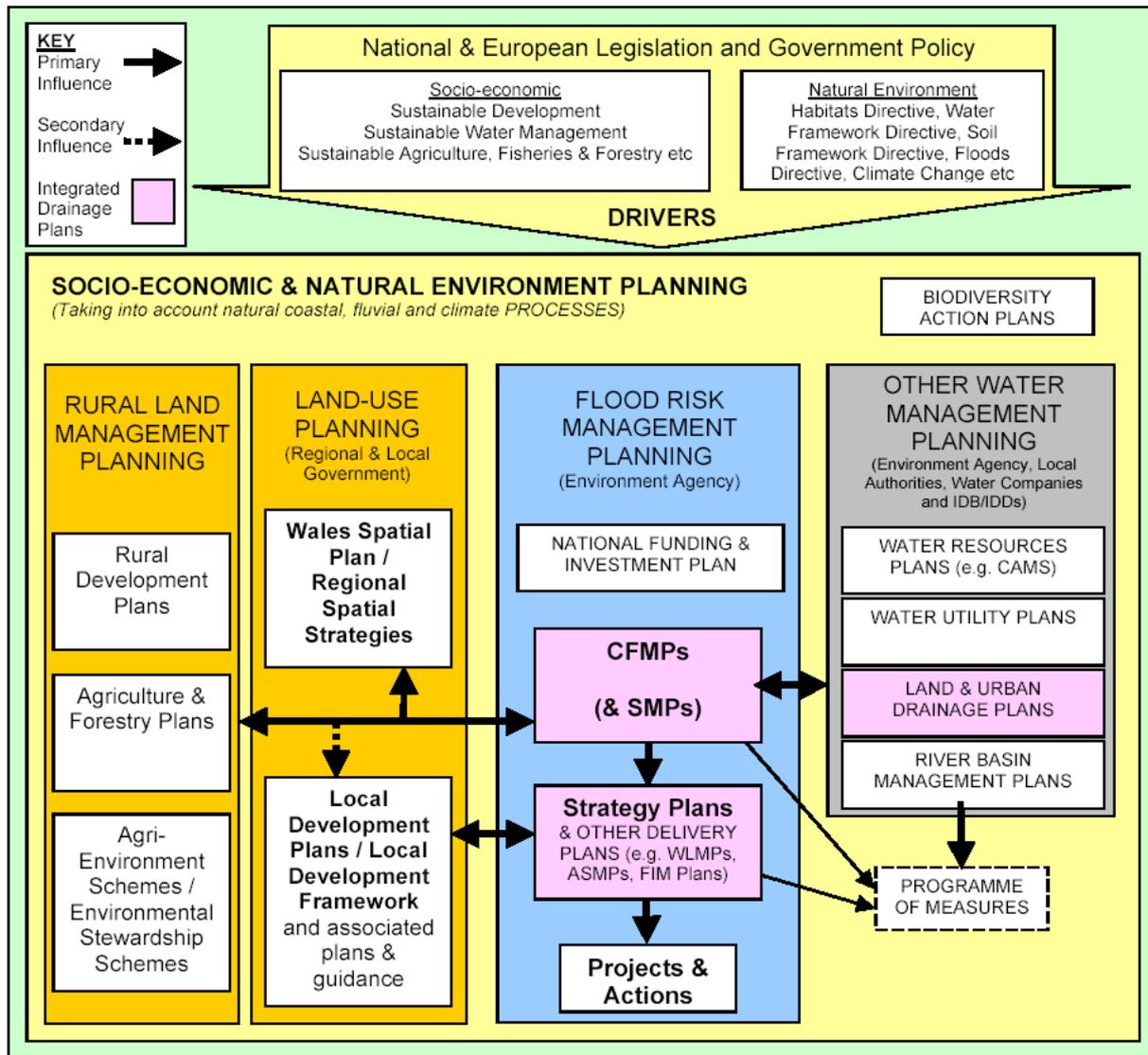


Table B3: Review of policies, plans, and programmes and relevance to the CFMP

Relevant plan, policy or programme	Type of Plan/Potential influence	Relevant opportunities or constraints we need the CFMP to consider
Land-Use Planning (Regional and Local Government)		
<p>Peoples, Places, Futures - The Wales Spatial Plan (South East Wales – The Capital Network) – WAG, 2004</p>	<p>Strengthening and development of the urban and transport systems within the South East Wales area to create a coherent urban network.</p> <p>Potential to influence current and future development in flood risk areas. Influences on urban density and future housing allocations.</p> <p>Enhancement of the natural and built environment.</p> <p>Help the environment, economy and society adapt to climate change’s potential impacts, including flood risk.</p> <p>Development should be avoided in areas vulnerable to future flooding in the light of estimates of the impact of climate change following the advice in TAN 15 Development and Flood Risk.</p>	<p>Development of Cardiff and Newport to provide strategic development opportunities has the potential to increase the number of people and assets at risk. The CFMP should influence where development is located.</p> <p>Regeneration of the Valleys corridor, particularly Ebbw Vale, through provision/improvements of housing stock, schools, leisure and retail facilities, will attract residents and increase prosperity, and may increase the number of people and assets at risk.</p> <p>Opportunities to manage the environment to contribute to sustainable development (i.e. maintaining soil carbon, reducing contamination, managing diffuse pollution sources to water, protecting landscapes and enhancing habitats).</p>
<p>Unitary Development and Local Plans:</p> <ul style="list-style-type: none"> - Blaenau Gwent Unitary Development Plan (Adopted July 2006) - Brecon Beacons National Park Adopted Local Plan (May 1999) - Caerphilly Unitary Development Plan 1996-2011 (Approved April 2003) - Cardiff Unitary Development Plan (to 2016) – Deposited written Statement (October 2003) - Newport Unitary Development Plan (1996 – 2011) 	<p>Potential to influence current and future development in flood risk areas. Influences on urban density and future housing allocations.</p> <p>Protection of natural and built environment, historical heritage and archaeological heritage.</p> <p>Allocation of open space, greenbelt and protected agricultural land.</p> <p>Protection of existing trees and hedgerows of high amenity value and also other landscape features such as watercourses, bankside vegetation and wetlands.</p>	<p>Accommodating future development to meet housing targets, particularly in growth areas (e.g. Caerphilly, Newport, Cardiff).</p> <p>Ensuring that the nature of future development is acceptable in terms of flood risk.</p> <p>Avoid damage to the natural environment and biodiversity (including designated international, national and local nature conservation sites).</p> <p>Avoid damage to landscape and historic environment assets.</p> <p>Consider opportunities to re-generate river corridors and/or wetlands.</p> <p>Protect the undeveloped coastline of the Wentlooge Levels.</p>
Flood Risk Management Planning		

Relevant plan, policy or programme	Type of Plan/Potential influence	Relevant opportunities or constraints we need the CFMP to consider
Severn Estuary Shoreline Management Plan (SMP) – <i>Severn Estuary Coastal Group 2000</i>	<p>Policy framework identifying future coastal flood management options for the Severn Estuary coastline.</p> <p>Management of coastal defences.</p> <p>Protection and enhancement of biodiversity.</p>	<p>CFMP objectives must complement those of the SMP.</p> <p>The SMP recommends a 'hold the line' policy for the short-term along the section of coast relevant to the CFMP. This will involve maintenance of existing defences to protect residential and industrial developments and the low-lying agricultural land in the Wentlooge Levels.</p> <p>In the longer term, a 'retreat the line' policy may be necessary to manage eroding foreshores, to create a more economically and environmentally sustainable defences and for nature conservation purposes.</p>
Strategy for the Severn Estuary – <i>Severn Estuary Partnership, 2001</i>	<p>A framework for the integrated and sustainable management of the Severn Estuary, for present and future generations.</p> <p>Conservation and enhancement of the cultural, natural and built environment.</p>	<p>Decisions regarding the provision of flood defence or coastal protection should take full account of the need to protect nature conservation, landscape character, amenity and features of geological and archaeological/heritage interest.</p> <p>Support the avoidance of new development on low-lying land at risk from flooding, or would exacerbate flooding elsewhere, or on coastal sites liable to erosion.</p> <p>The predicted implications of sea level rise must be taken into account when the future management of land drainage is planned.</p>
Other Water Management Planning		
Making Space for Water – Urban flood risk and integrated drainage – <i>Defra, March 2005</i>	<p>A holistic approach taking account of all sources of flooding, reflecting other relevant government policies in the policies of flood and coastal erosion risk management, in line with the Water Framework Directive.</p> <p>Its influences will be to manage risks to reduce the threat to people and their property and deliver the greatest environmental, social, and economic benefit consistent with the principals of sustainable development.</p>	<p>The CFMP must comply with management policies to address flood risk and coastal erosion.</p> <p>Opportunities to assess and improve the effectiveness of current flood risk management responsibilities and arrangements.</p> <p>Potential to identify opportunities for land use planning to encourage sustainable urban drainage.</p>

Relevant plan, policy or programme	Type of Plan/Potential influence	Relevant opportunities or constraints we need the CFMP to consider
Severn River Basin Management Plan – <i>Environment Agency, not yet published</i>	<p>Plans to achieve Water Framework Directive targets for 2015. The plan will include a description of river basin characteristics, a review of impact of human activity on status of any water bodies and an economic analysis of water use.</p> <p>This plan has not been reviewed as it has not yet been published.</p>	<p>Opportunities within the CFMP catchment include:</p> <ul style="list-style-type: none"> • Maintenance of water quality status of water bodies in the CFMP area and opportunities for improving towards Water Framework Directive targets; • Protection and enhancement of biodiversity, UK and local BAP priority species and habitats and designated fisheries; and • Consideration of the impact of improving water quality on flow, erosion, sedimentation and water body capacity.
Severn River Basin District - Significant Water Management Issues (SWMI) – <i>Environment Agency, 2008</i>	<p>The SWMI report for the Severn River Basin is the first stage of River Basin Management Planning which aims to identify what we believe to be the most significant issues that face each the Severn River Basin District.</p> <p>The SWMI for the Severn Estuary River Basin have been identified as:</p> <ul style="list-style-type: none"> - abstraction and other artificial flow pressures - alien species - nitrates - pesticides - phosphorus - physical modification (estuaries and coasts) - physical modification (rivers and lakes) - sediment (rivers and lakes) - urban and transport pollution. 	<p>Delivery of CFMP policies may provide opportunity to control alien plant and animal species with the CFMP area. This supports the objectives identified in the SWMI.</p> <p>Delivery of CFMP policies in areas where current levels of flood risk are to be maintained or improved may constrain the SWMI objective to improve rivers, estuaries and shorelines where they have been damaged by navigation, flood defences and the legacy of our industrial past.</p> <p>The CFMP should agree policies for sustainable flood risk management.</p>
Directing the Flow – Priorities for future water policy – <i>Defra, November 2002</i>	<p>Future water policy to respect environmental limits, productivity, abstraction, health, pollution, land use planning, climate change and recreation in order to implement the Water Framework Directive.</p>	<p>Potential opportunities for identifying water pollution issues arising from agricultural and urban diffuse pollution.</p> <p>Opportunity for improved understanding of the catchment and better land use planning in future, taking account of varying characteristics across the catchment, including water quality, water demand and land use. Potential for complementary land use management policies to reduce soil erosion and surface water run-off.</p> <p>Potential opportunities for returning watercourses to a more natural state.</p>

Relevant plan, policy or programme	Type of Plan/Potential influence	Relevant opportunities or constraints we need the CFMP to consider
Environment Agency Catchment Abstraction Management Strategies (CAMS) <ul style="list-style-type: none"> - Rhymney (2006) - Ebbw and Lwyd (2006) 	Sustainable management of water resources in the catchment including water allocation and abstraction licensing.	Improving water resource efficiency and abstraction issues. There may be opportunity for the CFMP and CAMS to work together to collect required data, including: <ul style="list-style-type: none"> - Hydrometric monitoring of the main watercourses in order to gain a better understanding of the catchment and to establish the effect on river flow caused by existing and new abstraction licences. In particular flows into and out of Roath Park Lake. - Low flow surveys. - Further ecological data collation. - Water quality monitoring and reporting in order to safeguard against deterioration. - Information regarding the requirements of the Wentlooge levels needs to be collected. - Further investigations into the nature of the existing - groundwater abstractions and surrounding geology.
Caldicot & Wentlooge Levels IDB – Water Level Management Plan - <i>Caldicot & Wentlooge Levels IDB, January 2007</i>	Influence the site management of the land drainage network in the Wentlooge Levels SSSI areas of the Eastern Valleys catchment. Water level management and flood protection. Conservation and protection of agricultural land and soils. Conservation of wetland habitats and biodiversity.	The IDB will provide support for the maintenance and improvement of sea defences, particularly sea level rises associated with climate change. This may constrain the CFMP in the Wentlooge Levels area, if the policy chosen stops, reduces or continues with existing or alternative actions to manage flood risk, and accepts that flood risk will increase over time. Work with the relevant authorities to ensure that flood risks will not be increased, especially in those areas becoming 'heavily' developed. The IDB will manage water levels within the area, with lives and property uppermost in their minds. They will manage water levels in the best interests of flood prevention, natural irrigation and nature conservation. This may conflict with the CFMP policies if they propose to increase flood risk in the area. Any changes in water levels must consider all adequate safeguards in relation to nature conservation.

Relevant plan, policy or programme	Type of Plan/Potential influence	Relevant opportunities or constraints we need the CFMP to consider
Eastern Valleys Local Environment Agency Plan (LEAP)	<p>LEAP's are a holistic approach to environmental management allowing the full range of management issues to be identified and considered within a geographical area, which is both relevant and meaningful.</p> <p>LEAP's are seen as the key mechanism for prioritising actions arising from biodiversity action plans.</p>	There is potential within the CFMP to protect, improve and enhance habitat and species diversity and therefore comply with and help towards BAP targets. The LEAP has considered the potential contribution of riverine systems and habitats within the BAP framework and this will be considered as an objective in the CFMP.
Rural Land Management Planning		
Land use management plans and policies including Common Agricultural Policy (CAP), Single Payment Scheme (SPS) and Tir Gofal.	<p>Holistic management of the land where schemes are increasingly incorporating environmental protection, including the potential for reducing flood risk, through sustainable land management practices.</p> <p>Farmers must maintain their land in good agricultural and environmental condition.</p> <p>These schemes also promote organic farming, energy crops, and increased woodland cover.</p>	<p>Likely to affect land use management in the catchment. Land use has an important influence on the risk of flooding, determining timing and rates of surface water run off.</p> <p>Opportunities for:</p> <ul style="list-style-type: none"> • Conservation of wildlife (biodiversity); • Maintenance and enhancement of landscape quality and character; • Protection of the historic environment and natural resources; and • Increasing public access to the countryside. <p>Potential constraints due to lack of certainty for funding availability to bring schemes forward.</p>
Brecon Beacons National Park Management Plan 2000-2005 (awaiting review) – <i>Brecon Beacons National Park Authority, 2000</i>	<p>Conservation and enhancement of the landscape character and special qualities of the National Park.</p> <p>Conservation and enhancement of the Park's biodiversity, habitats and species, and contribute to local, national and global biodiversity targets.</p> <p>Conservation, enhancement, promotion of and research into the Park's heritage and archaeological value.</p>	<p>Landscape character must be retained in general. This may result in potential restrictions to delivery of the chosen CFMP policies in National Park area.</p> <p>Protection and enhancement of UK and local BAP priority species and habitats.</p> <p>Note: the Brecon Beacons National Park is unlikely to result in major opportunities or constraints to the CFMP as such a small area of the park falls with the Eastern Valleys catchment.</p>
WAGs Woodland Strategy: Woodlands for Wales – <i>WAG/Forestry Commission,</i>	Changes in tree planting/forest cover.	The role of woodlands, as part of catchment flood management planning, could be developed to help in the management of water and the reduction of flood risks.

Relevant plan, policy or programme	Type of Plan/Potential influence	Relevant opportunities or constraints we need the CFMP to consider
2006		<p>Tree planting targets can potentially help reduce downstream flows (and help meet flood risk management objectives).</p> <p>However, within the Eastern Valleys catchment there is probably little scope for major tree planting schemes.</p>
<p>Local Authority Countryside and Conservation strategies:</p> <ul style="list-style-type: none"> - Cardiff Countryside Strategy: Review 2005 - Newport City Council Nature Conservation Strategy (2004) - A Countryside Strategy for Caerphilly County Borough 	<p>Strategies for the conservation and enhancement of biodiversity, landscape quality and character and the historic environment within Local Authority areas.</p>	<p>There is potential within the CFMP to contribute to the targets of the Local Authority Countryside and Conservation strategies, in particular:</p> <ul style="list-style-type: none"> - Conservation and enhancement of natural heritage; - Management of features of biodiversity value; - Contribute to a co-ordinated and planned approach to nature conservation; and - Protection and enhancement of landscape character.
<p>Farming for the Future (WAG, 2001)</p>	<p>This is a plan to determine the future direction of the farming in Wales.</p> <p>Provides actions for forming where the richness and wildlife of the Welsh countryside will be enhanced, for the enjoyment of Welsh people and tourists alike.</p>	<p>There may be opportunity for the CFMP, Welsh Assembly Government and the farming community to define environmentally-friendly best practice models of sustainable farming.</p> <p>The CFMP and Farming for the Future plan could influence the future evolution of Welsh land use, including agriculture, woodlands, the landscape, biodiversity and flood defence.</p>
<p>Rural Development Plan for Wales (WAG, 2007-2013)</p>	<p>The key strategic priorities for the Rural Development Plan are:</p> <ol style="list-style-type: none"> 1) To create stronger agriculture and forestry sectors. 2) To improve the economic competitiveness of rural communities and areas. 3) To maintain and protect the environment and rural heritage. 	<p>The CFMP and Rural Development Plan have a range of compatible objectives, where opportunities may arise. These include:</p> <ul style="list-style-type: none"> - Conserve the natural environment, with particular reference to Natural 2000 sites, supporting biodiversity and protecting landscapes. - Ensure protection of cultural landscapes including historic and archaeological features in line with the European Landscape Convention.
Environment/Biodiversity Plans		
<p>UK Biodiversity Action Plan – UK Biodiversity Partnership, 1994 (updated 2007)</p>	<p>The catchment contains UK BAP and Local BAP habitats and species. These habitats and species are currently of conservation concern, and require careful management, in line with the requirements of the Habitats Directive.</p>	<p>Presence of protected species with specific water level, water quality and habitat requirements must be considered. Some environmentally designated habitats are susceptible to changes in flood frequency, floodwater chemistry,</p>

Relevant plan, policy or programme	Type of Plan/Potential influence	Relevant opportunities or constraints we need the CFMP to consider
<p>Local Authority Biodiversity Action Plans:</p> <ul style="list-style-type: none"> - Wild about Cardiff (2002) - Newport - Blaenau Gwent (2003) - Caerphilly (2002) 	<p>Restoration of downgraded rivers and creation of urban corridors.</p>	<p>groundwater levels and drainage system maintenance.</p> <p>It is important that priority habitats and species are maintained and enhanced by preventing loss and damage to existing habitat, promoting new areas of habitat and improving quality through appropriate flood risk management planning.</p>
<p>Welsh Assembly Government Environment Strategy (WAG, 2006)</p>	<p>Welsh Assembly Government's long term strategy for the environment of Wales, setting the strategic direction for the next 20 years.</p> <p>It provides the framework within which to achieve an environment which is clean, healthy, biologically diverse and valued by the people of Wales.</p>	<p>The Welsh Assembly Government Environment Strategy and CFMP will integrate environmental considerations into all policies, programmes and service delivery.</p> <p>Appropriate measures should be in place to manage the risk of flooding from rivers and the sea and help adapt to climate change impacts.</p> <p>Flood risk information will need to be publicised and made available in a range of languages and formats. Emergency plans will need to address the requirements of disabled people in the event of an incident. This is compatible with the CFMP objectives to reduce the risk of harm to life from flooding and reduce community disruption caused by flooding.</p> <p>The CFMP provides opportunity to support the Welsh Assembly Government Environment Strategy's aims for biodiversity, including halting a loss of biodiversity by 2010 and ensuring that recovery is underway by 2026. It also could help Welsh Assembly Government achieve the aim that by 2010, 95 per cent of international sites are in favourable condition and by 2015, 95 per cent of Welsh SSSIs are in favourable condition and by 2026, all sites to be in favourable condition.</p> <p>The CFMP also complements the aim that the quality and diversity of the natural and historic character of our landscape and seascape is maintained and enhanced.</p>

Relevant plan, policy or programme	Type of Plan/Potential influence	Relevant opportunities or constraints we need the CFMP to consider
<p>Countryside Council for Wales Plans:</p> <ul style="list-style-type: none"> - A Brighter Future for People and Nature (CCW) - Corporate Plan 2005-08: 'Working Together to Create a Better Wales' (CCW, 2004) - A Better Wales: The Natural Environment of Wales in 2010 (CCW, 2001) 	<p>These are plans and strategies produced by CCW for dealing with environmental issues in Wales. These plans contain a vision for Wales, and identifies a series of goals and aims for the future.</p> <p>The plans aim to strive for a Wales which is:</p> <ul style="list-style-type: none"> - More distinctive in landscape character and includes greater biodiversity; - Where the land and sea support more wildlife; - Where economic development respects the natural environment, including its historical and cultural aspects - In which there is greater access to countryside and coast for all its people and its visitors, giving enjoyment, health and well-being. 	<p>These plans aim to restore urban parklands to make a link between urban dwellers and natural greenery. This is particularly relevant for the highly urbanised Eastern Valleys catchment, and has already begun in Cardiff's Roath Park. The delivery of the CFMP may provide opportunity to help restore urban parklands in other areas.</p> <p>The CFMP may provide opportunity to help towards CCW's goal of increasing the area of BAP Priority Habitat by 2% (20,000 hectares), with all UK BAP Priority Habitats and Species targets met. This may also include restoration work which will reduce the fragmentation of habitats, and as a result their plants and animals will be able to adjust better to the pressures which are being caused by climate change.</p> <p>The information detailed in the CFMP with regards to future flooding under climate change will help CCW understand how nature may respond to changing climate in the future and how wildlife is adapting.</p> <p>Both CCW and the CFMP encourage the sustainable management, use and enjoyment of the natural environment, which also contributes actively to economic and social development.</p>
Other		

Relevant plan, policy or programme	Type of Plan/Potential influence	Relevant opportunities or constraints we need the CFMP to consider
<p>Environment Agency Wales – Creating a Better Wales 2006-11 (<i>Environment Agency Wales, 2006</i>)</p>	<p>This plan outlines our commitment in Wales to the goals outlined the national Corporate Strategy <i>Creating a Better Place 2006-11</i>.</p> <p>The strategy identifies a range of actions required to meet our vision for Wales.</p>	<p>The CFMP may provide opportunity to contribute to the following aims in <i>Creating a Better Wales 2006-11</i>:</p> <ul style="list-style-type: none"> - Developing opportunities for cycle routes and footpaths alongside our flood defences, in areas such as the Caldicot and Wentlooge Levels. - Improving key wetland areas in Wales. - Continuing our Sustainable Fisheries Programme to carry out 20km of river habitat improvement each year and constructing 20 fish passes to increase the access for fish spawning to over 100km of river. - Implementing our area Biodiversity Action Plans and other work programmes to gain increases in biodiversity indicators such as water vole populations. - Restoring habitats, in conjunction with Catchment Abstraction Management Strategies and Water Level Management Plans. - Developing River Basin Management Plans. - Providing advice to local planning authorities on flood risk so that development in the floodplain is avoided.
<p>Environment Agency Wales Corporate Plan (2006-09) (<i>Environment Agency Wales, 2006</i>)</p>	<p>A vision statement for Environment Agency Wales.</p>	<p>Manage flood risk by working with natural processes where possible and constructing new flood defences and improving the quality of existing defences where this is justified.</p> <p>Improving flood forecasting to give better and earlier warnings so that people at risk are able to protect themselves and their property from the effects of flooding.</p> <p>Contribute to water and wetland biodiversity in the countryside, coast and towns, for example by creating wetlands as part of our work to reduce the risk of floods.</p>
<p>Responding to our Changing Climate (<i>WAG, 2007</i>)</p>	<p>A strategy for adapting to the impacts of climate change in Wales. It contains a draft Adaptation Action Plan which will identify the actions required to adapt to the impacts of climate change in Wales.</p> <p>The production of this report is a result of the Welsh Assembly Government Environment Strategy Action Plan.</p>	<p>Welsh Assembly Government is moving towards an overall risk management approach for the management of flood and coastal risk in Wales. This involves working with us, and other stakeholders to produce CFMPs and SMPs.</p> <p>Welsh Assembly Government will work with us and other stakeholders build a consensus around policy on flood risk and coastal erosion, to identify and implement new flood risk management measures, review the financial requirements</p>

Relevant plan, policy or programme	Type of Plan/Potential influence	Relevant opportunities or constraints we need the CFMP to consider
		<p>and establish a regime to monitor progress.</p> <p>The delivery of CFMP policies in the Eastern Valleys may help contribute to Welsh Assembly Government's policy of identifying the connectivity of habitats across Wales and focussing habitat restoration activity on these areas. The rivers within the CFMP area provide valuable habitat connectivity.</p>
<p>A Strategy for the Recreational Fisheries of Wales (WAG, 2003)</p>	<p>This strategy is a high level framework which aims to:</p> <ol style="list-style-type: none"> 1) Describe a vision for a better future for the recreational fisheries of Wales. 2) Summarise the present environmental, social and economic state of our coastal and inland fisheries and the potential for increasing fishery performance and values. 3) Identify the main opportunities for achieving the vision and ways of realising them that will enable all partners to maximise the value of their contributions. 4) Propose outcome targets in preparation for the development of a strategic fisheries action plan and indicate the level of investment that will be required to secure and sustain those outcomes. 	<p>The CFMP will have to ensure that the management of fisheries in Wales will be integrated with management of other aspects of the water environment and surrounding land that affects fishery performance, so as to minimise the impact upon fisheries, aquatic wildlife and their habitats and to secure increased synergy with other activities that affect the water and riparian lands.</p> <p>Delivery of CFMP policies should result in healthy aquatic habitats with self-sustaining populations of fish that are unconstrained by factors such as poor chemical or physical habitat, low flows, barriers to movement, or overexploitation.</p>
<p>The following plans were identified at the Scoping Stage, however, no relevant opportunities and constraints that the CFMP needs to consider, have been identified for the following plans. These plans are therefore not included in this review:</p> <ul style="list-style-type: none"> - Specific Drought Options – South East Wales Conjunctive Use System (SEWCUS) (Dwr Cymru Welsh Water) - Drought Plan for South East Wales (Environment Agency) - Development of the Welsh Fisheries and Aquaculture Sector: Strategic Action Plan (WAG, 2003) 		

B.3.2 Baseline review

Section 2 Catchment overview provides an overview to the characteristics of the catchment, including the environmental aspects relevant to the CFMP. Environmental issues within the catchment relevant to this CFMP are summarised below. Section B4. Assessment and evaluation of environmental effects provides more detail of the environmental characteristics of the individual areas most likely to be affected by the plan, their current state of the environment and the likely evolution thereof without implementation of the plan.

B.3.2.1 Current Flood Risk

Risks to people and property

In total, 1315 people are currently at fluvial flood risk from a 1% AEP event, where depths exceed 0.5m. The highest number of people at risk from a 1% AEP fluvial flood event are within the Rhymney catchment, including the main areas of Caerphilly, Cardiff, Machen, New Tredegar and Ystrad Mynach. Ebbw Vale and Risca also contain large numbers of people at risk. The numbers of people at risk increase dramatically for the 0.1% AEP fluvial flood event, as flood defences in most areas would be overtopped. The main areas with the largest numbers of people at risk for the 0.1% AEP fluvial flood event are Cardiff, Risca, Wentlooge Levels, Ystrad Mynach and Caerphilly, with between 1500 to over 3000 people at risk.

Our broad scale modelling also suggests that potentially hazardous flood depths could be reached in some of the main areas in Eastern Valleys during a 1% AEP fluvial flood event, particularly in New Tredegar. Here, flood water depths could reach in excess of two metres, and the velocities would be greater than 1m/s due to the steep watercourse gradient, creating a significant risk to life.

Under current catchment conditions 173 people are at risk from a 0.5% AEP tidal flood event, where depths exceed 0.5m. In Cardiff, our modelling shows that for high magnitude tidal flood events more people are at risk than from fluvial flows. This is because for the 0.5% AEP tidal event, defences are overtopped. The tidal flood risk to people is currently minimal in the Wentlooge Levels.

Some people are more vulnerable to flooding than others (e.g. the sick, elderly, socially deprived communities). An index of social vulnerability was used to assess the potential social effect of flooding in the Eastern Valleys, for present day conditions. This has shown that the areas with the highest social vulnerability, and therefore the potential for a high level of disruption as a result of flooding, include Caerphilly, Cardiff, Ebbw Vale, New Tredegar and Risca.

The areas with the highest number of residential and commercial properties at risk from a 1% AEP fluvial flood event include Caerphilly, Risca and Ystrad Mynach. Many additional properties become at risk for the 0.1% AEP fluvial flood event due to overtopping. In the Wentlooge Levels, the large increase is due to the topography of the land, meaning a small change in water levels significantly increases the flood extent. Only a comparatively small number of properties are at risk in the main areas in the headwaters of the catchments, such as Abertillery, Ebbw Vale and New Tredegar.

Community disruption can also be caused by the flooding of social infrastructure. Many health centres and surgeries are at flood risk, particularly in Risca and Caerphilly. In addition, a relatively high number of schools/colleges are at flood risk, especially for the 0.1% AEP fluvial flood event in Risca and Ystrad Mynach. However, greater community disruption would be caused in Ystrad Mynach where there are two hospitals at flood risk. The 0.5% AEP tidal flood event in Cardiff would affect one school and one police station.

Risks to the Environment

No sites of international or European importance are at current risk from fluvial or tidal flooding. Two SSSI are at risk from a 1% AEP fluvial flood event; the Gwent Levels – Rumney and Peterstone and the Gwent Levels – St Brides. Flooding is part of the natural hydrological regime of these 2 sites and is unlikely to have a negative impact. Periodic inundation may enhance water-dependent habitats. However, flooding from non-fluvial sources and by low quality water is likely to have a negative impact. Approximately 9% of the Plas Machen Wood SSSI is also at risk from a 0.1% AEP fluvial flood event. Periodic flooding of the wetland areas within this woodland site is unlikely to have a negative impact, and may enhance water-reliant habitats. However, prolonged or frequent flooding could cause damage, particularly to species intolerant of waterlogging. Flooding from non-fluvial sources, such as groundwater or the sewerage system, or by low quality water is likely to have an adverse impact.

The impact of flooding on BAP habitats and species is variable. The impacts may be positive or negative (and for some sites, both) depending on the nature of the site. Prolonged or frequent floodwater inundation, especially by low quality water, provides the greatest risk. Pollutants can be mobilised from landfill sites or contaminated land which can indirectly degrade habitats over time. Tidal flooding can also affect designated sites and biodiversity. For example, flooding of salt water habitats with freshwater, and freshwater habitats with salt water, can cause long-lasting damage to sensitive plants and animals. However, some wetland SSSI and habitats, and the species they support, may benefit from increased flooding.

Flooding can also affect fish populations in the catchment by degrading river habitats, through sediment erosion and deposition, changed flow regimes and changes in water quality.

The historic environment can also be affected by flooding, particularly assets located in close proximity to rivers and streams as a result of their function (e.g. bridges, mills). Within the CFMP area there are currently 3 Scheduled Monuments (SM), 2 Historic Landscape Areas, 2 Registered Parks and Gardens and 40 listed buildings at risk from a 1% AEP fluvial flood event. There is also 1 Historic Landscape Area and 1 listed building currently at risk from a 0.5% AEP tidal flood event. Listed buildings will be the only asset used during the policy appraisal process as this is the only type of asset where a negative impact of flooding can be assumed.

A range of tourist and recreational assets in the catchment are likely to be at risk of flooding, including regional trails and Sustrans cycle routes. Cardiff, which is an important tourist and strategic centre, may be significantly affected by flooding.

Water quality along the majority of the watercourses in the CFMP area is good. Flooding has the potential to affect the quality of surface waters, through erosion and deposition, introduction of pollutants and alteration of the physical water environment. The flooding of potentially contaminative sites may also lead to reduced water quality. Currently, 4 landfill sites are at risk from 1% AEP fluvial flood event and 1 is at risk from a 0.5% AEP tidal flood event.

B.3.2.2 Future Flood Risk

Risks to people and property

The main trend over the next 100 years is that the number of people at risk of flooding across the Eastern Valleys will increase. The magnitude of flood events is likely to get worse and the number of times that flooding occurs each year will increase, as a result the impact on people will be a lot worse.

In the future, the main areas, where the greatest number of people will be at risk, from a 1% AEP fluvial flood event are Cardiff, Wentlooge Levels, Risca and Ystrad Mynach. This is because (excluding the Wentlooge Levels) our flood defences will be overtopped, the areas are densely populated, and the floodplains are wider so a much larger area gets flooded. In the

catchment as a whole 7175 people are at risk from a 1% AEP fluvial flood event, where depths exceed 0.5m.

Our modelling of tidal flooding shows that in the future 2502 people will be at risk from a 0.5% AEP tidal flood event, where depths exceed 0.5m. In Cardiff, the modelling shows that the number of people at risk significantly increases for the 0.5% AEP flood event in the future. This is because our flood defences are overtopped. The number of people at risk from tidal flooding from the River Ebbw in the Wentlooge Levels also increases in the future events.

The scale of disruption will increase in nearly all our main areas in the future. This is because flood extents, depths, velocities and the number of people at risk from flooding will increase. The main areas where the scale of disruption in the future will be greatest are Cardiff, Risca and Ystrad Mynach. This is because these are densely populated areas that are currently defended but in the future the defences will be overtopped.

For the 1% AEP fluvial flood event, Cardiff, Risca and Ystrad Mynach have the largest increase in and highest numbers of properties at flood risk in the future, because of flood defences overtopping. The properties at risk in these areas are likely to flood more frequently, causing major disruption and significant damage.

The 0.5% AEP and 0.1% AEP tidal flood events would flood over 1,000 commercial and residential properties in Cardiff. There is a large increase in the future because of much higher tide levels flooding a much bigger area. Tide-locking will have the biggest impact. Currently only a small number of residential and commercial properties are at risk of flooding because water levels in the River Rhymney do not increase enough to overtop the defences. However, in the future water levels will be higher and the defences will be overtopped, causing much more disruption.

For the 1% AEP fluvial flood event all community services, except for law courts are affected somewhere within the Eastern Valleys. There is likely to be the greatest disruption in Ystrad Mynach where there are two hospitals at flood risk. At present the hospitals are not at flood risk until the 0.1% AEP fluvial flood event. In the future, 3 hospitals would be at flood risk in Ystrad Mynach for the 0.1% AEP fluvial flood event. This would cause significant community disruption.

Risk to the Environment

The impacts of flooding on nature conservation sites in the future are very similar to the impacts under existing catchment conditions. Three SSSI will be at risk from a 1% AEP fluvial flood event in the future (the Gwent Levels – Rumney and Peterstone, Gwent Levels – St. Brides and Plas Machen Wood). The area of SSSIs currently at risk of flooding will increase, and this has the potential to affect the ecological features for which the sites are designated to a greater extent. The impacts may be positive or negative (or for some sites, both) depending on the nature of the site and the type of flooding, as discussed above. No international, European or nationally important nature conservation sites will be at tidal flood risk in the future.

The impact of flooding on biodiversity in the future depends on the frequency, depth, duration and timing of flooding, which is extremely complex to model. However, increased peak river flows and storminess of the sea could mean that flooding of valuable habitats will happen more often in the future. This could have significant negative impacts on species and habitats intolerant of wet and waterlogged conditions. However, those species tolerant and adaptable to wetter conditions may benefit from increased flooding.

Increased flooding, higher peak flows, more intense rainfall and increased sediment inputs to rivers in the future could negatively affect fisheries, in particular by smothering spawning

gravels, affecting water quality or obstructing culverts. This may be particularly significant in the Rhymney which has important salmonid populations.

Four SMs, 2 Historic Landscape Areas, 2 Registered Parks and Gardens and 49 listed buildings will be at risk from a 1% AEP fluvial flood event in the future. This is an increase of 1 additional SM and 9 additional listed buildings, in comparison with the number currently at risk from a 1% AEP fluvial flood event.

In the future, 1 Historic Landscape, 2 Registered Parks and Gardens and 18 listed buildings will be at risk from a 0.5% AEP tidal flood event. This is an increase of 2 Registered Parks and Gardens and 17 listed buildings from the current baseline.

Increased flood extents, and more frequent flooding, in the future has the potential to affect tourist and recreation sites to a greater extent (i.e. regional trails such as the Rhymney Valley Ridgeway and Sustrans cycle routes). Those areas heavily dependent on tourism, such as Cardiff, are likely to suffer increased economic damage because of more frequent flooding.

More frequent flooding and increases in flood extents and depths in the future are likely to have a negative impact on water quality within the Eastern Valleys CFMP area through the creation of new pathways and the increased conveyance of pollutants into watercourses. An increased number of potentially contaminative sites will also be at risk of flooding in the future. Two COMAH sites and 5 landfill sites will be at risk from a 1% AEP fluvial flood event in the future, with 1 landfill site remaining at risk from a 0.5% AEP tidal flood event. This may cause the rivers to fail their Water Framework Directive (WFD) objectives. However, predicting the extent to which water quality will be affected is difficult and is beyond the scope of this CFMP.

B.3.3 Scope of the SEA and environmental objectives

An important early stage in the SEA process is to identify which environmental issues are relevant to this CFMP. Our Scoping exercise identified issues that are not relevant to this type and level of plan: allowing us to exclude these issues and focus our assessment on what is most important. To help us do this we consulted widely at the Scoping Stage which was published in November 2006.

The scope of this SEA was determined by:

- developing an understanding of the flood risk management context for the catchment, including current flood risk to people and the environment (we also considered the economy), and the potential constraints and opportunities to the management of flood risk;
- undertaking a review of the environmental context of the catchment, including identifying relevant trends;
- a review of relevant plans and policies, including an assessment of their relationship with catchment flood management planning;
- identifying relevant environmental protection objectives from these plans and policies and consideration of how the CFMP might conflict with these, or influence their achievement; and
- consultation with key stakeholders (see previous Section B2), including the SEA statutory consultation bodies: Countryside Council for Wales and CADW.

The environmental and social issues scoped into the SEA were then used alongside economic issues to develop a suite of policy appraisal objectives, indicators and, where possible, targets (see Section 5.2 Throughout this process we drew on the knowledge and vision of our CFMP Steering Group (see Section 1.6 Involving others) to help understand what matters in the catchment and shape what this plan was trying to achieve. Following our formal Scoping

exercise, we considered what the future might look like, including what the effects of climate change could be, and the impact of future development pressures and changes in land management. While we can not predict the future with complete certainty, we used this perspective on the future to help us understand the scale of changes we could face in the future and so consider them explicitly within the development of the plan.

Table B4 summarises the issues we scoped into the development of the plan, and the resulting broad objectives we developed against which to test our alternative options. Not all of these issues are equally relevant everywhere in our plan area, and we also drew on other relevant policies, plans and programmes to identify opportunities and constraints for individual areas (Policy Units) within the plan area.

Table B4: Scope of the SEA in relation to the CFMP

Environmental Topic	Scope and Justification		Relevant environmental objective	Relevance to Eastern Valleys CFMP
	Scoped in	Scoped out		
Population and Human Health	<p>People exposed to fluvial and tidally influenced flooding and the risk of being drowned due to flooding.</p> <p>Properties (commercial and residential) at risk from fluvial and tidally influenced.</p> <p>Nationally and regionally important community facilities (hospitals, educational facilities), emergency services, transport infrastructure, power and water supplies may be affected by flood risk management policy. Flooding of these sites could cause significant community disruption.</p> <p>Quality of life is affected by flooding with more socially deprived communities more likely to be affected. Quality of life/social deprivation is not used as a direct indicator during the policy appraisal process. The impact on quality of life is assessed indirectly by assessing other measures of community disruption (i.e. flood risk to property and community assets).</p>	<p>Disease, stress and trauma as a result of flooding. A robust assessment of the risk associated with these impacts is not established for this level of plan. The risk of disease for such rare events would be unlikely to be significant.</p> <p>Employment will not be significantly affected by the CFMP at a catchment level. The affects of flood risk management policy on employment will be considered further at project EIA stage.</p> <p>The CFMP will not have a significant affect on noise at a catchment level. The affects of flood risk management policy on noise would be considered further at project EIA stage.</p>	<p>Reduce the risk of harm to life from flooding</p> <p>Reduce community disruption caused by flooding</p> <p>Reduce economic damages caused by flooding</p>	<ul style="list-style-type: none"> - There are currently 1315 people in the catchment at risk from a 1% AEP fluvial flood event, where depths exceed 0.5m, rising to 7175 in the future. - The greatest number of people currently at risk from fluvial flooding are in Caerphilly, Cardiff, Machen, New Tredegar, Risca, Ystrad Mynach and Ebbw Vale. - There are currently 173 people in the catchment at risk from a 0.5% AEP tidal flood event, where depths exceed 0.5m, rising to 2502 in the future. - In Cardiff, tidal flooding is currently a greater risk to people than fluvial flooding. - There are currently 915 properties at risk from a 1% AEP fluvial flood event, in areas without existing flood warning, rising to 2323 in the future. - There are currently 99 properties at risk from a 0.5% AEP tidal flood event, in areas without existing flood warning, rising to 1389 in the future. - A range of community assets are currently at risk of flooding. The numbers at risk will increase in the future. Flooding of these sites would cause significant community disruption.

Environmental Topic	Scope and Justification		Relevant environmental objective	Relevance to Eastern Valleys CFMP
	Scoped in	Scoped out		
Material Assets	<p>National and regionally important material assets (e.g. ambulance stations, fire stations, water treatment works, sewage treatment works, electricity stations, transport links, landfill sites and telecommunications) may be affected by flooding and flood risk management policy.</p> <p>Recreational and amenity resources of national and regional importance. These may be affected by flooding and CFMP policy. CFMP policy could also present opportunities to deliver recreational benefits.</p>		<p>Reduce community disruption caused by flooding</p> <p>Reduce risk to critical transport routes and critical assets from flooding</p> <p>Reduce economic damages caused by flooding</p>	<ul style="list-style-type: none"> - A range of important material assets are currently at risk of flooding. The numbers at risk will increase in the future. - CFMP area contains a range of recreational resources (e.g. regional trails, Sustrans cycle networks, angling/fishing facilities). - Cardiff is an important tourist centre.

Environmental Topic	Scope and Justification		Relevant environmental objective	Relevance to Eastern Valleys CFMP
	Scoped in	Scoped out		
Landscape		<p>The Brecon Beacons National Park. Only a very small proportion of the site falls within the CFMP area. The affects of flood risk management policy on the national park will be considered further at project EIA stage.</p> <p>There are no AONBs within the Eastern Valleys Catchment.</p> <p>Local landscape designations (e.g. SLA, AGLV etc.) will not be significantly affected at the catchment level. The effects of flood risk management policy on local landscape designations will be considered further at project EIA stage.</p>	No objectives set	

Environmental Topic	Scope and Justification		Relevant environmental objective	Relevance to Eastern Valleys CFMP
	Scoped in	Scoped out		
Historic Environment, including cultural, architectural and archaeological heritage	<p>Listed buildings may be negatively affected by flooding and flood risk management policy.</p> <p>Listed buildings will be the only historic environment asset used in the policy appraisal process as this is the only type of asset where a negative impact of flooding can be assumed.</p>	<p>There are no World Heritage Sites in the CFMP area.</p> <p>Scheduled Monuments, Landscapes of Historic Interest and Historic Parks and Gardens may be affected by flooding and flood risk management policy. However, it cannot be determined if the impact on these sites will positive or negative and therefore these assets have been scoped out of the assessment.</p> <p>Conservation areas will not be significantly affected by the CFMP at a catchment level.</p> <p>Other known and unknown features of archaeological and/or heritage interest will not be significantly affected by the CFMP at a catchment level.</p> <p>The impact of flood risk management policy on Scheduled Monuments, Landscapes of Historic Interest, Historic Parks and Gardens, Conservation Areas and unknown archaeological features will be considered further at project EIA stage.</p> <p>Different grades of listed building will not be considered in the CFMP.</p>	<p>Manage flood risk to listed buildings and ensure sites which are currently 'safe' do not become at risk of flooding.</p>	<ul style="list-style-type: none"> - There are 584 listed buildings within the CFMP area. - 40 listed buildings are currently at risk from a 1% AEP fluvial flood event, rising to 49 in the future. - 1 listed building is at risk from a 0.5% AEP tidal flood event, rising to 18 in the future.

Environmental Topic	Scope and Justification		Relevant environmental objective	Relevance to Eastern Valleys CFMP
	Scoped in	Scoped out		
Air Quality		There is no potential for CFMP policies to influence issues that effect air quality (e.g. emissions or generation of particulate matter at a strategic level). Air quality issues are therefore not considered to be significant and have been scoped out of the assessment.	No objectives set	
Climatic Factors	The plan explicitly considers the implications of climate change on flood risk. Our policies are therefore aiming to help society to adapt to climate change.	Climate change is a key driver of flood risk management however policy options will not significantly affect the impacts of climate change; they will only potentially accommodate them.	No objectives set	

Environmental Topic	Scope and Justification		Relevant environmental objective	Relevance to Eastern Valleys CFMP
	Scoped in	Scoped out		
Biodiversity, Flora and Fauna	<p>International and European Sites of nature conservation importance (SAC, SPA, Ramsar site) and known supporting sites could be directly or indirectly affected by flood risk management policy.</p> <p>We have undertaken an assessment under the Habitats Regulations for all European sites that have the potential to be significantly affected by the CFMP.</p> <p>Flood risk management policy could have direct or indirect affects on the features of SSSIs within the current or future predicted 1% AEP floodplain.</p> <p>Flood risk management policy could have direct or indirect affects on UK and Local BAP species and habitats. The SEA will only consider those habitats and species known to be found within the CFMP area and likely to be affected by the current or future predicted 1% floodplain.</p>	<p>There are no NNRs within the Eastern Valleys catchment.</p> <p>SSSI outside of the current or future predicted 1% AEP floodplain will not be considered.</p> <p>SSSI underlying international and European sites have not been considered separately.</p> <p>SSSI designated for geological features of interest are not included in the assessment. At the strategic level geological sites are not likely to be affected by flooding.</p> <p>Potential impacts on species or habitats not classified within the UK or Local BAPs will not be addressed within the SEA, but will be considered further at EIA stage.</p> <p>Sites of Local Conservation Importance (e.g. CWS, LNRs) will not be significantly affected by the CFMP at a catchment level. The affects of flood risk management policy on such sites would be considered further at project EIA stage.</p>	<p>Ensure no deterioration of designated international and national nature conservation sites</p> <p>Protect and improve habitats and species diversity, particularly BAP habitats and those relying on freshwater</p>	<ul style="list-style-type: none"> - CFMP area contains 3 international designated sites (Severn Estuary Ramsar site, SPA and cSAC, Usk Bat Sites SAC and Aberbargoed Grassland SAC). - No international sites are at risk from fluvial or tidal flooding, now or in the future. - Being located downstream of the CFMP area the Severn Estuary may be affected by the chosen policies. - The CFMP area contains 20 SSSIs, several of which contain water-dependent habitats and species relevant to the CFMP. - 2 SSSIs are currently at risk from a 1% AEP fluvial flood event. - 3 SSSIs will be at risk from 1% AEP fluvial flood event in the future. - CFMP area contains several water-dependent BAP habitats, including wet woodlands, reedbeds and mesotrophic lakes. - CFMP area contains several water-dependent BAP species, including Otter, Water Vole and Brown Trout. - Impact of flooding on will be dependent on nature of the habitat and the type of flooding.

Environmental Topic	Scope and Justification		Relevant environmental objective	Relevance to Eastern Valleys CFMP
	Scoped in	Scoped out		
Soils	<p>Soil quality and quantity may be directly or indirectly affected by flood risk management policy.</p> <p>Land use may be directly or indirectly affected by flood risk management policy.</p>	<p>Flood risk management policy will not have a significant affect on geology at a catchment level. The affects of flood risk management policy on geology would be considered further at project EIA stage.</p> <p>The CFMP will not have a significant affect upon coastal and terrestrial geomorphology.</p> <p>Direct and indirect affects on fluvial geomorphology will be considered further at the project EIA stage.</p> <p>The CFMP will not have a significant affect on contaminated land at a catchment level. The affects of flood risk management policy on contaminated land would be considered further at project EIA stage.</p>	Reduce economic damages caused by flooding	<ul style="list-style-type: none"> - Soils in the Eastern Valleys catchment are highly sensitive to flooding. Prolonged or frequent inundation can reduce the soil quality and affect the physical and chemical soil characteristics. - Different types of land use and management can impact flood risk, by influencing run-off generation and sediment production. - 17.5% of the CFMP area is urbanised. - Agri-environment schemes in CFMP area, such as Tir Gofal, may influence land management and flood generation.

Environmental Topic	Scope and Justification		Relevant environmental objective	Relevance to Eastern Valleys CFMP
	Scoped in	Scoped out		
Water	<p>Flood risk management policy could have direct and indirect affects on water quality through the flooding of potentially contaminative sites (i.e. COMAH sites, landfill sites).</p> <p>The impact on water quality is considered indirectly through the consideration of the flooding of COMAH sites and landfill sites.</p>	<p>The CFMP will not have a significant affect on water resources at the catchment level. The affects of flood risk management policy on water resources would be considered further at project EIA stage.</p>	<p>Reduce risk to critical transport routes and critical assets from flooding</p>	<ul style="list-style-type: none"> - Biological water quality in CFMP area is generally good (grade B). - Chemical water quality in CFMP area is generally good (grade B) or very good (grade A). - 4 landfill sites are currently at risk from 1% AEP fluvial flood event and 1 is at risk from a 0.5% AEP tidal flood event. - In the future 2 COMAH sites and 5 landfill sites will be at risk from a 1% AEP fluvial flood event and 1 landfill site will at risk from a 0.5% AEP tidal flood event.
Inter-relationship between the above factors		Yes	Inter-relationships will be included where relevant i.e., where flood risk management policy options give rise to the potential for secondary or cumulative impacts	

B.4 Assessment and Evaluation of Environmental Effects

B.4.1 Strategic options and appraisal process

We have considered six generic options in our policy plan, which are listed in Table B5.

Table B5: Definition of policy options

Policy option	Risk management strategic approach
Policy 1 - No active intervention (including flood warning and maintenance). Continue to monitor and advise	Accept the risk – both current and future increases in risk
Policy 2 - Reduce existing flood risk management actions (accepting that flood risk will increase over time)	Accept the risk – both current and future increases in risk
Policy 3 - Continue with existing or alternative actions to manage flood risk at the current level (accepting that flood risk will increase over time from this baseline)	Accept the risk – our current scale of actions is sufficient to manage the current risk, and future increases will be acceptable
Policy 4 - Take further action to sustain current scale of flood risk into the future (responding to the potential increases in flood risk from urban development, land use change, and Climate Change).	Accept the risk – but in the longer term take action to ensure the risk does not increase from current level
Policy 5 - Take further action to reduce flood risk (now and/or in the future)	Reduce the risk – lower the probability of exposure to flooding and/or the magnitude of the consequences of a flood, and hence the risk
Policy 6 - Take action with others to store water or manage run-off in locations that provide overall flood risk reduction or environmental benefits, locally or elsewhere in the catchment.	Reduce the risk by transferring the risk to other locations where the risks (typically the consequences) are positive

These options relate to the outcome of flood risk management in terms of the scale of risk and management activity compared to today. Deciding on the specific measures needed to achieve these outcomes is not the purpose of the CFMP. However, we do need to appreciate whether or not the change in risk under a particular policy is generally feasible and desirable in terms of where the water goes in the catchment. To appreciate this we need to understand how the catchment works in times of flood so that our policies make sense. The water needs to go somewhere when it floods and we need to understand that if we prevent water from flooding homes in one location what the knock-on effects would be in another location.

In order to understand how the catchment works we develop models that can draw on information about the amount of rainfall and show to some extent how this drains off the land and into the river systems. We can then consider at a broad scale how the flow of water within the catchment could change over time with or without management intervention. Of particular importance in driving future changes in flood risk are:

- the potential impact of climate change on flooding due to increased rainfall and sea level rise;
- the potential impact of new development due to extra run-off from impermeable surfaces as well as new properties being developed in areas exposed to flooding; and
- the potential impact of changes in land management because this can change the permeability of the catchment and how the rate at which water drains into the river system.

To consider what the future might be like, and thus what the flood risk could be like with no management intervention, we have considered a number of future scenarios. These scenarios

aim to establish what changes there could be in the three important drivers of change listed above (climate change, development and land management). To develop reasonable predictions of change we have looked at past changes and had discussions with our Steering Group [or Project Board] to arrive at reasonable projections of what the future could be like. To consider the impact of climate change on flooding we have used the government guidance issued by Defra (Supplementary Note to Operating Authorities on climate change impacts, October 2006). A more detailed explanation of the scenarios used is given in Section 4.2 Scenarios.

Our appraisal of the alternative policies is undertaken by considering how the flow within the catchment could change in the future. This understanding is done at a high level using our models, complemented with expert judgement on how water flows through the catchment during times of flood. For example, we might say that if land management practices changed in the headlands of a catchment, the land would be more permeable and this would reduce the rate at which rainfall enters the river system downstream. Such a change in how water flows through the catchment could then reduce the volume of floodwater downstream (and reduce the frequency of flooding to homes in this downstream location).

Our consideration of how the catchment works, and what the current and future risks are has allowed us to divide the catchment up into smaller geographical areas that we have called Policy Units. In each Policy Unit we have considered how the risks arise (using a source-pathway-receptor model) and what our specific objectives are. We have considered other policies, plans and programmes to see where there may be objectives and constraints that our plan could contribute to or that we need to take account of. For example, a biodiversity action plan (BAP) may identify habitat improvement such as creation of wet grassland. Our investigations could start to show that if the area adjacent to the river corridor was to flood more frequently, then this could potentially help contribute to achieving the BAP improvements. The process of SEA encourages us to make these links with other plans so that we can help deliver broader benefits and reduce conflict between our flood risk management policies and other aspirations. We have done this during the review of other plans and considered others' objectives as opportunities or constraints to our policy development, as an integral part of our appraisal.

B.4.2 Assessment and evaluation of impacts

The alternative options have been assessed against objectives that are specific for each policy unit. The tables in Annex 1 detail this appraisal. These tables identify the losses and gains under each of the six generic policy options and identify the preferred option for each Policy Unit along with monitoring requirements. As such they set out the findings of the SEA in relation to the assessment of options.

A summary of the findings of appropriate assessment, related to the Habitats Directive, is included. We are currently consulting with CCW on the outputs of this assessment so that we can gain their view on its findings. The final assessment will then be appended to the final version of the CFMP. Table B6 summarises the findings of the appropriate assessment and the proposed mitigation.

Information on mitigation and enhancement measures related to the preferred policy option identified for each policy unit is set out in section B4.4.

Form 12.1: Purpose of the CFMP

Confirm the overall aims of CFMP and the key catchment specific objectives, opportunities and constraints that need to be taken into account when developing the CFMP.	
Has consultation been undertaken?	Yes: We consulted at the Scoping Stage.
Aims <p>This Catchment Flood Management Plan (CFMP) will set our flood risk management policies for the Eastern Valleys catchments in South East Wales. The CFMP will help us to answer the following questions about flood risk:</p> <ul style="list-style-type: none">• What is the significance of flooding within the catchments?• What are the characteristics of flooding within the catchments?• What are the sources of flooding such as river, tidal, surface water, sewerage system and drainage overflows and groundwater?• Can we continue with our existing approach to flood risk management?• How will flood risk change within the CFMP area in the future?• What are the most sustainable policies for managing flood risk? <p>The CFMP is a high-level strategic plan. The main aim of the CFMP is to develop policies to manage flood risk sustainably in the catchments now and in the future. Other aims include:</p> <ul style="list-style-type: none">• To reduce the risk of flooding and harm to people, the natural, historic and built environment caused by flooding;• To work with natural processes to achieve many benefits from flood risk management and contribute to sustainable development;• To help implement EU directives, meet Government and other interested groups' policies and targets and achieve our environmental vision;• To promote sustainable flood risk management;• To inform and support planning policies, statutory land use plans and the Water Framework Directive. <p>These policies must take into account the likely impacts of changes in climate and the effects of land use and land management. They should also bring a range of environmental and social benefits that contribute towards sustainable development.</p> Catchment Objectives <p>We have appraised the sustainable flood risk management policies for the CFMP area (from now on referred to as CFMP policies) against the objectives we identified for the Eastern Valleys catchments below.</p> <ul style="list-style-type: none">• Reduce the risk of harm to life from flooding• Reduce community disruption caused by flooding• Reduce risk to critical transport routes and critical assets from flooding• Reduce economic damages caused by flooding• Optimise the level of Flood Risk Management expenditure. Ensure investment is proportional to the risks	

- Manage flood risk to sites of cultural, architectural and heritage value and ensure sites which are currently 'safe' do not become at risk of flooding
- Manage flood risk to sites of notable landscape features. This includes ensuring sites which are currently 'safe' do not become at risk of flooding, and the natural flood regime of sites that rely on inundation is maintained.
- Ensure no deterioration of designated international and national nature conservation sites
- Protect and improve habitats and species diversity, particularly BAP habitat and those relying on freshwater.

Opportunities and Constraints

We have described these in more detail in Chapter 5 of the CFMP.

There may be opportunities to manage flood risk more sustainably and effectively that will benefit the local economy, society or the environment. The main opportunities in the Eastern Valleys are:

- To reduce the potential flood risk to residential properties, and the associated harm to life, through sustainable flood risk management;
- To improve our flood warning service and raise public awareness in flood risk areas;
- To discourage future development in flood risk areas;
- To improve and maintain existing flood defences where it is sustainable to do so, which will be assessed through more detailed pre-feasibility studies;
- To reduce the potential risk to critical infrastructure;
- To encourage the uptake of agri-environmental schemes.

There may be economic, social or environmental constraints on the use of certain flood risk management actions. This is particularly true where sensitive conservation sites might be affected by our flood risk management work. We will do our best to meet different needs but in some situations change is necessary and we will have to make difficult choices. This may involve replacing lost habitats elsewhere. The main constraints in the Eastern Valleys are:

- Some flood protection measures may be technically or economically unfeasible, this will be determined through pre-feasibility studies;
- Effective flood warning may be impossible in some areas where the rivers respond very quickly to rainfall;
- Pressure to meet regional housing targets may lead to proposals for development in flood risk areas;
- It may be economically or technically unfeasible to improve or maintain defences in some locations.

We have considered consultation responses on opportunities and constraints and our CFMP objectives during the Scoping Stage consultation and taken action to modify the opportunities and constraints and our CFMP objectives where appropriate.

Form 12.2: Meeting Legal Requirements and Environment Agency Corporate Objectives

List the legal requirements, and Government and Environment Agency targets that CFMP policy needs to comply with or support

We have reviewed all the relevant legislation, as well as local plans and strategies relating to the economy, society and environment, which are relevant to the CFMP area in Chapter 1 of the main document. These include:

Note: The legislation below is of particular relevance to this CFMP. For a comprehensive list of legislation applicable to the CFMP please see Appendix C.

National

- Environment Agency, Corporate Strategy – Creating a better place - 2006 to 2011
- Water Framework Directive (River Basin Management) 2000/60/EC.
- Land Use Policy Group 'The integration of agricultural, forestry and biodiversity conservation policies with flood management in England and Wales' 2004.
- National Biodiversity Action Plans (BAPs).
- Bonn Convention on the Conservation of Migratory Species of Wild Animals (Ratified in 1985).
- Bern Convention on the Conservation of European Wildlife and Natural Habitats. (Ratified by UK in 1983).
- Convention on Biological Diversity.
- EU Habitats Directive 92/43/EEC (as amended) (Implements the Bern Convention).
- EU Birds Directive 74/409/EEC (Implements the Bern Convention).
- Conservation (Natural Habitats etc) Regulations 1994: SI No 2716 (Enacts the EU Habitats Directive into UK law).
- Wildlife and Countryside Act 1981 (as amended) (Implements the Bern Convention into UK law).
- The Countryside and Rights of Way Act 2000 (an amendment to the Wildlife and Countryside Act 1981).
- National Parks and Access to the Countryside Act 1949, as amended by the Countryside and Rights of Way Act 2000.
- Salmon and Fresh Water Fisheries Act 1975.
- Freshwater Fish Directive 78/959/EEC.
- The Surface Waters (Fishlife) Classification Regulations, 1997 as amended by the Surface Waters (Fishlife) (Classification) (Amendment) Regulations 2003.
- The Countryside and Rights of Way Act 2000 (an amendment to the Wildlife and Countryside Act 1981).
- Environment Act 1995.
- Water Industry Act 1991.
- The Water Environment (Water Framework Directive) (England and Wales) Regulations, 2003.
- Water Resources Act 1991.
- The Water Supply (Water Quality) Regulations 2000 [S.I. 2000 No. 3184]
- Dangerous Substances Directive 76/464/EEC
- The Surface Waters (Dangerous Substances) (Classification) Regulations (1989, 1992, 1997 and 1998)
- Surface Water Abstraction Directive 75/440/EEC.
- The Surface Water (Abstraction for Drinking Water) (Classification) Regulations, 1996.
- Water Act 2003.
- Bathing Water Directive (76/160/EEC).
- Land Drainage Act 1991.
- Town and Country Planning Act 1971
- Planning (Listed Buildings and Conservation Areas) Act 1990.
- Ancient Monuments & Archaeological Areas Act 1979.

- National Heritage Act 1983.
- Planning and Compulsory Purchase Act 2004.

Regional

- Regional Planning Guidance for South East Wales.
- Environment Agency - Draft Drought Plan for Wales South East Area.
- Wales: A Better Country.

Local

- Cardiff Unitary Development Plan.
- Caerphilly Unitary Development Plan.
- Newport Unitary Development Plan.
- Blaenau Gwent Unitary Development Plan.
- Powys Unitary Development Plan.
- Severn Estuary Shoreline Management Plan.
- Caldicot and Wentlooge Levels IDB Water Level Management Plan.
- Brecon Beacons National Park Adopted Local Plan (May 1999).
- Tir Gofal (Agri-environment scheme).
- Cardiff Local Biodiversity Action Plan.
- Newport Local Biodiversity Action Plan.
- Blaenau Gwent Biodiversity Action Plan.
- Caerphilly Biodiversity Action Plan.
- Rhymney Catchment Abstraction Management Strategy.
- Ebbw and Lwyd Catchment Abstraction Management Strategy.
- Eastern Valleys Local Environment Agency Plan Environmental Overview.
- Brecon Beacons National Park Management Plan.

The final plan will sit within the wider socio-economic environmental planning framework in England and Wales, supporting the River Basin Management Plans required under the EU Water Framework Directive. The CFMP will contribute to the Programme of Measures in River Basin Management Plans and help regional planning authorities to make decisions on land-use planning. For the CFMP to be successfully implemented, there needs to be partnership between the National Assembly for Wales, local authorities, other operating authorities and statutory organisations, conservation groups and other interested groups.

Will the appraisal include/meet other specialist appraisal needs?	Yes
If so, state which:	The needs of a Strategic Environmental Assessment (SEA) are met in this Environmental Report.

Form 12.3: Summary of Flood Risks, and associated Source-Pathway-Receptor Components

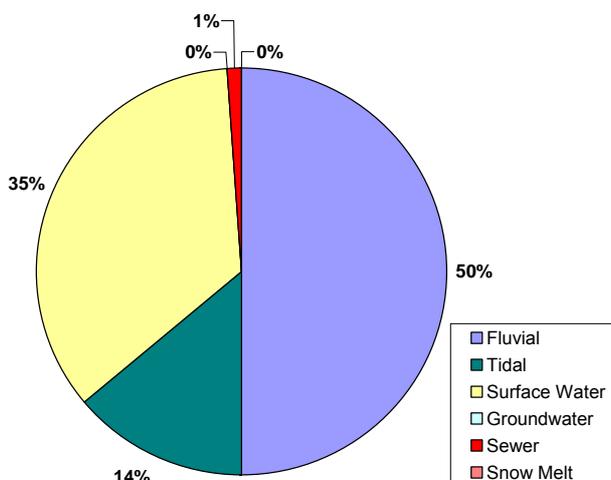
1. Indicate in summary form (using a map or series of maps and/or table or series of tables) the location, extent, and degree of flooding (current and possible future) and related distribution of flood risks that need to be addressed by the CFMP. These must include reference to Policy Units.
2. Amend the generalised Source – Pathway – Receptor model (provided in Excel format) for the catchment, populating the catchment objectives column as appropriate. In specific text below the S-P-R model highlight and summarise the S-P-R variability within the CFMP. Each policy unit should be covered by separate sections of text, but be placed within the same table. The text should be a concise summary, but sufficient to convey the specific S-P-R characteristics of each policy unit.

The rivers in the CFMP area have steep upper reaches which flatten out in the middle-lower reaches to form well-defined valleys and meandering channels that cross wide flood-plains. Because of this, water reaches the channels quickly after rainfall and can cause flash flooding with little warning at settlements near the sources of rivers, including New Tredegar and Ebbw Vale and further downstream as the floodplain starts to flatten out. Near the coast and along estuaries high tides and storm surges can also cause flooding. High tides can also make fluvial flooding worse, when they prevent high river flows from discharging downstream (known as tide-locking). Tidal flooding causes the highest risk in Cardiff, although fluvial flooding is also a major flood risk here. Overflowing sewers, excess surface water and rising groundwater can also cause flooding, although this tends to be more localised. We have identified the main sources of flood water in the Eastern Valleys CFMP area as:

Table B6: Main sources of flooding

Source	Flooding Mechanism	Affected areas in CFMP area
River (fluvial) flooding	When the volume of water within the channel exceeds the size of the channel. This may be because of significant rainfall or undersized or blocked culverts or bridges.	Cardiff, Bedwas, Machen, Caerphilly, Ystrad Mynach, Llanbradach, New Tredegar, Ebbw Vale, Cwm, Abertillery, Newbridge, Risca, Llanhilleth, Ynysddu, Bassaleg and Tredegar Park.
Tidal flooding	A combination of high tides and storm surges raises water levels. In this CFMP we have not considered coastal flooding; we are only considering tidal flooding beyond the boundary of the SMP.	Cardiff, Bassaleg and Tredegar Park and the Wentlooge Levels.
Surface water and sewer flooding	When rainwater collects on the surface before flowing into a watercourse or soaking into the ground. Sewer flooding can be caused by small pipe systems, too much rainfall and blockages.	<p><i>Surface Water:</i> This is a significant problem in areas where steep valley sides line the catchments, e.g. Ebbw Vale and New Tredegar.</p> <p><i>Sewer Flooding:</i> A risk in some areas of the CFMP area, but the issue is not easily addressed at a catchment level. As the responsible authority, DCWW is best placed to make improvements to reduce the risk of sewer flooding in line with targets set by the regulator (Ofwat).</p>
Groundwater flooding	When the water table rises above the ground surface.	Having looked at the geology of the catchment, which does not provide significant aquifers, we do not consider groundwater flooding to be a large enough risk to warrant further consideration in the CFMP.

Figure B1: Relative importance of different sources of flooding



Below is an overview of the modelled flood risk outlines for the CFMP area for the current and future 1% AEP flood events. We have looked at the influence of climate and land use changes on flood risk in the future as part of this CFMP. Our modelling during the CFMP process has showed us that climate change, in the form of higher river flows and rising sea levels, and urban development, with corresponding increases in runoff to rivers would have the greatest effect on future flood risk.

Figures 2 and 3 show current and future fluvial flood risk, respectively, for the main rivers in the Eastern Valleys. Figures 4 and 5 show current and future tidal flood risk. The policy units we have devised for this CFMP are shown on the maps. Policy units are areas covered by the CFMP where we will use the same flood risk management policies. Each unit is made up of a broadly similar set of characteristics and features that include:

- drivers of future levels of flood risk;
- main flood-producing mechanisms;
- type of river and flood plain topography;
- types of 'receptor' – economic, social or environmental.

We chose the final policy units after discussing them with the Project Team and Steering Group. They are:

- PU1 Cardiff
- PU2 Bedwas and Machen
- PU3 Rhymney Corridor
- PU4 Mid and Upper Reaches
- PU5 Upper Ebbw
- PU6 Ebbw Corridor
- PU7 Wentlooge Levels

There is more information on the policy units we have chosen in Chapter 6 of the main document.

Figure B2: Current 1% fluvial flood event extent for the main rivers of the Eastern Valleys

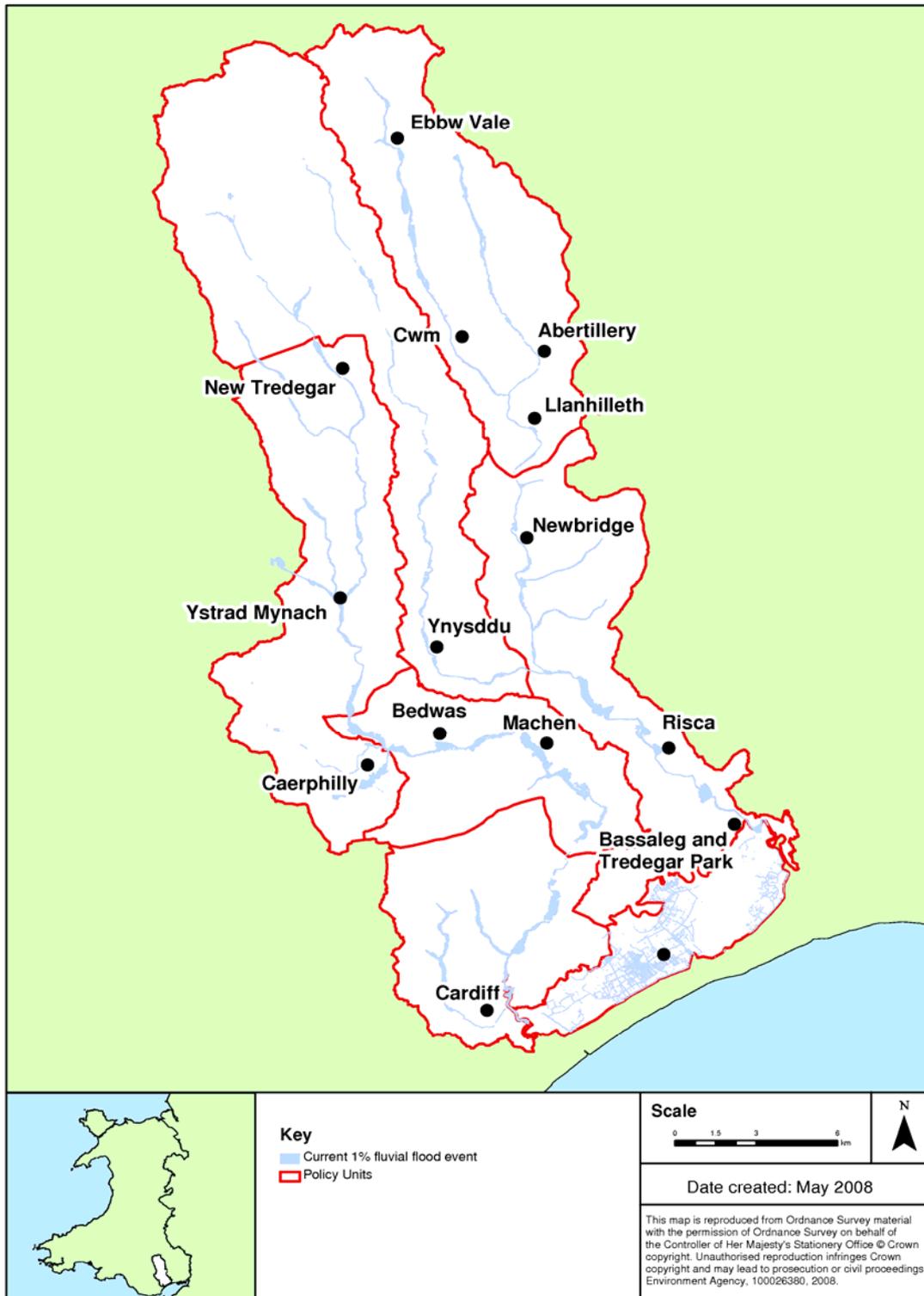


Figure B3: Future 1% fluvial flood event extent for the main rivers of the Eastern Valleys



Figure B4: Current 0.5% tidal flood event extent

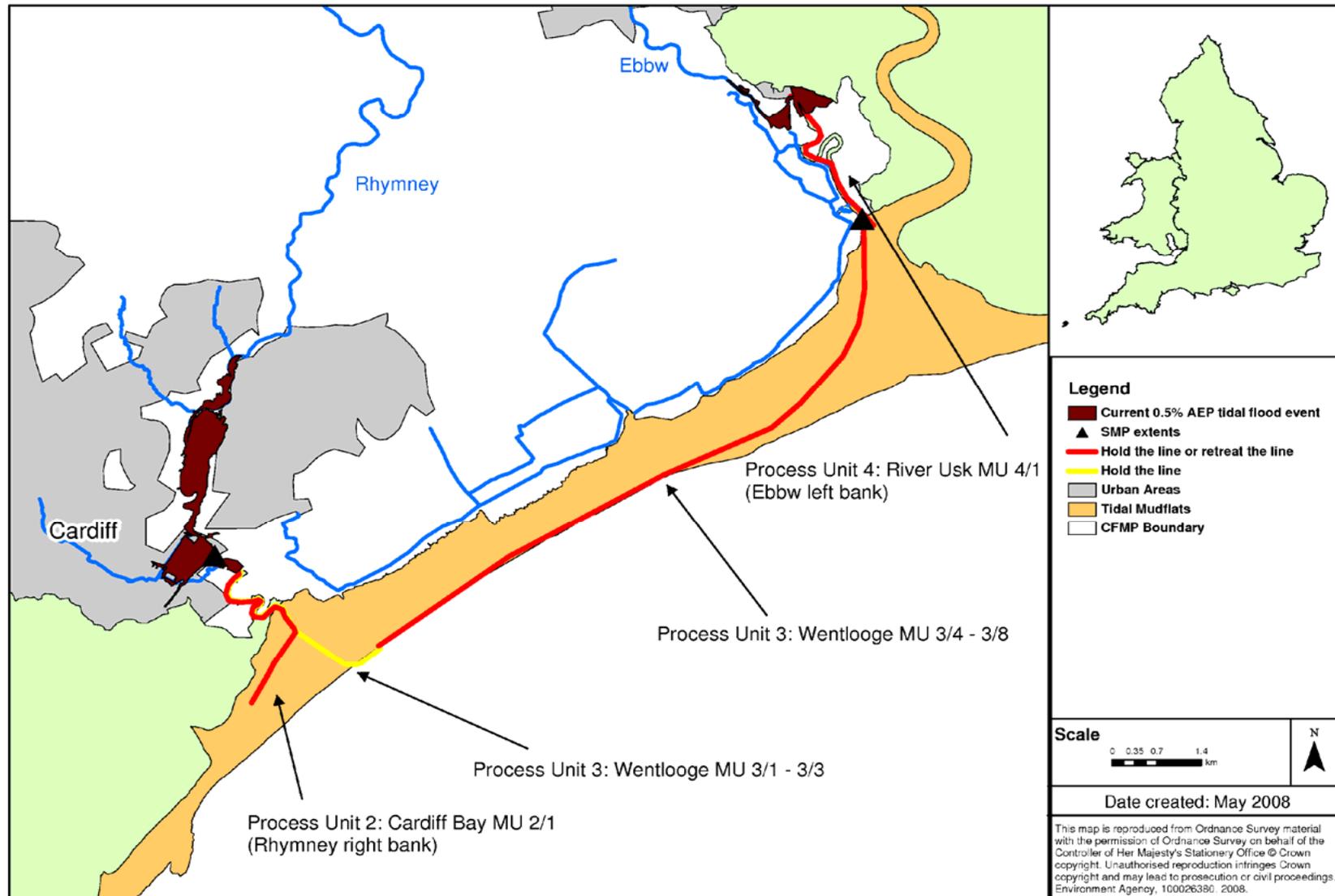


Figure B5: Future 0.5% tidal flood event extent

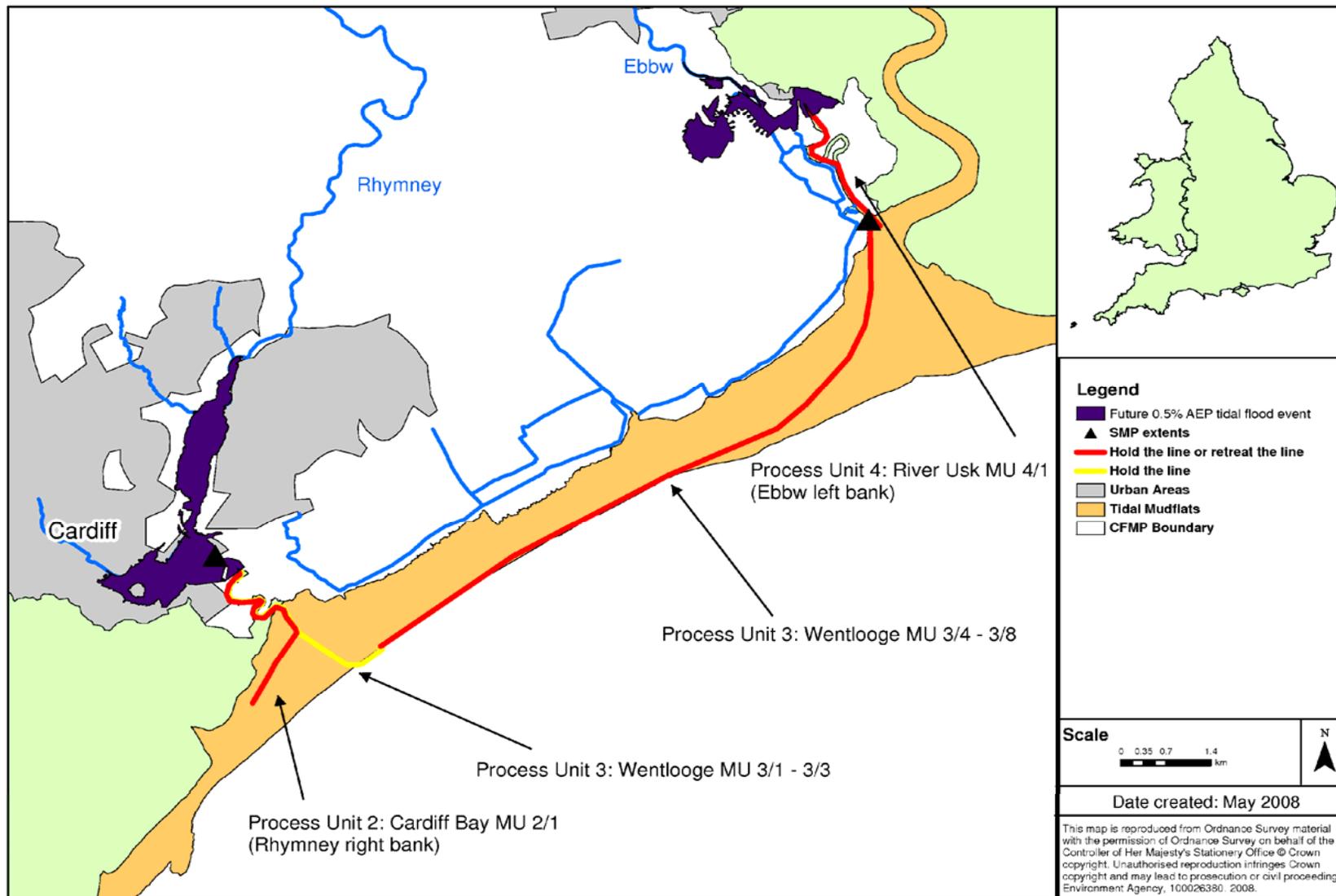


Figure B6 looks at the sources, pathways and receptors of flooding in the CFMP area and our CFMP objectives and responses to flood risk. Table 2 looks more specifically at the sources, pathways and receptors to flood risk in each of the eight policy units we have devised for this CFMP.

Figure B6: Source-Pathway-Receptor diagram

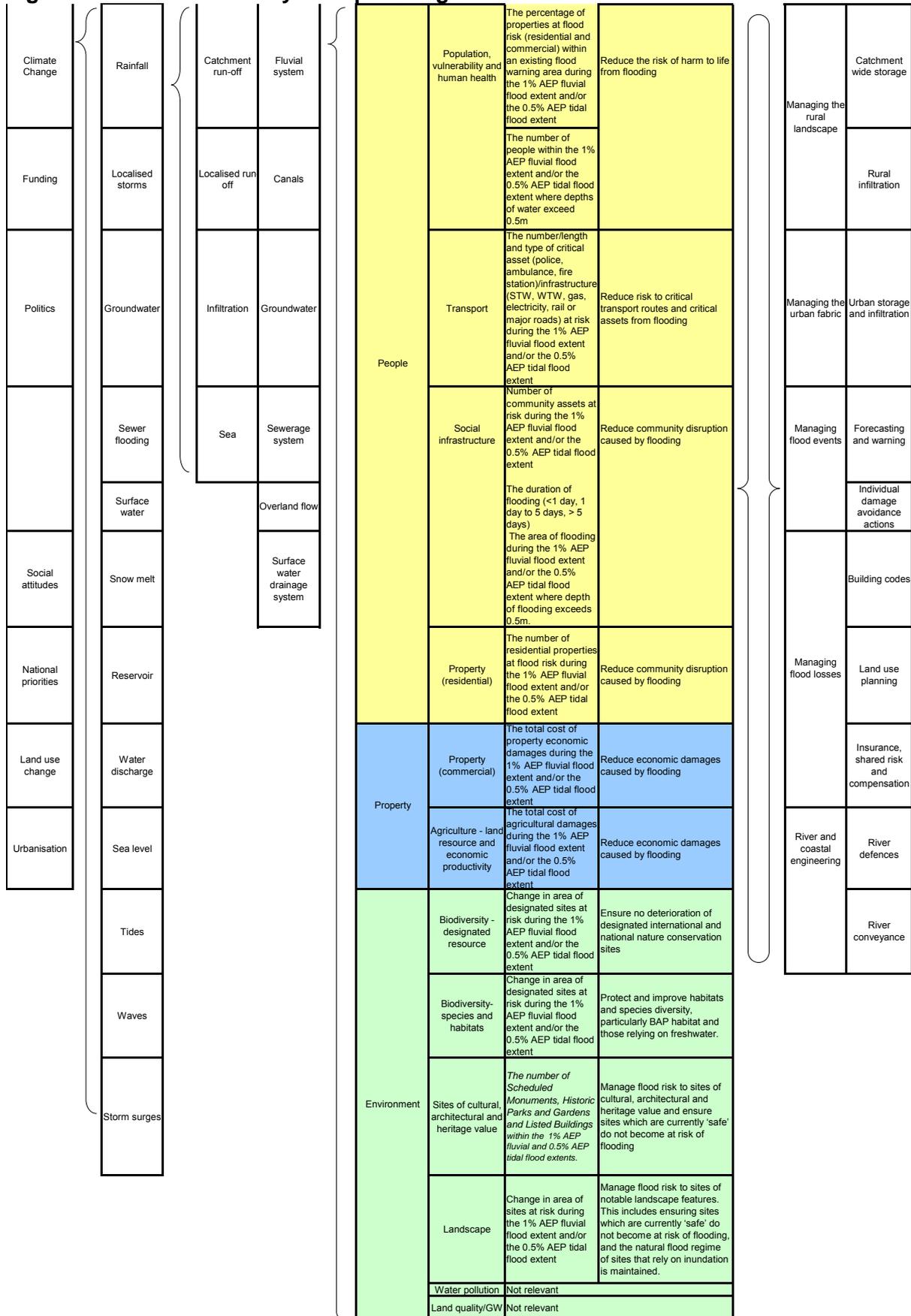


Table B7: Sources, pathways and receptors to flooding for each policy unit

Policy unit	Sources	Pathways	Receptors
<p>PU1 Cardiff</p>	<p>Rainfall, localised storms, sewer flooding, surface water, tides, storm surges</p>	<p>Catchment and localised runoff, fluvial system - River Rhymney and Porset Brook, responds relatively quickly to rainfall</p> <p>Sewerage system, overland flow and surface water drainage system in urban area</p>	<p>Cardiff is the main urban area in the Eastern Valleys, and is the centre for employment and urban growth. There is protection from fluvial flooding to a 1% AEP standard along most of the River Rhymney in Cardiff. These will be overtopped in the future, where damages increase significantly. We have also identified high residual risk (defences breaching or overtopping) in addition to high risk to life. Tidal flooding is a high risk in Cardiff, particularly along the lower Rhymney and Roath Brook. A high number of residential properties are at flood risk in Cardiff from both fluvial and tidal flood events, now and in the future, as are numerous community assets and critical assets such as electricity stations and police stations.</p>
<p>PU2 Bedwas and Machen</p>	<p>Rainfall, localised storms, sewer flooding, surface water</p>	<p>Catchment and localised runoff, fluvial system - River Rhymney responds relatively quickly to rainfall</p> <p>Sewerage system, overland flow and surface water drainage system in urban areas</p>	<p>The areas of Bedwas and Machen have a significant fluvial flood risk from the River Rhymney, and a high residual risk (defences breaching or overtopping). The defences along the River Rhymney in this policy unit offer a 1% AEP standard of protection (SoP) in most places. Current and future risk is comparatively low in this policy unit. However, those properties at risk are mainly residential properties in Machen. The highest economic damages are as a result of flooding to commercial properties in Bedwas. There are few community assets or critical assets at flood risk under current and future conditions.</p>
<p>PU3 Rhymney Corridor</p>	<p>Rainfall, localised storms, sewer flooding, surface water</p>	<p>Catchment and localised runoff, fluvial system – River Rhymney, Porset Brook, Nant Y Aber, Nant Cylla and an unnamed tributary. Rivers respond very quickly to rainfall in this policy unit</p> <p>Sewerage system, overland flow and surface water drainage system in urban area</p>	<p>The areas of New Tredegar, Ystrad Mynach and Caerphilly have a high fluvial flood risk both now and into the future. The defences along the River Rhymney in this policy unit offer a 1% SoP in most places. Damages increase significantly in the future when defences would be overtopped. There is also a high residual risk to people and to property, due to the defences along the River Rhymney. There are large numbers of residential properties at flood risk, particularly in Ystrad Mynach from the Nant Cylla, and in Caerphilly. There are also numerous community assets and critical assets at risk, including two hospitals in Ystrad Mynach, and the A469 and A472. The highest economic damages are in Caerphilly. New Tredegar has a high risk of harm to life due to the expected high depths and velocities of flood water and the very quick onset of flooding during a flood event.</p>

Policy unit		Sources	Pathways	Receptors
PU4	Mid and Upper Reaches	Rainfall, localised storms, sewer flooding, surface water	<p>Catchment and localised runoff, fluvial system - Rivers Rhymney and River Sirhowy. Rivers respond very quickly to rainfall in this policy unit</p> <p>Sewerage system, overland flow and surface water drainage system in urban areas</p>	Ynysddu is the main area at risk in this policy unit. Flooding is not extensive in this policy unit. Damages are low as there is little urbanisation, with isolated farms on the hillsides rather than villages or towns, and agricultural land is low in value. There is one defence scheme, in Ynysddu along the Sirhowy, in this policy unit, offering a 1% AEP SoP. Therefore, there is a residual risk of flooding in Ynysddu. There are few residential or commercial properties at flood risk in this policy unit both now and in the future. In addition, there are few community assets and no critical assets at flood risk in this policy unit. Where flooding does occur, the onset would be quick due to the quick response of the rivers in the upper catchment areas.
PU5	Upper Ebbw	Rainfall, localised storms, sewer flooding, surface water	<p>Catchment and localised runoff, fluvial system - River Ebbw (Ebbw Fawr and Fach). Rivers respond very quickly to rainfall in this policy unit</p> <p>Sewerage system, overland flow and surface water drainage system in urban areas</p>	The areas of Ebbw Vale, Cwm, Llanhilleth and Abertillery are at significant fluvial flood risk in this policy unit, particularly into the future. There are defence schemes in Cwm, Abertillery and Llanhilleth, offering a 1% AEP SoP in most places. Risk to people and property increase significantly into the future when these defences would be overtopped. There is also a high residual risk to people and property due to the location of buildings behind these defences. Most of the properties at risk are residential, however there are numerous community assets at risk including schools and health services. There are few critical assets at flood risk. The highest economic damages are in Ebbw Vale. The onset of flooding would be quick in this policy unit due to the quick response of rivers in upper catchment areas.
PU6	Ebbw Corridor	Rainfall, localised storms, surface water, tides, storm surges	<p>Catchment and localised runoff, fluvial system - River Ebbw, Nant Gwyddon and Cwm Carn. Rivers respond relatively quickly to rainfall in this policy unit</p> <p>Sewerage system, overland flow and surface water drainage system in urban areas</p>	Risca, Bassaleg and Tredegar Park and Newbridge are the main fluvial flood risk areas in this policy unit, particularly Risca. Future flood events will pose a high risk to people and to property here. Tidal flood events affect the Duffryn area, close to the outfall of the River Ebbw. There is protection from fluvial flooding to a 1% AEP standard along most of the River Ebbw in Risca and Crosskeys. These will be overtopped in the future, where damages increase significantly. We have also identified high residual risk (defences breaching or overtopping) in addition to high risk to life. A high number of residential properties are at flood risk in Risca from fluvial flood events in the future, as are numerous community assets including schools and health services. Several electricity stations and the A467 are also at risk. Numerous residential properties are at risk in Duffryn during tidal flood events. Risca has the highest economic damages in this policy unit.
PU7	Wentlooge Levels	Rainfall, localised storms, sewer flooding, surface water, tides,	Catchment and localised runoff, fluvial system – Reens and drainage	There is no fluvial flood risk to people or property in this policy unit from the reens and drains, although we lack understanding of the actual fluvial flood risk in this policy

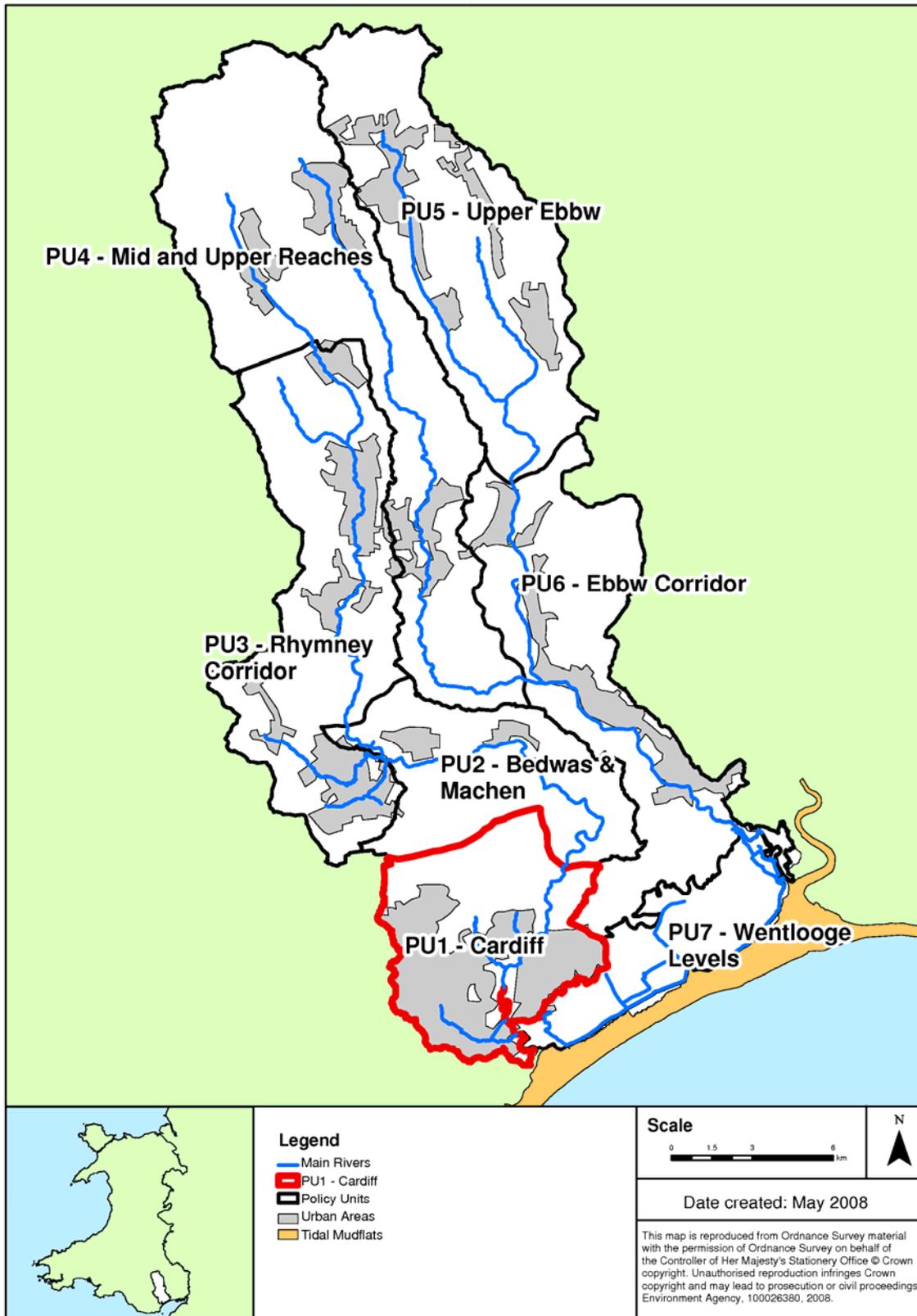
Policy unit	Sources	Pathways	Receptors
	<p>surges</p> <p>There is also a coastal flood risk in this policy unit</p>	<p>network, tidally influenced at there outfalls.</p> <p>Sewerage system, overland flow and surface water drainage system in urban areas</p>	<p>unit. There are no formal flood defences in this policy unit. There is flood risk people and property from a tidal flood event along the River Ebbw, affecting the Duffryn Estate. There is a residual risk to people and property in this policy unit, from the coastal defences breaching or overtopping. This has not been considered in the CFMP, but will be considered in the Severn Estuary SMP. Flood water is likely to inundate the policy unit for long periods of time due to the nature of the outfalls. The Wentlooge Levels has 2 SSSIs within it that may be sensitive to changes in management practice or the flood regime.</p>

Form 12.4: CFMP Policy Options

The following generic policy options have been recommended in the CFMP guidelines for consideration. They are intended to cover the whole spectrum of potential policy choices in response to flood risk.

Option 1:	No active intervention (including flood warning and maintenance); continue to monitor and advise.
Option 2:	Reduce existing flood risk management actions (accepting that flood risk will increase over time)
Option 3:	Continue with existing or alternative actions to manage flood risk at the current level (accepting that flood risk will increase over time from this baseline)
Option 4:	Take further action to sustain the current level of flood risk into the future (responding to the potential increases in risk from urban development, land use change and climate change)
Option 5:	Take further action to reduce flood risk
Option 6:	Take action with others to store water or manage run-off in locations that provide overall flood risk reduction or environmental benefits, locally or elsewhere in the catchment.

Spatial location of policy unit 1: Cardiff



Form 12.5: Summary of current and future levels of and responses to flood risk

<p>Policy unit name/number:</p>	<p>Policy Unit 1: Cardiff</p>
<p>Current responses to flood risk within the policy unit?</p>	<p>Defences We defend the main urban area of Cardiff from flooding using raised earth and blockstone embankments along both sides of the River Rhymney. These extend from Rumney Bridge to Docks Link Road (0.2km). We implemented these as part of the Rhymney Tidal Flood Alleviation Scheme in 1981. This involved raising bank levels on the right hand bank of the River Rhymney. In 2005, these defences were extended further to offer protection along the right hand bank of the River Rhymney from Newport Road to Rentokil (0.4km). The river bank here was raised to accommodate flood flows. In addition, there are flood defences along the River Rhymney between Lamby Way Road Bridge and Newport Road (1.0km on both banks), and at Llanrumney playing fields (1.0km on both banks). We also defend Cardiff along Roath Brook between Waterloo Gardens and Colchester Avenue (0.4km on both banks).</p> <p>Flood Warning We provide a flood warning service via Floodline Warnings Direct. Flood Warning Area 103FWF035 covers fluvial risk from the River Rhymney in Cardiff from Began Farm down to Lamby Way Road Bridge. The lead times for flood warning in PU1 are approximately 3 hours. We aim to issue flood warnings at least 2 hours before a flood event occurs. There are currently 86 properties at flood risk during a 1% AEP fluvial flood event, none of which lie within the existing flood warning area. There are currently 217 properties at flood risk during a 0.5% AEP tidal flood event, 134 of which lie within the existing flood warning area. Uptake to the flood warning service is unknown.</p> <p>Maintenance of existing structures We carry out routine maintenance works along all our main rivers within the Eastern Valleys CFMP area. This includes weed cutting, de-silting and repairs to all defence structures. We also do minor silt removal on the Roath Brook at Waterloo Gardens (in 5 year programme) and re-active work has been undertaken in the past by Roath Park. Cardiff policy unit is classified as a high risk asset system, and therefore assets are inspected every 6 to 12 months. We currently spend approximately £20,000 per year on maintenance and operations in Cardiff.</p>
<p>Standards of service that apply to flood defences within the policy unit?</p>	<p>Standard of Protection The existing flood defence works in the Cardiff policy unit offer a 1% AEP fluvial SoP in most places along the River Rhymney. They also offer a 0.5% AEP tidal SoP in most places. The right hand bank between Rumney Bridge and Docks Link Road can contain flood levels up to 8.30m AOD (approximately a 0.5% AEP SoP). The right hand bank between Newport Road and Rentokil can contain flood levels up to 9.05m AOD (approximately a 0.5% AEP SoP). These defences are likely to be overtopped when allowances are made for climate change into the future or if a fluvial flood event coincides with a tidal flood event. The existing flood defence works along Roath Brook in Cardiff offer a 1% AEP fluvial SoP in most places. These defences are below the 0.5% AEP tidal SoP. Again, these defences are likely to be overtopped when allowances are made for climate change into the future.</p> <p>Condition and maintenance of defences This information is unknown.</p>
<p>What is currently exposed to flooding?</p>	<p>People We estimate that there are currently 225 people at risk of flooding in policy unit one from a 1% AEP fluvial flood event and 291 people at risk from a 0.5% AEP tidal flood event. The majority of the fluvial flood risk comes from the upper reaches of</p>

	<p>Roath Brook for the 1% AEP flood event. Flood risk significantly increases in the 0.1% AEP fluvial and tidal flood events are as a result of flood defences being overtopped along the River Rhymney and Roath Brook.</p> <p>Community Disruption</p> <p>We estimate that there are currently 86 properties at risk of flooding in policy unit one from a 1% AEP fluvial flood event, 84 of which are residential; no community assets are at flood risk. During a 0.5% AEP tidal flood event, 217 properties are risk, which includes 154 residential properties and one school at Llanrumney. Community disruption will significantly increase for the 0.1% AEP fluvial and tidal flood events.</p> <p>Critical Infrastructure</p> <p>We estimate that there are currently no critical infrastructure buildings or transport routes at flood risk in policy unit one from a 1% AEP fluvial flood event. We estimate that there is currently 1 police station (Pen Y Lan), 1 fire station (Pen Y Lan), 4 electricity stations (Roath) and 0.9km of the A4161 at flood risk in policy unit one from a 0.5% AEP tidal flood event.</p> <p>Economic Damages</p> <p>We estimate the total economic property damages resulting from the 1% AEP fluvial and 0.5% AEP tidal flood events to be £1.6 million and £21.8 million, respectively.</p> <p>We estimate the total economic agricultural damages resulting from the 1% AEP fluvial and 0.5% AEP tidal flood events to be £162,993 and £138,159, respectively.</p> <p>Historic Environment</p> <p>We estimate that seven listed buildings are at current flood risk from a 1% AEP fluvial flood event. One listed building is also at risk from a 0.5% tidal flood event.</p> <p>Recreation</p> <p>We estimate that there are currently no recreational areas at flood risk in policy unit one from either a 1% AEP fluvial flood event or a 0.5% AEP tidal flood event.</p> <p>Nature conservation sites</p> <p>We estimate that there are currently no designated nature conservation sites at risk of flooding in the policy unit from a 1% AEP fluvial flood event or a 0.5% AEP tidal flood event.</p> <p>BAP Habitats</p> <p>The exact location of BAP habitats in the catchment is unknown, but we estimate that several locally important habitats, identified in the Cardiff Local BAP, will be at risk of flooding. These habitats include; lakes and reservoirs; mudflats; ponds; rivers, streams and floodplains; and wet woodlands.</p> <p>Species</p> <p>The exact location of BAP species in the catchment us unknown, but we estimate that a several locally important species, identified in the Cardiff Local BAP, will be at risk of flooding. These species include Brown Trout; Great Crested Newt; Lapwing; Otter; Pipistrelle Bat; Reed Bunting; and Water Vole.</p>
<p>Who and what are currently most vulnerable to flood damage and losses?</p>	<p>Social and economic receptors</p> <p>People living in areas behind flood defences are the most vulnerable to flooding due to the high depths and velocities of flood water that would be expected if a breach occurred in the defence scheme or the defences were overtopped. The area of Cyncoed has the highest economic damages during a 1% AEP fluvial flood event, most of which are as a result of flooding to residential properties.</p>

	<p>The people most vulnerable to flooding during a 0.5% AEP tidal flood event are located in Llanrumney, where there is a medium to high social vulnerability. The greatest economic risk from flooding is in Roath and Llanrumney, most of which are as a result of damages to residential properties and industrial properties (particularly the Senlan Industrial Estate). One police station, one fire station and four electricity stations are also at risk during this flood event.</p> <p>Environmental receptors</p> <p>BAP habitats and species in the policy unit are at greatest risk from prolonged or frequent floodwater inundation, especially if water quality is low, which can indirectly degrade habitats. However, some wetland BAP habitats, and the species they support, may benefit from increased flooding.</p> <p>Tidal flooding can also affect BAP habitats and species, as flooding of saltwater habitats with freshwater, and freshwater habitats with salt water, can cause long-lasting damage to sensitive plants and animals.</p> <p>Flooding may cause considerable damage to the seven listed buildings currently at risk of flooding in the unit.</p>
<p>What are the key factors that could drive future flood risk?</p>	<p>Climate change</p> <p>Climate change is the main driver of future flood risk in Cardiff. Climate change will result in higher flows and higher tide levels, which will increase water levels in our rivers. This will put pressure on existing flood defences and will result in the current Standard of Protection of our channels and flood defences being reduced. Flooding under our modelled future scenarios of climate change would cause significantly more damage and pose a significantly higher risk to people and property than existing conditions.</p> <p>Land use management changes</p> <p>We have decided not to consider the impact of land use change outside of urban areas on future flood risk in this CFMP. Agricultural intensification and changes in drainage practices are unrealistic scenarios because the Eastern Valleys has poor quality soils that are unsuitable for agricultural intensification. It is also constrained by the steep gradients of the land, meaning arable farming is impossible in certain areas. We recognise that within this policy unit there is some good quality agricultural land to the north of Cardiff but it is very difficult for us to predict the future of agriculture in the Eastern Valleys beyond the immediate future. It may be that extensification is a more realistic long-term scenario, where land is farmed less intensively and for environmental benefits. However, it is unlikely that extensification would have little impact on flood risk as the area is not intensively farmed at present.</p> <p>Development in the flood plain</p> <p>Increased urbanisation will result in increased flood volumes and higher peak water levels, and flooding would occur more quickly. Unless runoff from new urban development within and outside of floodplains is balanced flood risk will increase locally and downstream. Development in the floodplain should only be allowed when no other suitable land allocations are available and any buildings within floodplains should have flood resilience measures incorporated into their design, and floodplain compensation would be necessary.</p> <p>Flood defence failure</p> <p>In the event of flood defence infrastructure failure during a flood event, the resulting flood water depths and velocities would be very high. There would also be very little flood warning time for people located close to existing flood defences. Therefore, the risk of harm to life would be very high and the resulting economic</p>

	<p>damages would be very high. The areas most vulnerable to flood defence failure in policy unit one are the Senlan Industrial Estate and the properties located behind the Llanrumney defences along the River Rhydney.</p>
<p>What are the possible future levels of flood risk under the main scenarios?</p>	<p>Our final future scenario that we used to assess possible future levels of flood risk considered a combination of the two main drivers, climate change and urbanisation. We have identified the following:</p> <p>People</p> <p>In the future, we estimate that there will be an additional 2007 people at risk of flooding in policy unit one from a 1% AEP fluvial flood event and an additional 1958 people at risk from a 0.5% AEP tidal flood event. The significant increase in people at risk during these events is due to our flood defences overtopping. The majority of flood risk comes from the lower reaches of Roath Brook.</p> <p>Community Disruption</p> <p>In the future, we estimate that there will be an additional 1022 properties at risk of flooding from a 1% AEP fluvial flood event, 1010 of which are residential. During a 0.5% AEP tidal flood event, there will be an additional 1377 properties at risk of flooding, which includes 1366 residential properties. Community assets will also be at flood risk in the future 1% AEP fluvial and 0.5% AEP tidal flood events: one health service (Roath), two schools (Llanrumney and Pen y Lan) and two community centres (Roath).</p> <p>Critical Infrastructure</p> <p>In the future, we estimate that there will be one police station (Pen Y Lan), one fire station (Pen Y Lan), six electricity stations (Roath), 0.5km of the railway, 1.5km of the A4161 and 0.5km of the A469 at flood risk in policy unit one for a 1% AEP fluvial flood event.</p> <p>In the future, we estimate that there will be one police station (Pen Y Lan), one fire station (Pen Y Lan), nine electricity stations (Roath) and 1.7km of the A4161 at flood risk in policy unit one for a 0.5% AEP tidal flood event.</p> <p>Economic Damages</p> <p>In the future, we estimate the total economic property damages resulting from the 1% AEP fluvial and 0.5% AEP tidal flood events will increase by £57.4 million and £79.1 million, respectively.</p> <p>In the future, we estimate the total economic agricultural damages resulting from the 1% AEP fluvial and 0.5% AEP tidal flood events will increase by £192,598 and £99,950, respectively.</p> <p>Historic Environment</p> <p>In the future, we estimate that two additional listed buildings will be at flood risk from a 1% AEP fluvial event, meaning nine will be at risk in total. Two additional listed buildings will also be at flood risk from a future 0.5% tidal flood event, resulting in three being at risk in total.</p> <p>Recreation</p> <p>In the future, we estimate that there will be no recreational areas at flood risk in policy unit one from either a 1% AEP fluvial flood event or a 0.5% AEP tidal flood event.</p> <p>Nature conservation sites</p> <p>In the future, we estimate that there will be no designated nature conservation sites at risk of flooding in the policy unit from a 1% AEP fluvial flood event or a 0.5% AEP tidal flood event.</p> <p>BAP Habitats</p>

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	What potential responses (or groups of responses) are being considered to manage flood risk?	<table border="1"> <thead> <tr> <th>Generic Response/Strategic</th> <th>Response</th> </tr> </thead> <tbody> <tr> <td rowspan="2"> Attenuation/ retention </td> <td> <ul style="list-style-type: none"> ▪ On-line storage ▪ Off-line storage </td> <td>Existing online storage on the Roath Brook (Roath Park Lake) and offline storage (Llanishen and Lisvane Reservoir). Could be opportunities for 'small-scale' FSR within this policy unit, particularly on Rhymney, north of Cardiff.</td> </tr> <tr> <td> <ul style="list-style-type: none"> ▪ SUDS - new/retrospective </td> <td>A potential method for reducing surface water runoff and should be included in all new developments.</td> </tr> <tr> <td rowspan="2"> Increased or decreased conveyance </td> <td> <ul style="list-style-type: none"> ▪ River maintenance ▪ De-silting </td> <td>The maintenance regime within this policy unit is unknown but it is assumed that some maintenance is undertaken. Reduced/increased maintenance activities within this policy unit should be considered further. Minor silt removal on the Roath Brook at Waterloo Gardens (in 5 year programme). May be potential to increase to include Lower Rhymney.</td> </tr> <tr> <td> <ul style="list-style-type: none"> ▪ Fluvial defences </td> <td>The main urban areas of this policy unit are defended to a 1 in 100 year Standard of Protection (SoP). Defences on both the Roath Brook and River Rhymney. There may be possibilities for building new and/or increasing the SoP offered by the existing defences within this policy unit. This will be assessed through more detailed pre-feasibility studies. In Cardiff at Newport Road, the scheme is currently an unfunded Capital programme.</td> </tr> <tr> <td rowspan="3"> Influencing and informing </td> <td> <ul style="list-style-type: none"> ▪ Flood awareness </td> <td>National campaign. Should be continued and awareness increased within this policy unit where the flood risk from fluvial and tidal flooding is very high.</td> </tr> <tr> <td> <ul style="list-style-type: none"> ▪ Flood warning and evacuation </td> <td>Existing flood warning area - uptake to FWD unknown but likely to be opportunity to increase. In light of future flood risk, it is likely that the flood warning area may need extending.</td> </tr> <tr> <td> <ul style="list-style-type: none"> ▪ Emergency & disaster planning/response </td> <td>Policy unit covered by Cardiff Local Authority. Existing emergency plans in place, which should be reviewed and updated as new information becomes available.</td> </tr> </tbody> </table>	Generic Response/Strategic	Response	Attenuation/ retention	<ul style="list-style-type: none"> ▪ On-line storage ▪ Off-line storage 	Existing online storage on the Roath Brook (Roath Park Lake) and offline storage (Llanishen and Lisvane Reservoir). Could be opportunities for 'small-scale' FSR within this policy unit, particularly on Rhymney, north of Cardiff.	<ul style="list-style-type: none"> ▪ SUDS - new/retrospective 	A potential method for reducing surface water runoff and should be included in all new developments.	Increased or decreased conveyance	<ul style="list-style-type: none"> ▪ River maintenance ▪ De-silting 	The maintenance regime within this policy unit is unknown but it is assumed that some maintenance is undertaken. Reduced/increased maintenance activities within this policy unit should be considered further. Minor silt removal on the Roath Brook at Waterloo Gardens (in 5 year programme). May be potential to increase to include Lower Rhymney.	<ul style="list-style-type: none"> ▪ Fluvial defences 	The main urban areas of this policy unit are defended to a 1 in 100 year Standard of Protection (SoP). Defences on both the Roath Brook and River Rhymney. There may be possibilities for building new and/or increasing the SoP offered by the existing defences within this policy unit. This will be assessed through more detailed pre-feasibility studies. In Cardiff at Newport Road, the scheme is currently an unfunded Capital programme.	Influencing and informing	<ul style="list-style-type: none"> ▪ Flood awareness 	National campaign. Should be continued and awareness increased within this policy unit where the flood risk from fluvial and tidal flooding is very high.	<ul style="list-style-type: none"> ▪ Flood warning and evacuation 	Existing flood warning area - uptake to FWD unknown but likely to be opportunity to increase. In light of future flood risk, it is likely that the flood warning area may need extending.	<ul style="list-style-type: none"> ▪ Emergency & disaster planning/response
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		<ul style="list-style-type: none"> ▪ Planning policy, Development control 	Continue to follow Welsh Assembly Government policies. Cardiff Local Authority should ensure that suitable land allocations outside flood risk areas are sought first.
		<ul style="list-style-type: none"> ▪ Building regulations (resilience) 	To be incorporated into all new developments located within flood risk areas.
	Monitoring, advise and survey	<ul style="list-style-type: none"> ▪ Data and information 	Should continue despite policy selected.
		<ul style="list-style-type: none"> ▪ Asset inspection 	Policy unit classified as high risk and therefore assets are inspected every 6-12 months. It is unlikely this could be increased further but should be explored, and perhaps main flood risk areas targeted.
		<ul style="list-style-type: none"> ▪ Hydrometric network 	Existing gauge at Llanedryn. Hydrometric Improvements Project suggests that a new gauge at Llanrumney would improve knowledge on the effects of high tides/river level interaction and may help improve the accuracy of flood warnings.
	Studies	<ul style="list-style-type: none"> ▪ Flood risk mapping 	Current flood risk management study being undertaken within this policy unit - includes Roath Brook and Lower Rhymney. Flood risk management study should be undertaken for Rhymney upstream of confluence. All studies should be revisited as more data becomes available.
		<ul style="list-style-type: none"> ▪ Flood forecasting 	No existing studies. Due to the very high tidal and fluvial flood risk, a flood forecasting study may be beneficial.
		<ul style="list-style-type: none"> ▪ Pre-feasibility 	Pre-feasibility study completed at Newport Road, Cardiff. If further new defences are considered, pre-feasibility studies will be required.
		<ul style="list-style-type: none"> ▪ Strategy plans 	Recommended that a strategy plan should be undertaken to target areas where pre-feasibility studies are needed.
		<ul style="list-style-type: none"> ▪ SAMPs 	Policy unit covered by SAMPs. Likely that they will need reviewing to take into account future flood risk, but policy unit is already classified as high risk
<ul style="list-style-type: none"> ▪ Urban drainage plans 		Policy unit contains main urban centre and therefore urban drainage plans will exist. Will be a need to review them in light of future flood risk.	
What gaps and uncertainties are there in knowledge, and what assumptions have been made?	<p>Broadscale modelling</p> <ul style="list-style-type: none"> ▪ Broadscale hydrology and hydraulic modelling techniques used; ▪ Lacked a specific tide level for the Rhymney Estuary for different flood events, therefore this has been based on the Newport tide levels; ▪ Where no existing models are available, these have been supplemented by other modelling techniques. Existing models were available for the Lower Rhymney in this policy unit. <p>Future scenarios</p>		

	<ul style="list-style-type: none"> ▪ Although climate change projections are based on current guidance, these are still estimations; ▪ Urbanisation projections up until the year 2100 are based on current rates of urbanisation. <p>Data limitations</p> <ul style="list-style-type: none"> ▪ Topography data (Digital Elevation Model) for Cardiff not as good as the rest of the catchment; ▪ No data on the percentage uptake of properties located in Flood Warning Areas; ▪ No data on the condition of flood defences/maintenance regime. ▪ The exact location of BAP habitats and species within the policy unit is unknown.
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Broad scale Modelling Tables

Generic Response Modelling

The following tables provide a summary of how flooding will change in response to flood management options which may be adopted within policy unit one and what the implications of these changes might be. We have not applied any specific measures or schemes to the policy unit, but rather have applied what has been termed a 'generic response'. This represents the most likely outcome of a given policy, but is not specific and does not reflect any proposed scheme or project. It simply allows a broad assessment of what the impact of that policy might be.

Our broad scale models have been used to investigate the impact of these changes and have allowed us to quantify the effect on flood damages. We compare the risks for each generic response against the current base case conditions (the risk which currently exists in the catchment today). The results given below for each of the generic responses (i.e. the appropriate scenario for that part of the catchment) are for the 1% AEP fluvial flood event and the 0.5% AEP tidal flood event, where applicable.

We have unit costs available for defences, however the costs of flow attenuation schemes are not available. The cost of large scale flow attenuations scheme would be extremely high, as they form heavy structural response to flood risk. More local schemes for attenuating flow would cost less, but the costs would still be high compared to defences.

Policy unit 1: Cardiff

Generic response: Policy 1 - Withdraw/retreat defences and decreased conveyance

Description: We used our broad scale River Rhymney models to assess the combined effects of not maintaining defences and stopping river maintenance. Channel and floodplain roughness values in our broad scale models were increased from 0.04 and 0.06 to 0.075 and 0.095 respectively, to reflect the increase of roughness expected if maintenance were stopped. Defences were not removed from the model as their impact was considered negligible, due to them being overtopped.

For undefended tidal conditions we used the future 0.1% AEP tidal flood outline as a surrogate for an extreme tidal event, which we would not defend against, as we consider this to be a worse case scenario. Compared to the influence of the tide level, the channel maintenance we undertake has very little effect in tidally-influenced areas. We therefore have shown that the risk would be greater than that from the 0.1% AEP tidal event.

Base case conditions (1% AEP fluvial flood event / 0.5% AEP tidal flood event)

People at risk: Fluvial - 225	Economic risk: Fluvial – £1.6m	Properties at risk: Fluvial – 86	Environmental sites at risk: Fluvial – N/A
Tidal - 291	Tidal - £21.8m	Tidal - 217	Tidal – N/A

Results of the broad scale modelling

People at risk: Fluvial – 3092	Economic risk: Fluvial – £100.7m	Properties at risk: Fluvial – 1,517	Environmental sites at risk: Fluvial – N/A
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Environment Agency Wales

(+1,274%) Tidal - > 2,453 (+>740%)	(+6,194%) Tidal - > £114.7m (+ >420%)	(+1,664%) Tidal - > 1,619 (+ >640%)	Tidal – N/A
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Conclusions

Cost: Nothing - no active intervention

Conclusion: The results of this modelling have indicated that if we stopped our maintenance of the defences and channels in Cardiff the risk to people, properties and the economy would increase greatly. The impact of 'no active intervention' in Cardiff is very significant, because we would be encouraging more flooding to occur. Our defences and the maintenance we undertake on the River Rhymney and Roath Brook around Cardiff are very important in reducing the risk of flooding and this is why the existing level of risk is low.

We would withdraw our current flood warning service that we provide under this generic response.

Policy unit 1: Cardiff

Generic response: Policy 2 – Reduced maintenance

Description: The active removal of the defences we maintain in and around Cardiff would not be a sustainable flood risk management strategy. Around Cardiff the defences currently have a 1% AEP Standard of Protection, so provide considerable protection. We could reduce our flood risk management around Cardiff by relaxing our maintenance activities, such as weed-cutting and clearing. We increased channel and floodplain roughness in the Rhymney broad scale models from 0.04 and 0.06 to 0.055 and 0.075 respectively, to reflect the increase of roughness expected if maintenance were reduced.

Channel roughness has a negligible effect on tidal water levels, so we did not model tidal scenarios for this generic response.

Base case conditions (1% AEP fluvial flood event)

People at risk: Fluvial - 225	Economic risk: Fluvial – £1.6m	Properties at risk: Fluvial – 86	Environmental sites at risk: Fluvial – N/A Tidal – N/A
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Results of the broad scale modelling (1% AEP fluvial flood event)

People at risk: Fluvial - 2630 (+1069%)	Economic risk: Fluvial - £78.4 (+4,800%)	Properties at risk Fluvial – 1302 (+1,414%)	Environmental sites at risk: Fluvial – N/A Tidal – N/A
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Conclusions

Cost: We currently spend approximately £20,000 per year on maintenance and operations in Cardiff. Under policy two we would not stop this regime, but we would scale down our programme, for example we may downgrade Cardiff policy unit from a high risk flood risk management system (FRMS) to a medium FRMS, which may reduce funding by up to 50% (to £10,000 per year).

Conclusion:

If we were to reduce our maintenance regime, water levels would be expected to increase and bring additional risk to people. During a 1% AEP fluvial event in the future, the defences we maintain would be overtopped if we did not increase them in line with future increases in water levels. By reducing our maintenance the risk to people, property, the economy and the environment would be increased further. This is because channel capacity would reduce and more flooding would occur.

We would withdraw our current flood warning service that we provide under this generic response.

Policy unit 1: Cardiff

Generic response: Policy 3 – Continue with existing flood defence actions only

Description: This response to manage risk at the same level assumes that we would not undertake any alternative flood risk management actions, and that we would continue to maintain our defences at their current level. We would also continue our river maintenance, which allows the rivers to flow freely, at the

same level. The current level of flood risk management under the chosen future scenario of climate change and increased urbanisation was modelled for Chapter 4.

Base case conditions (1% AEP fluvial flood event / 0.5% AEP tidal flood event)

People at risk: Fluvial - 225	Economic risk: Fluvial – £1.6m	Properties at risk: Fluvial – 86	Environmental sites at risk: Fluvial – N/A
Tidal - 291	Tidal - £21.8m	Tidal - 217	Tidal – N/A

Results of the broad scale modelling (1% AEP fluvial flood event / 0.5% AEP tidal flood event)

People at risk: Fluvial – 2,232 (+892%)	Economic risk: Fluvial – £59.0m (+3,588%)	Properties at risk: Fluvial – 1,108 (+1,188%)	Environmental sites at risk: Fluvial – N/A
Tidal - > 2,249 (+>670%)	Tidal - > £100.9m (+ >360%)	Tidal - > 1,494 (+ >580%)	Tidal – N/A

Conclusions

Cost: Cardiff policy unit falls predominantly within one high risk flood risk management system, for which we currently spend approximately £20,000 per year on maintenance, assets and operations. We would continue investing this much in the future.

Conclusion: In the past our management of flood risk has been mainly through building defences. We could continue investing in flood risk management to the same level in Cardiff, by maintaining our defences at their current level. To increase them into the future would require additional investment. The results from this model show that if we did not undertake any additional work in managing flood risk into the future across Cardiff, then risks to people, property and the economy would greatly increase, because our existing flood defences would overtop. However, it is important that we consider alternative responses other than focusing on defences alone.

Policy unit 1: Cardiff

Generic response: Policy 3 – Reduced maintenance balanced by flood storage

Description: An alternative, softer approach to flood risk management is that we could relax our channel maintenance regime. This would raise water levels as channel capacity would reduce (as modelled under policy two). To compensate for this we could implement local scale flood storage schemes to reduce water levels. These would attenuate flows by up to 5%, and would operate at a local scale. In Cardiff, there may be opportunities for local storage along the Roath Brook, just upstream of Cardiff, and along the Nant Glandulas. We ran our broad scale models with increased channel and flood plain roughness values to assess the affects of a reduction in channel capacity, by relaxing our channel maintenance regime (roughness values as per policy two). Combined with this, we reduced the flows by 5% to reflect flood storage.

Maintenance has a negligible effect of tidal water levels, and storage of tidal inflows along the River Rhymney is not practical. Therefore we did not include tidal risk for this generic response.

Base case conditions (1% AEP fluvial flood event)

People at risk: Fluvial - 225	Economic risk: Fluvial – £1.6m	Properties at risk: Fluvial – 86	Environmental sites at risk: Fluvial – N/A
			Tidal – N/A

Results of the broad scale modelling (1% AEP fluvial flood event)

People at risk: Fluvial – 2,379 (+957%)	Economic risk: Fluvial - £71.8 (+4,388%)	Properties at risk Fluvial – 1203 (+1,299%)	Environmental sites at risk: Fluvial – N/A
			Tidal – N/A

Conclusions

Cost: We currently spend approximately £20,000 per year on maintenance and operations in Cardiff. If we were to scale down our regime, investment may reduce by up to 50% (to £10,000 per year). We do

not have unit costs for implementing flood storage schemes but we expect that the costs would be higher than we currently spend on maintenance. Therefore the overall cost of this response is expected to be quite high, dependant on the size and location of the flood storage schemes.

Conclusion: As we discussed above for the policy two generic response, reducing maintenance encourages more flooding. If we were to reduce flows by 5%, we have shown that we could not compensate for this risk and are unable to further reduce risk beyond what is achievable with defences alone at their current level. This demonstrates that in the Cardiff policy unit, we would not be able to achieve the goal of policy three using combinations of other flood risk management options. In Cardiff we recognise the need to improve the number of people who are signed up to receive flood warnings.

Policy three manages risk in the future at the current level of flood risk management activity. However, our broad scale modelling has shown that this combination of generic responses is unlikely to meet this objective, and costs would be considerable in implementing local flood storage schemes. This suggests that a continuation of our work in inspecting and maintaining our defences is a more suitable and cost effective strategy.

Policy unit 1: Cardiff

Generic response: Policy 4 – Take further action to improve and create new flood defences

Description: This response to sustain flood risk into the future at the current level assumes that we would not undertake any alternative activities. All the increase of risk into the future would be managed by increasing and maintaining our defences. We have identified two areas within the Cardiff policy unit where there is a big increase in flood risk in the future. The first is along the Roath Brook downstream of Blenheim Road, which is because of a combination of existing defences overtopping and the channel capacity being exceeded. The second area we have identified is along the left bank of the River Rhymney at Llanrumney, a result of existing flood defences overtopping. We trimmed our future flood outlines to show that these areas would benefit from either new defences or increasing existing defences.

Base case conditions (1% AEP fluvial flood event / 0.5% AEP tidal flood event)

People at risk: Fluvial - 225	Economic risk: Fluvial – £1.6m	Properties at risk: Fluvial – 86	Environmental sites at risk: Fluvial – N/A
Tidal - 291	Tidal - £21.8m	Tidal - 217	Tidal – N/A

Results of the broad scale modelling (1% AEP fluvial flood event / 0.5% AEP tidal flood event)

People at risk: Fluvial – 256 (+14%)	Economic risk: Fluvial – £2.2m (+38%)	Properties at risk: Fluvial – 108 (+26%)	Environmental sites at risk: Fluvial – N/A
Tidal - 291 (no change)	Tidal - £21.8m (no change)	Tidal – 217 (no change)	Tidal – N/A

Conclusions

Cost: We currently spend approximately £20,000 per year on inspecting and maintaining our defence assets in the Cardiff policy unit. We have based our costs on a new flood wall costing £1,500 per metre and increasing existing defences costing £406 per metre. To construct new and increase the height of existing defences along the Roath Brook would cost approximately £3.2m. To increase the height of existing defences along the River Rhymney at Llanrumney would cost in the order of £700,000. However, there would also be the cost of undertaking pre-feasibility studies and further maintenance costs, particularly with the new defences. Therefore, in total, the indicative cost would be in excess of £4.0m.

To maintain the current tidal standard of protection into the future, we would need to increase the height of approximately 1km of defences along the right bank of the River Rhymney adjacent to the Senlan Industrial Estate. This would cost in excess of £400,000.

Conclusion: If we continued to maintain, improve and build new defences to account for the additional risk in the future in the main flood risk areas in the Cardiff policy unit, there will still be a small amount of fluvial flood risk during a 1% AEP fluvial flood event. Our flood risk management approach is to, where possible, move away from the traditional form of structural responses such as defences, in favour of combinations of softer management options. Improving existing and building new defences along the downstream extent of the Roath Brook will provide protection to approximately 890 properties, reducing

economic damages by approximately £52.0m. Increasing the height of defences along the River Rhyrne at Llanrumney will protect just over 100 properties, and reduce damages by up to £5.0m.

Policy unit 1: Cardiff

Generic response: Policy 4 – Localised Flood Storage

Description: We could implement local scale flood storage schemes to reduce water levels. These would attenuate flows by up to 5%, and would operate at a local scale. Due to topographic restrictions and land constraints, flow attenuation schemes which reduce flows above 5% are not feasible. Within the Cardiff policy unit, there may be opportunities for local storage along the Roath Brook, just upstream of Cardiff, and along the Nant Glandulas. We ran our broad scale models reducing peak flows by 5% to reflect flood storage.

Storing tidal flows along the River Rhyrne is not practical. Therefore we did not include tidal risk for this generic response.

Base case conditions (1% AEP fluvial flood event)

People at risk: Fluvial - 225	Economic risk: Fluvial – £1.6m	Properties at risk: Fluvial – 86	Environmental sites at risk: Fluvial – N/A Tidal – N/A
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Results of the broad scale modelling (1% AEP fluvial flood event)

People at risk: Fluvial – 2,195 (+876%)	Economic risk: Fluvial - £54.9 (+3,331%)	Properties at risk Fluvial – 1,075 (+1,150%)	Environmental sites at risk: Fluvial – N/A Tidal – N/A
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Conclusions

Cost: We do not have unit costs for implementing flood storage schemes but we expect that the costs would be quite high, dependant on the size and location of the schemes.

Conclusion: In the future, our flood defences would be overtopped if we did not continue to improve them in-line with future increases in water levels. The aim of policy four is to sustain the current level of risk in to the future, although there may be a small amount of risk that we would have to accept. Our broad scale modelling has shown that if we were to adopt small scale flood storage responses alone, the consequences in the future to people, property and the economy would still be significantly high in Cardiff and only slightly lower than the additional consequences shown for the policy three generic response, continue with existing flood defence actions only. This is because our existing flood defences would be overtopped into the future, leading to extensive flooding. With the level of investment that would be required for introducing storage schemes, compared with the small benefits they would provide, we are not considering this response further for Cardiff.

In Cardiff we recognise the need to improve the number of people who receive our flood warnings.

Policy unit 1: Cardiff

Generic response: Policy 4 – Increased maintenance

Description: We currently undertake widespread channel maintenance across the Cardiff policy unit. We have the option to increase this further, to increase channel capacity and allow flow to be conveyed more freely. This would theoretically reduce flood risk. Our broad scale model was run with channel and flood plain roughness values reduced by 10%, to simulate an increase in our maintenance.

Maintenance has a negligible effect on tidal water levels; therefore we did not include tidal risk for this generic response.

Base case conditions (1% AEP fluvial flood event)

People at risk: Fluvial - 225	Economic risk: Fluvial – £1.6m	Properties at risk: Fluvial – 86	Environmental sites at risk: Fluvial – N/A
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Environment Agency Wales

			Tidal – N/A
Results of the broad scale modelling (1% AEP fluvial flood event)			
People at risk: Fluvial – 2,161 (+860%)	Economic risk: Fluvial - £51.9 (+3,144%)	Properties at risk Fluvial – 1,058 (+1,130%)	Environmental sites at risk: Fluvial – N/A Tidal – N/A
Conclusions			
Cost: We currently spend approximately £20,000 per year on maintenance and operations in Cardiff. If we were to increase our maintenance programme costs might be expected to increase by approximately 50% (to £30,000 per year).			
Conclusion: In the future, our flood defences would be overtopped if we did not continue to improve them in-line with future increases in water levels. The aim of policy four is to sustain the current level of risk in the future, although there may be a small amount of risk that we would have to accept. By increasing our channel maintenance throughout the policy unit, we would increase channel capacity. This would allow more water to be contained within the channel, and reduce the flood risk. By undertaking this response alone in Cardiff, the consequences in the future to people, property and the economy would still be significantly high in Cardiff and only slightly lower than the additional consequences shown for the policy three generic response, continue with existing flood defence actions only. Therefore, this generic response is considered not to be suitable for Cardiff. We already carry out significant maintenance within this policy unit, and it is unlikely that we would be able to increase our current maintenance activities significantly. In addition, the benefits gained from further activities would not out way the additional costs involved. In light of these considerations, we will not be considering this as a generic response to take forward to policy appraisal.			

Policy unit 1: Cardiff			
Generic response: Policy 5 – Take further action to improve and create new flood defences			
Description: Taking further action to improve and create new flood defences to reduce flood risk, both now and into the future, assumes that sustaining the current level of risk would be unacceptable. There is not currently a significant fluvial flood risk in Cardiff. However, we have identified under the policy four generic response take further action to improve and create new defences, two main areas where defences either could be improved or new ones built. Under policy five, we could take further action to reduce flood risk by building new defences in the following areas: Llanishen Brook, Nant Fawr (up and downstream of the reservoirs) and along the Nant Glandulas. However, the schemes along the Nant Fawr would not be economically feasible as cost (see below), would not offset the economic benefit. Therefore, we only trimmed our future fluvial flood outlines (further than the defences P4 generic response) in two locations only; along Llanishen Brook and along the Nant Glandulas. This showed that these areas would benefit from new defences.			
We consider that the existing tidal flood risk is high and into the future this risk will become even higher because of the increase in tide levels as a result of climate change. We could manage these risks by significantly increasing the height of existing defences along the right hand bank of the lower Rhymney adjacent to the Senlan Industrial Estate. We trimmed our future tidal flood outlines to demonstrate the benefits of increasing existing defences in this location.			
Base case conditions (1% AEP fluvial flood event / 0.5% AEP tidal flood event)			
People at risk: Fluvial - 225 Tidal - 291	Economic risk: Fluvial – £1.6m Tidal - £21.8m	Properties at risk: Fluvial – 86 Tidal - 217	Environmental sites at risk: Fluvial – N/A Tidal – N/A
Results of the broad scale modelling (1% AEP fluvial flood event / 0.5% AEP tidal flood event)			
People at risk: Fluvial – 104 (-54%) Tidal - 102	Economic risk: Fluvial – £820,000 (-49%) Tidal - £982,000	Properties at risk: Fluvial – 47 (-45%) Tidal – 42	Environmental sites at risk: Fluvial – N/A Tidal – N/A

(-65%)	(-95%)	(-86%)	
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Conclusions

Cost: We currently spend approximately £20,000 per year on inspecting and maintaining our defence assets in the Cardiff policy unit. We have based our costs on a new flood wall costing £1,500 per metre and increasing existing defences costing £406 per metre. On top of the costs we estimated in policy four (in excess of £4.0m), we estimated the additional costs under policy five if new defences were built in our selected areas. However, as discussed above and in the conclusion, having weighed up the costs against the benefits, we selected only two fluvial risk areas to be considered under policy five (selected areas highlighted in bold).

- 170m new defence on the Nant Fawr upstream of Lisvane Road would cost approximately £255,000.
- 400m new defence on the Nant Fawr downstream of the reservoirs in the location of Rhyd-y-Penua Road would cost approximately £600,000.
- **550m of new defences along the Llanishen Brook in the areas of Crystal Glen and Duffryn Close would cost approximately £825,000.**
- 150m of new defence on the Nant Fawr within the vicinity of Roath Park Wild Gardens, would cost approximately £225,000.
- **300m of new defences along the Nant Glandulas around Pentwyn Road would cost approximately £450,000**

To increase further the tidal standard of protection into the future, we would need to significantly increase the height of approximately 1km of defences along the right bank of the River Rhymney adjacent to the Senlan Industrial Estate. We have estimated that this would cost in excess of £1.5m.

Therefore, the total indicative cost under policy five would be in excess of £7.0m.

Conclusion: We recognise that into the future we must be aware of the potential consequences from both fluvial and tidal flood events. By increasing the height of existing and building new defences we are taking more action to manage flood risks into the future. This could be suitable in the following areas, which will be taken forward in our consideration of policy five in the policy appraisal forms:

- New defences along the Llanishen Brook at a cost of approximately £825,000 would reduce economic damages by up to £650,000 and protect approximately 30 properties and 70 people. We suggest that the current and future risk in this area is high and the benefits that would be gained from building defences may warrant new investment and should be explored further.
- Along the Nant Glandulas we could provide protection to approximately 30 properties and over 70 people, reducing economic damages by up to £750,000. We suggest that the current and future risk in this area is high and the benefits that would be gained from building defences at an approximate cost of £450,000 would warrant new investment and should be explored further, and will therefore be taken forward as a P5 into the policy appraisal forms.

However, we recognise that reducing flood risk in the following areas would not be economically feasible as the benefits would not offset the level of investment:

- Building defences along Lisvane Road at a cost of approximately £255,000 would only provide protection to approximately 12 properties and reduce economic damages by up to £175,000.
- Approximately 17 properties and 40 people would be protected by building defences downstream of the reservoirs and would reduce economic damages by up to £380,000. With an approximate cost of £600,000, we do not think the benefits offered in this location warrant new investment.
- Within the vicinity of Roath Park Wild Gardens, approximately 10 properties and a £240,000 reduction in economic damages would be gained by building new defences at a cost of approximately £225,000.

Under policy five, we will assess the potential of establishing new flood warning areas in several communities, along the Roath Brook and the Nant Glandulas.

Policy unit 1: Cardiff

Generic response: Policy 6 – Attenuation

Environment Agency Wales

Description: The creation of flow attenuation areas in the Cardiff policy unit is not feasible. Given that Cardiff is the main urban area within the Eastern Valleys CFMP area, responses that deliberately promote large scale flooding are not considered as sustainable methods for reducing risk. Setting back defences within Cardiff is not an option, as much of the floodplain has been developed. In addition to this, the agricultural land upstream of Cardiff is already being extensively used as floodplains for naturally storing floodwater, and there is no further scope to increase this. There is no scope for broad scale modelling under policy 6 for the Cardiff policy unit, so no further action has been undertaken.			
Base case conditions (1% AEP fluvial flood event)			
People at risk: Fluvial - 225	Economic risk: Fluvial – £1.6m	Properties at risk: Fluvial – 86	Environmental sites at risk: Fluvial – N/A Tidal – N/A
Results of the broad scale modelling (1% AEP fluvial flood event)			
People at risk: N/A	Economic risk: N/A	Properties at risk: N/A	Environmental sites at risk: Fluvial – N/A Tidal – N/A
Conclusions			
Cost: N/A			
Conclusion: Taking action to increase the frequency of flooding is not feasible in the Cardiff policy unit, as such, there is not scope for carrying out policy six in this policy unit. Increased frequency of flooding to make space for water would result in a very high number of people at risk and very high economic damages. Deliberately promoting flooding through schemes, which make space for water, would cause large scale community disruption.			

The following table summarises the findings of the generic response modelling for policy unit one (Cardiff). The responses or combination of responses chosen for each policy will be taken forward and compared against the objectives and indicators in table 12.6.

Policy	Generic response
1	Withdraw / retreat defences and stop maintenance
2	Reduced maintenance
3	Risk cannot be managed at the same level of risk by any combination of softer options, such as reducing maintenance and balancing with local flood storage schemes.
4	We have demonstrated that local flood storage schemes and increased maintenance have very little effect for reducing risk in to the future in Cardiff. Using these schemes in combination would not be cost effective given that the costs are not proportional to the benefits they bring. Therefore a response of defences alone has been chosen.
5	A combination of defences and alternative flood risk management options would not be suitable. Therefore a defences alone option has been chosen, although measures such as flood warning and evacuation procedures will be considered as well.
6	Not technically feasible in this policy unit.

Form 12.6: Screening of policy options against appraisal objectives

Policy unit name/number:		Policy unit 1: Cardiff								
N o.	Specific (appraisal) objectives	Indicators	Current baseline	Future baseline	Policy Options					
					P1 No active intervention	P2 Reduce existing actions	P3 Continue with existing actions to maintain current risk	P4 Take further action to sustain current risk	P5 Take further action to reduce current risk	P6 Take further action to increase frequency of flooding
Generic Response					Decreased conveyance Monitoring, advise & survey	Decreased conveyance Influencing and Informing Monitoring, advise & survey Studies	Increased or decreased conveyance Attenuation/retention Influencing and Informing Monitoring, advise & survey Studies	Increased or decreased conveyance Attenuation/retention Influencing and Informing Monitoring, advise & survey Studies	Increased or decreased conveyance Attenuation/retention Influencing and Informing Monitoring, advise & survey Studies	Increased or decreased conveyance Attenuation/retention Influencing and Informing Monitoring, advise & survey Studies
PEOPLE										
1.	Reduce the risk of harm to life in Cardiff	The number of people within the 1% AEP fluvial and 0.5% AEP tidal flood extents where depths of water exceed 0.5m	There are 12 people at risk where depths exceed 0.5m during a 1% AEP fluvial flood event There are 159 people at risk where depths exceed 0.5m during a 0.5% AEP tidal flood event	There will be 1574 people at risk where depths exceed 0.5m during a 1% AEP fluvial flood event There will be 1525 people at risk where depths exceed 0.5m during a 0.5% AEP tidal flood event	There would be 2129 people at risk where depths exceed 0.5m during a 1% AEP fluvial flood event There would be 1898 people at risk where depths exceed 0.5m during a 0.5% AEP tidal flood event	There would be 1878 people at risk where depths exceed 0.5m during a 1% AEP fluvial flood event Tidal flood risk not considered for this policy	There would be 1574 people at risk where depths exceed 0.5m during a 1% AEP fluvial flood event There would be 1525 people at risk where depths exceed 0.5m during a 0.5% AEP tidal flood event	There would be 7 people at risk where depths exceed 0.5m during a 1% AEP fluvial flood event There would be 159 people at risk where depths exceed 0.5m during a 0.5% AEP tidal flood event	There would be 2 people at risk where depths exceed 0.5m during a 1% AEP fluvial flood event There would be 75 people at risk where depths exceed 0.5m during a 0.5% AEP tidal flood event	There is no scope for carrying out policy six in this policy unit. Increased frequency of flooding to make space for water could result in a significant increase in harm to life. Deliberately flooding specific areas to make space for water

Policy unit name/number:		Policy unit 1: Cardiff								
N o.	Specific (appraisal) objectives	Indicators	Current baseline	Future baseline	Policy Options					
					P1 No active intervention	P2 Reduce existing actions	P3 Continue with existing actions to maintain current risk	P4 Take further action to sustain current risk	P5 Take further action to reduce current risk	P6 Take further action to increase frequency of flooding
		The number of properties that are at risk during the 1% AEP fluvial and 0.5% tidal flood events but not within an existing flood warning area	86 properties that are at flood risk during a 1% AEP fluvial flood event are not within an existing flood warning area 83 properties that are at flood risk during a 0.5% AEP tidal flood event are not within an existing flood warning area	1007 properties that will be at flood risk during a 1% AEP fluvial flood event would not be within an existing flood warning area 1355 properties that will be at flood risk during a 0.5% AEP tidal flood event would not be within an existing flood warning area	Flood warning areas would be removed under this policy and therefore all properties would not be within a flood warning area. 1517 properties that would be at flood risk during a 1% AEP fluvial flood event would not be within an existing flood warning area 1619 properties that would be at flood risk during a 0.5% AEP tidal flood event would not be within an existing flood warning area	Flood warning areas would be removed under this policy and therefore all properties would not be within a flood warning area. 1302 properties that would be at flood risk during a 1% AEP fluvial flood event would not be within an existing flood warning area Tidal flood risk not considered for this policy	1007 properties that would be at flood risk during a 1% AEP fluvial flood event would not be within an existing flood warning area 1355 properties that would be at flood risk during a 0.5% AEP tidal flood event would not be within an existing flood warning area	108 properties that would be at flood risk during a 1% AEP fluvial flood event would not be within an existing flood warning area 83 properties that would be at flood risk during a 0.5% AEP tidal flood event would not be within an existing flood warning area	47 properties that would be at flood risk during a 1% AEP fluvial flood event would not be within an existing flood warning area 15 properties that would be at flood risk during a 0.5% AEP tidal flood event would not be within an existing flood warning area	would cause large-scale community disruption in those areas. We have not identified any areas in the policy unit where we could do this without increasing harm to life.

Policy unit name/number:		Policy unit 1: Cardiff								
N o.	Specific (appraisal) objectives	Indicators	Current baseline	Future baseline	Policy Options					
					P1 No active intervention	P2 Reduce existing actions	P3 Continue with existing actions to maintain current risk	P4 Take further action to sustain current risk	P5 Take further action to reduce current risk	P6 Take further action to increase frequency of flooding
2.	Reduce community disruption caused by flooding in Cardiff. This includes reducing flood risk to community assets, such as hospitals and schools and managing risk to flooding of local transport routes.	The number of community assets at risk during the 1% AEP fluvial and 0.5% tidal flood events	<p>There is 1 retail building at flood risk during the 1% AEP fluvial flood event</p> <p>There is 1 school (Llanrumney) and 3 retail buildings at flood risk during the 0.5% AEP tidal flood event</p>	<p>There will be 1 health service (Roath), 2 schools (Llanrumney, Pen Y Lan), 2 community centres (Roath) and 30 retail buildings at flood risk during the 1% AEP fluvial flood event</p> <p>There will be 1 health service (Roath), 2 schools (Llanrumney, Pen Y Lan), 2 community centres (Roath) and 9 retail buildings at flood risk during the 0.5% AEP tidal flood event</p>	<p>There would be 2 health services (Roath), 5 schools (Pen Y Lan, Roath, Llanrumney), 7 community centres (Roath), 50 retail buildings and 1 recreation area at flood risk during the 1% AEP fluvial flood event</p> <p>There would be 1 health service (Roath), 2 schools (Pen Y Lan, Llanrumney), 1 community centre (Roath) and 19 retail buildings at flood risk during the 0.5% AEP tidal flood event</p>	<p>There would be 1 health service (Roath), 2 schools (Llanrumney, Pen Y Lan), 2 community centres (Roath) and 33 retail buildings at flood risk during the 1% AEP fluvial flood event</p> <p>Tidal flood risk not considered for this policy</p>	<p>There would be 1 health service (Roath), 2 schools (Llanrumney, Pen Y Lan), 2 community centres (Roath) and 30 retail buildings at flood risk during the 1% AEP fluvial flood event</p> <p>There would be 1 health service (Roath), 2 schools (Llanrumney, Pen Y Lan), 2 community centres (Roath) and 9 retail buildings at flood risk during the 0.5% AEP tidal flood event.</p>	<p>There would be 4 retail buildings at flood risk during the 1% AEP fluvial flood event</p> <p>There would be 1 school (Llanrumney) and 3 retail buildings at flood risk during the 0.5% AEP tidal flood event</p>	<p>There would be no community assets at risk during the 1% AEP fluvial flood event</p> <p>There would be no community assets at risk during the 0.5% AEP tidal flood event</p>	<p>There is no scope for carrying out policy six in this policy unit. Increased frequency of flooding to make space for water could result in a significant increase in community disruption. Deliberately flooding specific areas to make space for water would cause large-scale community disruption in those areas. We have not identified any areas in the policy unit where we could do this</p>

Policy unit name/number:		Policy unit 1: Cardiff								
N o.	Specific (appraisal) objectives	Indicators	Current baseline	Future baseline	Policy Options					
					P1 No active intervention	P2 Reduce existing actions	P3 Continue with existing actions to maintain current risk	P4 Take further action to sustain current risk	P5 Take further action to reduce current risk	P6 Take further action to increase frequency of flooding
		<p>The number of residential properties at flood risk during the 1% AEP fluvial and 0.5% tidal flood events</p>	<p>There are 84 residential properties at flood risk during the 1% AEP fluvial flood event</p> <p>There are 154 residential properties at flood risk during the 0.5% AEP tidal flood event</p>	<p>There will be 1,010 residential properties at flood risk during the 1% AEP fluvial flood event</p> <p>There will be 1,366 residential properties at flood risk during the 0.5% AEP tidal flood event</p>	<p>There would be 1,358 residential properties at flood risk during the 1% AEP fluvial flood event</p> <p>There would be 1,406 residential properties at flood risk during the 0.5% AEP tidal flood event</p>	<p>There would be 1,193 residential properties at flood risk during the 1% AEP fluvial flood event</p> <p>Tidal flood risk not considered for this policy</p>	<p>There will be 1,010 residential properties at flood risk during the 1% AEP fluvial flood event</p> <p>There will be 1,366 residential properties at flood risk during the 0.5% AEP tidal flood event</p>	<p>There will be 103 residential properties at flood risk during the 1% AEP fluvial flood event</p> <p>There will be 154 residential properties at flood risk during the 0.5% AEP tidal flood event</p>	<p>There will be 46 residential properties at flood risk during the 1% AEP fluvial flood event</p> <p>There will be 41 residential properties at flood risk during the 0.5% AEP tidal flood event</p>	<p>without increasing community disruption.</p>
		<p>The duration of flooding (<1 day, 1 day to 5 days, > 5 days)</p>	<p>The duration of flooding is between one to five days for both the 1% AEP fluvial and 0.5% AEP tidal flood events</p>	<p>The duration of flooding will be greater than five days for both the 1% AEP fluvial and 0.5% AEP tidal flood events</p>	<p>The duration of flooding would be greater than five days for both the 1% AEP fluvial and 0.5% AEP tidal flood events</p>	<p>The duration of flooding would be greater than five days for the 1% AEP fluvial flood event</p> <p>Tidal flood risk not considered for this policy</p>	<p>The duration of flooding would be greater than five days for both the 1% AEP fluvial and 0.5% AEP tidal flood events</p>	<p>The duration of flooding would be between one to five days for both the 1% AEP fluvial and 0.5% AEP tidal flood events</p>	<p>The duration of flooding would be between one to five days for both the 1% AEP fluvial and 0.5% AEP tidal flood events</p>	

Policy unit name/number:		Policy unit 1: Cardiff								
N o.	Specific (appraisal) objectives	Indicators	Current baseline	Future baseline	Policy Options					
					P1 No active intervention	P2 Reduce existing actions	P3 Continue with existing actions to maintain current risk	P4 Take further action to sustain current risk	P5 Take further action to reduce current risk	P6 Take further action to increase frequency of flooding
		The area of flooding during the 1% AEP fluvial and 0.5% tidal flood events where depth of flooding exceeds 0.5 metres.	The flooded area where depths exceed 0.5 metres is 0.8km ² (Llanrumney but no properties affected) during a 1% AEP fluvial flood event The flooded area where depths exceed 0.5 metres is 0.7km ² (Llanrumney) during a 0.5% AEP tidal flood event	The flooded area where depths exceed 0.5 metres will be 2.0km ² (Llanrumney and Roath) during a 1% AEP fluvial flood event The flooded area where depths exceed 0.5 metres will be 1.6km ² (Llanrumney and Roath) during a 0.5% AEP tidal flood event	The flooded area where depths exceed 0.5 metres would be 2.8km ² (Llanrumney and Roath) during a 1% AEP fluvial flood event The flooded area where depths exceed 0.5 metres would be 1.8km ² (Llanrumney and Roath) during a 0.5% AEP tidal flood event	The flooded area where depths exceed 0.5 metres would be 2.4km ² (Llanrumney and Roath) during a 1% AEP fluvial flood event Tidal flood risk not considered for this policy	The flooded area where depths exceed 0.5 metres would be 2.0km ² (Llanrumney and Roath) during a 1% AEP fluvial flood event The flooded area where depths exceed 0.5 metres would be 1.6km ² (Llanrumney and Roath) during a 0.5% AEP tidal flood event	The flooded area where depths exceed 0.5 metres would be 1.0km ² (Llanrumney but no properties affected) during a 1% AEP fluvial flood event The flooded area where depths exceed 0.5 metres would be 0.7km ² (Llanrumney and Roath) during a 0.5% AEP tidal flood event	The flooded area where depths exceed 0.5 metres would be 1.0km ² (Llanrumney but no properties affected) during a 1% AEP fluvial flood event The flooded area where depths exceed 0.5 metres would be 0.3km ² (Llanrumney and Roath) during a 0.5% AEP tidal flood event	
ECONOMICS										
3.	Reduce flood risk to critical infrastructure in Cardiff. This includes reducing flood risk to police stations and critical transport routes such as the railway through Cardiff and the A4161 through Cardiff.	The number, length and type of critical asset (police, ambulance, fire station), infrastructure (STW, WTW, gas, electricity, rail or major roads) at risk during the 1% AEP fluvial and 0.5% tidal flood events	There are no critical infrastructure buildings or transport routes at flood risk during the 1% AEP fluvial flood event. There is 1 police station (Pen Y Lan), 1 fire station (Pen Y Lan), 4 electricity stations (Roath) and 0.9km of the A4161 at flood risk during the	There will be 1 police station (Pen Y Lan), 1 fire station (Pen Y Lan) and 6 electricity stations (Roath), 0.5km of the railway, 1.5km of the A4161 and 0.5km of the A469 at flood risk during the 1% AEP fluvial flood event. There will be 1 police station (Pen Y Lan), 1 fire	There would be 1 police station (Pen Y Lan), 1 fire station (Pen Y Lan), 8 electricity stations (Roath), 0.8km of the railway, 1.7km of the A4161 and 0.7km of the A469 at flood risk during the 1% AEP fluvial flood event. There would be 1 police station (Pen Y Lan), 1 fire	There would be 1 police station (Pen Y Lan), 1 fire station (Pen Y Lan), 7 electricity stations (Roath), 0.7km of the railway, 1.5km of the A4161 and 0.7km of the A469 at flood risk during the 1% AEP fluvial flood event. Tidal flood risk not considered for this policy	There would be 1 police station (Pen Y Lan), 1 fire station (Pen Y Lan) and 6 electricity stations (Roath), 0.5km of the railway, 1.5km of the A4161 and 0.5km of the A469 at flood risk during the 1% AEP fluvial flood event. There would be 1 police station (Pen Y Lan), 1 fire	There would be 0.6km of the railway at flood risk during the 1% AEP fluvial flood event. There would be 1 police station (Pen Y Lan), 1 fire station (Pen Y Lan), 4 electricity stations (Roath) and 0.9km of the A4161 at flood risk during the 0.5% AEP tidal flood event	There would be no critical infrastructure buildings or transport routes at flood risk during the 1% AEP fluvial flood event. There would be no critical infrastructure buildings or transport routes at flood risk during the 0.5%	There is no scope for carrying out policy six in this policy unit. Increased frequency of flooding to make space for water could result in a significant increase in risk to critical assets and critical transport routes. Deliberately flooding specific areas to make space for water

Policy unit name/number:		Policy unit 1: Cardiff								
N o.	Specific (appraisal) objectives	Indicators	Current baseline	Future baseline	Policy Options					
					P1 No active intervention	P2 Reduce existing actions	P3 Continue with existing actions to maintain current risk	P4 Take further action to sustain current risk	P5 Take further action to reduce current risk	P6 Take further action to increase frequency of flooding
			0.5% AEP tidal flood event	station (Pen Y Lan), 9 electricity stations (Roath) and 1.7km of the A4161 at flood risk during the 0.5% AEP tidal flood event	station (Pen Y Lan), 10 electricity stations (Roath) and 1.9km of the A4161 at flood risk during the 0.5% AEP tidal flood event		station (Pen Y Lan), 9 electricity stations (Roath) and 1.7km of the A4161 at flood risk during the 0.5% AEP tidal flood event		AEP fluvial flood event	would cause large-scale community disruption in those areas. We have not identified any areas in the policy unit where we could do this without increasing risk to critical assets and critical transport routes
4.	Reduce economic damages caused by flooding in Cardiff	The total cost of property economic damages during the 1% AEP fluvial and 0.5% tidal flood events	The 1% AEP fluvial flood economic property damages are £1.6m The 0.5% AEP tidal economic property damages are £21.8m	The 1% AEP fluvial flood economic property damages will be £59.0m The 0.5% AEP tidal economic property damages will be £100.9m	The 1% AEP fluvial flood economic property damages would be £100.7m The 0.5% AEP tidal economic property damages would be £114.7m	The 1% AEP fluvial flood economic property damages would be £78.4m Tidal flood risk not considered for this policy	The 1% AEP fluvial flood economic property damages would be £59.0m The 0.5% AEP tidal economic property damages would be £100.9m	The 1% AEP fluvial flood economic property damages would be £2.2m The 0.5% AEP tidal economic property damages would be £21.8m	The 1% AEP fluvial flood economic property damages would be £820,000 The 0.5% AEP tidal economic property damages would be £982,000	There is no scope for carrying out policy six in this policy unit. Increased frequency of flooding to make space for water could result in a significant increase in risk to critical assets and critical

Policy unit name/number:		Policy unit 1: Cardiff								
N o.	Specific (appraisal) objectives	Indicators	Current baseline	Future baseline	Policy Options					
					P1 No active intervention	P2 Reduce existing actions	P3 Continue with existing actions to maintain current risk	P4 Take further action to sustain current risk	P5 Take further action to reduce current risk	P6 Take further action to increase frequency of flooding
		The total cost of agricultural damages during the 1% AEP fluvial flood extent and/or the 0.5% AEP tidal flood extent	The 1% AEP fluvial flood agricultural damages are £162,993 The 0.5% AEP tidal flood agricultural damages are £138,159	The 1% AEP fluvial flood agricultural damages will be £355,591 The 0.5% AEP tidal flood agricultural damages will be £238,109	The 1% AEP fluvial flood agricultural damages would be £426,876 The 0.5% AEP tidal flood agricultural damages would be £244,901	The 1% AEP fluvial flood agricultural damages would be £411,783 Tidal flood risk not considered for this policy	The 1% AEP fluvial flood agricultural damages would be £355,591 The 0.5% AEP tidal flood agricultural damages would be £238,109	The 1% AEP fluvial flood agricultural damages would be £182,892 The 0.5% AEP tidal flood agricultural damages would be £138,159	The 1% AEP fluvial flood agricultural damages would be £177,145 The 0.5% AEP tidal flood agricultural damages would be £49,470	transport routes. Deliberately flooding specific areas to make space for water would cause large-scale community disruption in those areas. We have not identified any areas in the policy unit where we could do this without increasing risk to critical assets and critical transport routes
5.	Optimise the level of Flood Risk Management expenditure. Ensure investment is proportional to the risks	The indicative costs of our flood risk management actions	We currently spend approximately £20,000 per year on maintenance and operations	We will spend more than we currently spend on maintenance and operations as risk is going to increase in the future in the Eastern Valleys, placing more demand on our resources and expenditure.	No construction or maintenance costs associated with undertaking this policy but it would be necessary to devise a strategy, and withdraw over a number of years, monitoring the situation once this had been done.	We would expect costs to reduce by half to £10,000 per year. However, the risks would significantly increase	We would continue to spend £20,000 per year on maintenance and operations. However, the risks would significantly increase	Indicative costs to improve and build new defences would cost approximately £4.0 million. Tidal flood risk would remain high. Maintenance costs will increase as a result.	Indicative costs to improve and build new defences would cost approximately £7.0 million. Both fluvial and tidal flood risk would be significantly reduced. Maintenance costs will increase as a result.	There is no scope for carrying out policy six in this policy unit. Constructing formal flood storage areas would cost many millions of pounds. Deliberately promoting flooding through schemes that make space for water would cause large scale community disruption to Cardiff and the Eastern Valleys as a whole
ENVIRONMENT										
6.	Ensure no	The	There are no	There will be no	There would be no	There would be no	There would be no	There would be no	There would be	There is no scope

Policy unit name/number:		Policy unit 1: Cardiff								
N o.	Specific (appraisal) objectives	Indicators	Current baseline	Future baseline	Policy Options					
					P1 No active intervention	P2 Reduce existing actions	P3 Continue with existing actions to maintain current risk	P4 Take further action to sustain current risk	P5 Take further action to reduce current risk	P6 Take further action to increase frequency of flooding
	deterioration of designated international and national nature conservation sites	percentage area of each SSSI affected during the 1% AEP fluvial and 0.5% AEP tidal flood events	SSSIs at risk during the 1% AEP fluvial flood event. There are no SSSIs at risk during the 0.5% AEP tidal flood event.	SSSIs at risk during the 1% AEP fluvial flood event. There will be no SSSIs at risk during the 0.5% AEP tidal flood event.	SSSIs at risk during the 1% AEP fluvial flood event. There would be no SSSIs at risk during the 0.5% AEP tidal flood event.	SSSIs at risk during the 1% AEP fluvial flood event. There would be no SSSIs at risk during the 0.5% AEP tidal flood event.	SSSIs at risk during the 1% AEP fluvial flood event. There would be no SSSIs at risk during the 0.5% AEP tidal flood event.	SSSIs at risk during the 1% AEP fluvial flood event. There would be no SSSIs at risk during the 0.5% AEP tidal flood event.	no SSSIs at risk during the 1% AEP fluvial flood event. There would be no SSSIs at risk during the 0.5% AEP tidal flood event.	for carrying out policy six in this policy unit. Increased frequency of flooding to make space for water would result in a higher percentage area of risk to designated sites. Deliberately promoting flooding through schemes that make space for water would cause large scale community disruption to Cardiff and the Eastern Valleys as a whole
7.	Protect and improve habitats and species diversity, particularly BAP habitats and those relying on freshwater.	BAP habitats and species at risk during the 1% AEP fluvial and 0.5% AEP tidal flood events.	The following BAP habitats are likely to experience more frequent and longer duration of flooding in the future: <ul style="list-style-type: none"> lakes and reservoirs mudflats ponds rivers, streams and floodplains wet woodland The following BAP species are likely to experience more	The following BAP habitats are likely to experience more frequent and longer duration flooding as a result of Policy 1: <ul style="list-style-type: none"> lakes and reservoirs mudflats ponds rivers, streams and floodplains wet woodland The following BAP species are likely to experience more	The following BAP habitats are likely to experience more frequent and longer duration flooding as a result of Policy 2: <ul style="list-style-type: none"> lakes and reservoirs mudflats ponds rivers, streams and floodplains wet woodland The following BAP species are likely to experience more	The following BAP habitats are likely to experience more frequent and longer duration flooding as a result of Policy 3: <ul style="list-style-type: none"> lakes and reservoirs mudflats ponds rivers, streams and floodplains wet woodland The following BAP species are likely to experience more	The following BAP habitats are likely to be at risk to the same extent as under current baseline conditions, as a result of Policy 4: <ul style="list-style-type: none"> lakes and reservoirs mudflats ponds rivers, streams and floodplains wet woodland The following BAP	The following BAP habitats are likely to experience less frequent and shorter duration flooding as a result of Policy 5: <ul style="list-style-type: none"> lakes and reservoirs mudflats ponds rivers, streams and floodplains wet woodland The following BAP species are likely to	The following BAP habitats are likely to experience more frequent and longer duration of flooding in the future: <ul style="list-style-type: none"> lakes and reservoirs mudflats ponds rivers, streams and floodplains wet woodland Increased frequency of flooding to make space for water would result in an increased number of BAP species being at risk from flooding. Deliberately promoting flooding through schemes that make space for water would cause large scale community disruption to Cardiff	

Policy unit name/number:		Policy unit 1: Cardiff								
N o.	Specific (appraisal) objectives	Indicators	Current baseline	Future baseline	Policy Options					
					P1 No active intervention	P2 Reduce existing actions	P3 Continue with existing actions to maintain current risk	P4 Take further action to sustain current risk	P5 Take further action to reduce current risk	P6 Take further action to increase frequency of flooding
			frequent and longer duration of flooding in the future: <ul style="list-style-type: none"> • Brown Trout • Great Crested Newt • Lapwing • Otter • Pipistrelle Bat • Reed Bunting • Water Vole. 	frequent and longer duration flooding as a result of Policy 1: <ul style="list-style-type: none"> • Brown Trout • Great Crested Newt • Lapwing • Otter • Pipistrelle Bat • Reed Bunting • Water Vole. 	frequent and longer duration flooding as a result of Policy 2: <ul style="list-style-type: none"> • Brown Trout • Great Crested Newt • Lapwing • Otter • Pipistrelle Bat • Reed Bunting • Water Vole. 	frequent and longer duration flooding as a result of Policy 3: <ul style="list-style-type: none"> • Brown Trout • Great Crested Newt • Lapwing • Otter • Pipistrelle Bat • Reed Bunting • Water Vole. 	species are likely to be at risk to the same extent as under current baseline conditions, as a result of Policy 4: <ul style="list-style-type: none"> • Brown Trout • Great Crested Newt • Lapwing • Otter • Pipistrelle Bat • Reed Bunting • Water Vole. 	experience less frequent and shorter duration flooding as a result of Policy 5: <ul style="list-style-type: none"> • Brown Trout • Great Crested Newt • Lapwing • Otter • Pipistrelle Bat • Reed Bunting • Water Vole. 	The following BAP species are likely to experience more frequent and longer duration of flooding in the future: <ul style="list-style-type: none"> • Brown Trout • Great Crested Newt • Lapwing • Otter • Pipistrelle Bat • Reed Bunting • Water Vole. 	and the Eastern Valleys as a whole
8.	Manage flood risk to Listed Buildings in Cardiff and ensure sites which are currently 'safe' do not become at risk of flooding.	The number of Listed Buildings within the 1% AEP fluvial and 0.5% AEP tidal flood extents	There are 7 Listed Buildings at risk during the 1% AEP fluvial flood event There is 1 Listed Building at risk during the 0.5% AEP tidal flood event	There will be 9 Listed Buildings at risk during the 1% AEP fluvial flood event There will be 3 Listed Buildings at risk during the 0.5% AEP tidal flood event	There would be 11 Listed Buildings at risk during the 1% AEP fluvial flood event There would be 4 Listed Buildings at risk during the 0.5% AEP tidal flood event	There would be 9 Listed Buildings at risk during the 1% AEP fluvial flood event Tidal flood risk not considered for this policy	There would be 9 Listed Buildings at risk during the 1% AEP fluvial flood event There would be 3 Listed Buildings at risk during the 0.5% AEP tidal flood event	There would be 7 Listed Buildings at risk during the 1% AEP fluvial flood event There would be 1 Listed Building at risk during the 0.5% AEP tidal flood event	There would be 7 Listed Buildings at risk during the 1% AEP fluvial flood event There would be 1 Listed Building at risk during the 0.5% AEP tidal flood event	There is no scope for carrying out policy six in this policy unit. Deliberately promoting flooding through schemes that make space for water would cause large scale community disruption to Cardiff and the Eastern Valleys as a whole.

Form 12.7: Summary of the relative overall losses (including flood risk management costs) and gains (including flood alleviation benefits), thus demonstrating the rationale behind selecting the preferred option

Policy unit name/number:	Policy unit 1: Cardiff		
Policy options	Losses	Gains	Preferred policy option
Policy option P1			
Environmental	<p>MEDIUM - Four additional listed buildings are at risk from a 1% AEP fluvial flood event. Three additional listed buildings are also at risk from a 0.5% AEP tidal flood event.</p> <p>LOW- More frequent and longer duration flooding may adversely affect habitats intolerant of waterlogging. Impacts will be particularly severe if inundation is from low quality water or if freshwater habitats are flooded by salt water.</p> <p>LOW- Increase in BAP species at risk of flooding from a 1% AEP fluvial flood event or a 0.5% AEP tidal flood event.</p>	<p>LOW+ More frequent and longer duration flooding may enhance water-dependent habitats.</p> <p>LOW+ Stopping river maintenance and not maintaining defences may benefit BAP species through reduced disturbance. In particular, Otter, Reed Bunting and Water Vole are likely to benefit.</p>	Not preferred option – risk to people, property and the economy would remain very high and there would be very significant and high increases in risks in the future
Social	<p>HIGH- Significant increase in risk to people. The number of people at flood risk increases by over 2800 and 2100 for the 1% AEP fluvial and 0.5% AEP tidal flood events, respectively. Over 2100 (fluvial) and 1700 (tidal) of which are located within flood risk areas where flood depths exceed 0.5 metres.</p> <p>HIGH- Significant increase in numbers of residential properties at flood risk. The number of residential properties at flood risk increases by over 1200 for the 1% AEP fluvial and 0.5% AEP tidal flood events.</p> <p>HIGH- Significant increase in numbers of properties not within flood warning areas as under this policy all flood warning services would be withdrawn. Over 1500 and 1600 properties for the 1% AEP fluvial and 0.5% AEP tidal flood events, respectively, would not receive flood warnings.</p> <p>HIGH- Significant community disruption. The following additional community assets would be at risk during the 1% AEP fluvial flood event: two health services, five schools, seven community centres, 49 retail buildings and one recreation area. The flooded area where depths exceed 0.5 metres would also increase by 2.0km². For the 0.5% AEP tidal flood event the following additional community assets would be at risk: one health service, one school, one community centre and 16 retail buildings. The flooded area where depths exceed 0.5 metres would also increase by 1.1km².</p> <p>HIGH- More frequent flooding, to greater depths and longer durations.</p>		

Policy unit name/number:	Policy unit 1: Cardiff		
Policy options	Losses	Gains	Preferred policy option
Economic	<p>HIGH- Significant risk to critical assets and critical infrastructure. For the 1% AEP fluvial flood event the following additional critical assets would be at risk: one police station, one fire station and eight electricity stations. Critical transport routes at risk are the Cardiff main railway line (0.8km), A4161 (1.7km), A469 (0.7km). For the 0.5% AEP tidal flood event the following additional critical assets would be at risk: six electricity stations. The following additional critical transport routes would also be at risk: 1.0km of the A4161.</p> <p>HIGH- Significant increase in direct economic property damages as a result of flooding. Increases by £99.1 million and £92.9 million for the 1% AEP fluvial and 0.5% AEP tidal flood events, respectively.</p> <p>LOW- Small increase in direct economic agricultural damages as a result of flooding. Total agricultural damages remain low but increase by £260,000 and £100,000 for the 1% AEP fluvial and 0.5% AEP tidal flood events, respectively.</p>		
Policy option P2			
Environmental	<p>LOW - Two additional listed buildings are at risk from a 1% AEP fluvial flood event.</p> <p>LOW- More frequent and longer duration flooding may adversely affect habitats intolerant of waterlogging. Impacts will be particularly severe if inundation is from low quality water or if freshwater habitats are flooded by salt water.</p> <p>LOW- Increase in BAP species at risk of flooding from a 1% AEP fluvial flood event or a 0.5% AEP tidal flood event.</p>	<p>LOW+ More frequent and longer duration flooding may enhance water-dependent habitats.</p> <p>LOW+ Reduced maintenance may benefit BAP species through reduced disturbance. In particular, Otter, Reed Bunting and Water Vole are likely to benefit.</p>	Not preferred option – reducing flood risk management in any areas of the Cardiff policy unit would result high increases in risk to people, property and the economy.
Social	<p>HIGH- Significant increase in risk to people. The number of people at flood risk increases by over 2400 for the 1% AEP fluvial flood event. Over 1800 of which are located within flood risk areas where flood depths exceed 0.5 metres.</p> <p>HIGH- Significant increase in numbers of residential properties at flood risk. The number of residential properties at flood risk increases by over 1100 for the 1% AEP fluvial flood event.</p> <p>HIGH- Significant increase in numbers of properties not within flood warning areas. Over 1300 properties for the 1% AEP fluvial flood event, would not be within an existing flood warning area.</p> <p>MEDIUM - Medium community disruption. The following additional community assets would be at risk during the 1% AEP fluvial flood event: one health service, two schools, two community centres, 32 retail buildings and one recreation area. The flooded area where depths exceed 0.5 metres would also increase by 1.6km².</p> <p>HIGH- More frequent flooding, to greater depths and longer</p>		

Policy unit name/number:	Policy unit 1: Cardiff		
Policy options	Losses	Gains	Preferred policy option
Economic	<p>durations.</p> <p>HIGH- Significant risk to critical assets and critical infrastructure. For the 1% AEP fluvial flood event the following additional critical assets would be at risk: one police station, one fire station and seven electricity stations. Critical transport routes at risk are the Cardiff main railway line (0.7km), A4161 (1.5km), A469 (0.7km).</p> <p>HIGH- Significant increase in direct economic property damages as a result of flooding. Increases by £76.8 million for the 1% AEP fluvial flood event.</p> <p>LOW- Small increase in direct economic agricultural damages as a result of flooding. Total agricultural damages remain low but increase by £248,000 for the 1% AEP fluvial flood event.</p>		
	Policy option P3		
Environmental	<p>LOW - Two additional listed buildings are at risk from a 1% AEP fluvial flood event. Two additional listed buildings are also at risk from a 0.5% AEP tidal flood event.</p> <p>LOW- More frequent and longer duration flooding may adversely affect habitats intolerant of waterlogging. Impacts will be particularly severe if inundation is from low quality water or if freshwater habitats are flooded by salt water.</p> <p>LOW- Increase in BAP species at risk of flooding from a 1% AEP fluvial flood event or a 0.5% AEP tidal flood event.</p>	<p>LOW+ More frequent and longer duration flooding may enhance water-dependent habitats.</p>	<p>Not preferred option – maintaining our current level of management is not a sustainable option in this policy unit. Risk to people, property and the economy would significantly increase in the future under this option.</p>
	Social	<p>HIGH- Significant increase in risk to people. The number of people at flood risk increases by over 2000 and 1900 for the 1% AEP fluvial and 0.5% AEP tidal flood events, respectively. Over 1500 (fluvial) and 1300 (tidal) of which are located within flood risk areas where flood depths exceed 0.5 metres.</p>	

Policy unit name/number:	Policy unit 1: Cardiff		
Policy options	Losses	Gains	Preferred policy option
	<p>HIGH- Significant increase in numbers of residential properties at flood risk. The number of residential properties at flood risk increases by over 900 and 1200 for the 1% AEP fluvial and 0.5% AEP tidal flood events, respectively.</p> <p>HIGH- Significant increase in numbers of properties not within flood warning areas. Over 1000 and 1300 properties for the 1% AEP fluvial and 0.5% AEP tidal flood events, respectively, would not be within an existing flood warning area.</p> <p>MEDIUM - Medium community disruption. The following additional community assets would be at risk during the 1% AEP fluvial flood event: one health service, two schools, two community centres and 29 retail buildings. The flooded area where depths exceed 0.5 metres would also increase by 0.8km². For the 0.5% AEP tidal flood event the following additional community assets would be at risk: one health service, one school, two community centres and six retail buildings. The flooded area where depths exceed 0.5 metres would also increase by 0.9km².</p> <p>HIGH- More frequent flooding, to greater depths and longer durations.</p>		
Economic	<p>HIGH- Significant risk to critical assets and critical infrastructure. For the 1% AEP fluvial flood event the following additional critical assets would be at risk: one police station, one fire station and six electricity stations. Critical transport routes at risk are the Cardiff main railway line (0.5km), A4161 (1.5km), A469 (0.5km). For the 0.5% AEP tidal flood event the following additional critical assets would be at risk: nine electricity stations. The following additional critical transport routes would also be at risk: 0.8km of the A4161.</p> <p>HIGH- Significant increase in direct economic property damages as a result of flooding. Increases by £57.4 million and £79.1 million for the 1% AEP fluvial and 0.5% AEP tidal flood events, respectively.</p> <p>LOW- Small increase in direct economic agricultural damages as a result of flooding. Total agricultural damages remain low but increase by £192,500 and £99,950 for the 1% AEP fluvial and 0.5% AEP tidal flood events, respectively.</p>		
Policy option P4			
Environmental	<p>NEUTRAL= no increase in the number of listed buildings at risk from a 1% AEP fluvial flood event or a 0.5% AEP tidal flood event.</p> <p>NEUTRAL = No change in the frequency or duration of flooding to BAP habitats or species.</p> <p>MEDIUM- Delivery of CFMP policy to sustain current flood risk may</p>	<p>NEUTRAL= no increase in the number of listed buildings at risk from a 1% AEP fluvial flood event or a 0.5% AEP tidal flood event.</p> <p>NEUTRAL = No change in the frequency or duration of flooding to BAP habitats or species.</p>	Not preferred option – although fluvial risk may be low, maintaining tidal risk at the current level is high, as risks to people and the

Policy unit name/number:	Policy unit 1: Cardiff		
Policy options	Losses	Gains	Preferred policy option
	reduce the quality and quantity of the BAP habitat and species within the policy unit. Rivers, streams and floodplains, Brown Trout, Otter and Water Vole and likely to be particularly affected.		economy remain significantly high now and into the future.
Social	<p>LOW- Small increase in risk to people. The number of people at flood risk increases by 31 for the 1% AEP fluvial flood event, but the number of people which are located within flood risk areas where flood depths exceed 0.5 metres reduces by 5. There is no change in risk to people for the 0.5% AEP tidal flood event.</p> <p>LOW- Small increase in numbers of residential properties at flood risk. The number of residential properties at flood risk increases by 19 for the 1% AEP fluvial flood event. There is no change for the 0.5% AEP tidal flood event.</p> <p>LOW- Small increase in numbers of properties not within flood warning areas. Over 100 properties for the 1% AEP fluvial flood event would not be within an existing flood warning area. There is no change for the 0.5% AEP tidal flood event.</p> <p>LOW- Low community disruption. During the 1% AEP fluvial flood event only three additional retail buildings would be at risk. There would be no change for the 0.5% AEP tidal flood event. The flooded area where depths exceed 0.5 metres would increase slightly by 0.2km² for the 1% AEP fluvial flood event, with no change for the 0.5% AEP tidal event.</p>		
Economic	<p>LOW- Risk to critical assets and critical infrastructure. For the 1% AEP fluvial flood event no critical assets would be at risk. Additional critical transport routes that would be at risk are the Cardiff main railway line (0.6km). There would be no change for the 0.5% AEP tidal flood event.</p> <p>LOW- Small increase in direct economic property damages as a result of flooding. Total economic property damages would increase by £0.6 million for the 1% AEP fluvial flood event. There is no change for the 0.5% AEP tidal flood event.</p> <p>LOW- Small increase in direct economic agricultural damages as a result of flooding. Total economic agricultural damages would increase by £19,899 for the 1% AEP fluvial flood event. There is no change for the 0.5% AEP tidal flood event.</p>		
Policy option P5			
Environmental	<p>NEUTRAL= no increase in the number of listed buildings at risk from a 1% AEP fluvial flood event or a 0.5% AEP tidal flood event.</p> <p>MEDIUM- Delivery of CFMP policy to reduce current flood risk may reduce the quality and quantity of the BAP habitat and species</p>	<p>NEUTRAL= no increase in the number of listed buildings at risk from a 1% AEP fluvial flood event or a 0.5% AEP tidal flood event.</p> <p>LOW+ Less frequent and shorter duration flooding of BAP habitats will benefit BAP habitats intolerant of waterlogging.</p>	<p>✓ Reduce flood risk now and in the future</p> <p>Undertaking small and large-</p>

Policy unit name/number:	Policy unit 1: Cardiff		
Policy options	Losses	Gains	Preferred policy option
Social	<p>within the policy unit. Rivers, streams and floodplains, Brown Trout, Otter and Water Vole and likely to be particularly affected.</p> <p>LOW- Less frequent and shorter duration flooding of BAP habitats may adversely affect habitats dependent on waterlogging.</p>	<p>LOW+ A decrease in the number of BAP species at risk from a 1% AEP fluvial flood event or a 0.5% AEP tidal flood event.</p> <p>LOW+ - There would be a decrease in community disruption as no community assets would be at risk during the 1% AEP fluvial or 0.5% AEP tidal flood events.</p> <p>MEDIUM+ - There would be a decrease in risk to people. The number of people at flood risk decreases by 121 and 189 for the 1% AEP fluvial and 0.5% AEP tidal flood events, respectively. The number of people that are located within flood risk areas where flood depths exceed 0.5 metres reduces by 10 and 84 for the 1% AEP fluvial and 0.5% AEP tidal flood events, respectively.</p> <p>MEDIUM+ - There would be a decrease in numbers of residential properties at flood risk. The number of residential properties at flood risk decreases by 38 and 113 for the 1% AEP fluvial and 0.5% AEP tidal flood events, respectively.</p> <p>MEDIUM+ - There would be a decrease in numbers of properties not within flood warning areas. The number of properties at flood risk but not within an existing flood warning area decreases by 39 and 68 for the 1% AEP fluvial and 0.5% AEP tidal flood events, respectively.</p>	<p>scale works could significantly reduce risk to people, property and the economy. Taking action to reduce flood risk would be economically justifiable in this policy unit.</p>
Economic		<p>LOW+ - There would be a small decrease in total economic agricultural damages of £88,689 for the 0.5% AEP tidal flood event. For the 1% AEP fluvial flood event, total economic agricultural damages would increase slightly by £14,152.</p> <p>HIGH+ - There would be a decrease in risk to critical assets and critical transport routes. There would be no risk to either during the 1% AEP fluvial and 0.5% AEP tidal flood events. This would be no change for the fluvial event but would be a decrease of one police station, one fire station, four electricity stations and a 0.9km stretch of the A4161 for the 0.5% AEP tidal flood event.</p> <p>HIGH+ - There would be a significant decrease in total economic property damages, particularly for the 0.5% AEP tidal flood event. Total economic property damages would decrease by £780,000 and nearly £21.0 million for the 1% AEP fluvial and 0.5% AEP tidal flood events, respectively.</p>	
Policy option P6			

Policy unit name/number:	Policy unit 1: Cardiff		
Policy options	Losses	Gains	Preferred policy option
Environmental	There is no scope for carrying out policy six in this policy unit. Increased frequency of flooding to make space for water would result in a very high number of people at risk and very high economic damages. Deliberately promoting flooding through schemes that make space for water would cause large-scale community disruption to Cardiff and the Eastern Valleys as a whole.	There is no scope for carrying out policy six in this policy unit. Increased frequency of flooding to make space for water would result in a very high number of people at risk and very high economic damages. Deliberately promoting flooding through schemes that make space for water would cause large-scale community disruption to Cardiff and the Eastern Valleys as a whole.	Not preferred option – there is no scope for carrying out policy six in this policy unit. There is very limited opportunity for increasing the frequency of flooding as a flood risk management option within this policy unit.
Social			
Economic			

Key

HIGH:	<p>High negative</p> <p>A policy has a 'high negative' effect where it could contribute to a social, economic or environmental objective in a significantly negative way.</p> <p>A 'high negative' effect could be:</p> <ul style="list-style-type: none"> (i) a very large increase in current flood risk; (ii) very large projected increases in flood risk under future conditions, and/or; (iii) significant additional social, economic and/or environmental losses.
MEDIUM:	<p>Medium negative</p> <p>A policy has a 'medium negative' effect where it could contribute to a social, economic or environmental objective in a negative way.</p> <p>A 'medium negative' effect could be:</p> <ul style="list-style-type: none"> (i) an increase in current flood risk; (ii) a projected increase in flood risk under future conditions, and/or; (iii) social, economic and/or environmental losses.
LOW:	<p>Low negative</p> <p>A policy has a 'low negative' effect where it could make a limited contribution to a social, economic or environment objective, but where the overall contribution would be negative.</p> <p>A 'low negative' effect could be:</p> <ul style="list-style-type: none"> (i) an overall increase in current flood risk; (ii) an overall increase in flood risk under future conditions, and/or; (iii) overall social, economic and/or environmental losses.
NEUTRAL:	<p>Neutral</p> <p>A policy has a 'neutral' effect where it makes neither a positive or negative contribution to a social, economic or environmental objective.</p> <p>A 'neutral' effect could be:</p> <ul style="list-style-type: none"> (i) no change in current level of risk. In this instance the current level of risk would have to be low, so that the residual risk after a neutral policy was implemented remained acceptable; (ii) no change in flood risk under future conditions. In this instance projected future risk would need to be low so that the residual risk after a neutral policy was implemented remained acceptable, and/or; (iii) no additional social, economic and/or environmental gains or losses. <p>Policy options may also be 'neutral' where they are not relevant in a particular policy unit, or where it is not feasible for a policy option to contribute to an objective.</p>
HIGH:	<p>High positive</p> <p>A policy has a 'high positive' effect where it could contribute to a social, economic or environmental objective in a significantly positive way.</p> <p>A 'high positive' effect could be:</p> <ul style="list-style-type: none"> (i) a very large reduction in current flood risk; (ii) avoiding/reducing very large projected increases in flood risk under future conditions, and/or; (iii) significant additional social, economic and/or environmental gains.
MEDIUM:	<p>Medium positive</p> <p>A policy has a 'medium positive' effect where it could contribute to a social, economic or environmental objective in a positive way.</p> <p>A 'medium positive' effect could be:</p> <ul style="list-style-type: none"> (i) a reduction in current flood risk; (ii) avoiding/reducing projected increases in flood risk under future conditions, and/or; (iii) additional social, economic and/or environmental gains.
LOW:	<p>Low positive</p> <p>A policy has a 'low positive' effect where it could make a limited contribution to a social, economic or environment objective, but where the overall contribution would be positive.</p> <p>A 'low positive' effect could be:</p> <ul style="list-style-type: none"> (i) an overall reduction in current flood risk; (ii) an overall avoidance/reduction in flood risk under future conditions,

Form 12.8: Summary of the preferred policy

<p>Policy Unit name/number:</p>	<p>Policy Unit 1: Cardiff The policy unit is located within the lower reaches of the Eastern Valleys CFMP. The policy unit covers the main conurbation within the Eastern Valleys, Cardiff. Note that parts of western Cardiff lie outside of the CFMP area.</p>
<p>Problem / risk:</p>	<p>The main rivers within this policy unit are the River Rhymney and the Roath Brook (the main tributary of the Lower River Rhymney). There is also another minor right bank tributary, the Nant Glandulas, which joins the River Rhymney in the Llanedeyrn area. There are two main sources of flooding within this policy unit; fluvial and tidal. Other secondary sources of flooding within this policy unit include surface and sewer flooding.</p> <p>Current fluvial risk within the policy unit is low for flood events up to the 1% AEP. The reason current fluvial risk is low is because of the flood defences we currently maintain to a 1% Standard of Protection (SoP). In the future, these flood defences will be overtopped and as a result fluvial flood risk during a 1% AEP event significantly increases. Tidal flood risk now and into the future is very high. The tidal SoP of the defences is at the 0.5% level along the River Rhymney.</p> <p>Under both current and future conditions the risk to people and property is very high for the 0.1% AEP extreme fluvial and tidal events.</p>
<p>Policy selected</p>	<p>Policy 5 – take further action to reduce flood risk (now and/or in the future)</p> <p>We have selected this policy based on the risk posed by inland flooding sources and tidal flooding sources. Our goal for selecting policy five for the Cardiff policy unit is to reduce the currently high tidal flood risk, which in the future would be significantly worse based on our projections of sea level rise as a result of climate change. In addition to this, we have selected this policy to reduce the future fluvial flood risk, which again would significantly increase based on current climate change projections. Taking further action to reduce flood risk now and into the future is important as Cardiff is the main economic centre in the Eastern Valleys.</p> <p>If the risks posed by tidal flooding were removed from the policy appraisal process, preliminary estimates suggest that this policy would change from a P5 to a P4.</p>
<p>Justification and alternative policies considered</p>	<p>Policy 5 sets a framework that reduces flood risk now and/or into the future. This policy is appropriate for this policy unit for the following reasons:</p> <ul style="list-style-type: none"> - The level of tidal flood risk is high now and into the future (due to the risk from the Roath Brook for tidal flooding where there are no defences), and the risks present severe consequences for harm to life. - Risks for extreme fluvial events (0.1% AEP) are high now and into the future. - There are a significant number of properties now and in the future that are or will be at flood risk but are not covered by the existing flood warning areas, and therefore new investment in flood warning will be necessary now and in the future. - There is currently a need to improve the existing hydrometric network, particularly at Llanrumney, which would improve knowledge on the effects of high tides/river level interaction and may help improve the accuracy of flood warnings. <p>The main area of Cardiff is situated in the lower reaches of the River Rhymney and Roath Brook. There is also a tidal flood risk in Cardiff. The existing floodplain of the River Rhymney in Cardiff is restricted by the presence of flood defences, constructed in the 1980s. There is also a residual risk of these defences breaching, so properties located behind these flood defences are extremely vulnerable.</p> <p>The current scale of fluvial flood risk during a 1% AEP flood event in the main area of Cardiff is low. The estimated total property damages are £1.1 million for a 10% AEP fluvial flood event and £1.6 million for the 1% AEP fluvial flood event. The level of risk for the 0.1% AEP fluvial flood event is very high with estimated total</p>

	<p>property damages being £80.0 million. It can be seen that the damages principally arise from the more extreme events, which is due to our flood defences, which have an SoP of 1% AEP, overtopping. The 1% AEP fluvial flood event would affect approximately 86 properties and but no critical assets or critical transport routes would be affected under current conditions.</p> <p>In the future, the 1% AEP fluvial flood event damages for the main area of Cardiff are high. Damages significantly increase to £59 million, affecting approximately 1,088 properties. This large increase is due to our flood defences overtopping.</p> <p>The current scale of tidal flood risk in the main area of Cardiff is high, due to flooding along the Roath Brook where there are no defences. The estimated total property damages are £5.1 million for a 10% AEP tidal flood event, £21.0 million for the 0.5% AEP tidal flood event and £29.1 million for the 0.1% AEP tidal flood event. It can be seen that the damages principally arise from the more extreme events, which is due to our flood defences, which have an SoP of 1% AEP, overtopping. The 0.5% AEP tidal flood event would affect approximately 239 properties and one police station, one fire station, four electricity stations and the A4161 in Cardiff.</p> <p>In the future, the 0.5% AEP tidal flood event damages for the main area of Cardiff increase to £99.4 million, affecting approximately 1,430 properties.</p> <p>The expected annual damages in the main area of Cardiff are £677,000/yr, which amounts to 10% of the total annual damages within the Eastern Valleys CFMP. The expected annual damages could increase by over 50% in the future as a result of the impacts of climate change and further development planned within the catchment.</p> <p>The expected annual damages in the main area of Cardiff are £1.5 million/yr for tidal flood events, which amounts to 100% of the total annual damages within the Eastern Valleys CFMP. The expected annual damages could increase by over 500% in the future as a result of the impacts of climate change and further development planned within the catchment.</p> <p>The current scale of tidal flood risk is high and this is what drives the selections of a P5 for this policy unit. Under a P4, the current tidal flood risk would still remain high, with £22 million property damages and 160 people at flood risk.</p>
<p>Justification and alternative policies considered</p>	<p>Gains and losses under preferred policy (policy five)</p> <p><i>Social</i> Policy five gives one low and three medium gains against our social CFMP objectives and indicators. Gains would be both local (to areas of high current risk) and distributed (to larger areas that we would expect to be at risk under future conditions if we did not take additional action). Flood risk would be significantly reduced for 1% AEP fluvial and 0.5% AEP tidal flood events now and into the future. We accept that there would still be a small number of people at flood risk during the 1% AEP fluvial and 0.5% AEP tidal flood events. For more extreme events such as the 0.1% AEP flood event, we accept that we cannot build structural defences to protect the people, property and the economy, and that there would be significant consequences during such extreme events.</p> <p><i>Economic</i> Policy five gives one low, one medium and two high gains against our economic CFMP objectives and indicators. Reducing flood risk to critical assets and critical transport routes, and significantly reducing economic damages under policy five would have widespread benefits as Cardiff is the main economic centre in the Eastern Valleys.</p> <p><i>Environmental</i> Policy five gives one neutral gain, 1 medium loss, 1 low loss and 2 low gains</p>

	<p>against our environmental CFMP objectives and indicators. Rivers in policy unit one are already managed for flood risk purposes; therefore we would not expect the natural environment to be significantly affected if we took further action to reduce risk to society and the economy. In addition to this, because the policy unit is mainly urban, there are a limited number of environmental sites within the policy unit.</p> <p>Alternative policies considered</p> <p>Policy one – <i>No active intervention</i>. The increased risk to people (+2,870), properties (+1,430) and the economy (+£99m) would be very high and there would be very significant and high increases in risks in the future.</p> <p>Policy two – <i>Reduce current levels of flood risk management</i>. The increased risk to people (+2,405), properties (+1,220) and the economy (+£77m) would be very high and there would be very significant and high increases in risks in the future.</p> <p>Policy three – <i>Maintain current levels of flood risk management</i>. The increased risk to people (+2,010), properties (+1,020) and the economy (+£57m) would be very high and there would be very significant and high increases in risks in the future.</p> <p>Policy four – <i>Take further action to sustain the current level of flood risk into the future</i>. Although current fluvial risks for the 1% AEP flood event are low, the current tidal flood risks are high, and these would not be reduced by selecting policy four for this policy unit, as 290 people and 217 properties remain at flood risk under this policy.</p> <p>Policy six – <i>Take action with others to store water or manage run-off in locations that provide overall flood risk reduction or environmental benefits, locally or elsewhere in the catchment</i>. There is no scope for carrying out policy six in this policy unit. There is very limited opportunity for increasing the frequency of flooding as a flood risk management option within this policy unit.</p>
<p>Catchment-wide opportunities & constraints</p>	<p>The greatest opportunity in policy unit one is for us to significantly reduce or eliminate the risk of flooding to people, property and the economy; these risks are currently very high (particularly tidal risk) and have the potential to significantly increase in the future. In order to do this we need to take further action as the current approach to flood risk management is unsustainable in the long-term. Significant redevelopment is planned in Cardiff over the next 50 years. Much of this development could take place in areas that could be at high risk of flooding under future conditions.</p> <p>There are few opportunities within this policy unit to reconnect the river with its floodplain as this policy unit is heavily urbanised and increasing the frequency of flooding in most locations would affect more people and property.</p>
<p>Actions</p>	<ul style="list-style-type: none"> • The scale of the expected economic damages and risk to people and property indicates that we should develop a Strategy Plan for Cardiff within the next 5 years. This will consider where investment for structural responses can and should be implemented to reduce flood risk in Cardiff. Moving forward from the Strategy Plan, Pre-feasibility studies will be needed. • The tidal risk to Cardiff should be investigated further through a detailed study to determine more accurate consequences tidal flooding would cause to Cardiff. • In partnership with Cardiff Local Authority we should enforce stringent building controls on new development within flood risk areas. Suitable land allocations for new development should first be sought outside of flood risk areas. • SUDs and building regulations (resilience) should be incorporated, where appropriate, into all new developments.
<p>Risks, uncertainties & dependencies</p>	<p>The damages to Cardiff from flooding are estimates that are considered sufficiently accurate to justify the cost of further investigations into the appropriate intervention to reduce flood risk. More detailed assessments will be required to identify the</p>

actual level of investment that can be justified and its relative priority with other flood risk reduction work.

An existing model of the Lower Rhymney and the lower Roath Brook was used, this was supplemented by more broadscale modeling to ensure all the risk was assessed in the policy unit. There is more uncertainty with the broadscale modeling than areas with existing models.

For this policy to be successful, appropriate policies and actions must be implemented throughout the River Rhymney catchment.

Form 12.9: Requirements for further policy development and appraisal

Is there a need for further policy development?	Yes
If yes, then mark Policy Options for more detailed development. Some complex policies may require more detailed development, probably at Strategy Plan level.	
Is there a need for further more detailed appraisal?	Yes
If yes, take forward to Strategy study.	

Form 12.10: Indicators for monitoring, review and evaluation

Set out the indicators that need to be included in the policy implementation plan, for policy monitoring, drawing on the residual risks and likely impacts identified above. This will allow better review and evaluation of the policy when implemented.	
Monitoring	Significance/impact
Hydrometric monitoring of river flows and levels, sea level, rainfall and groundwater levels throughout the catchment in order to monitor changes in climate	<ul style="list-style-type: none"> Additional data may change our assessment of current or future conditions
Scientific advancements in flood risk management	<ul style="list-style-type: none"> Improved sea level rise predictions Improved predictions in changes to river flows
Land use change monitored using satellite imagery	<ul style="list-style-type: none"> Further information on land use change may change future predictions of flood risk
Actual development rates	<ul style="list-style-type: none"> Need to check if urbanisation predictions made are realistic in light of current and future development undertaken
Designation and condition of environmental sites	<ul style="list-style-type: none"> May change the chosen policy if additional sites are designated. Monitoring of site condition will confirm that chosen CFMP policies have not adversely affect designated sites
Designation and condition of historic environmental assets	<ul style="list-style-type: none"> May change the chosen policy if additional sites are designated. Monitoring of site condition will confirm that chosen CFMP policies have not adversely affect designated sites
Detrimental impacts of flood risk management projects on BAP habitats and species	<ul style="list-style-type: none"> To ensure that specific flood risk management projects do not adversely affect BAP habitats and species
Level of uptake of flood warning services	<ul style="list-style-type: none"> Monitor whether the community are aware of the flood risks
Condition of flood defences	<ul style="list-style-type: none"> Need to maintain defences in line with the policy chosen
Actual expenditure on maintenance activities by policy unit, subdivided into activities.	<ul style="list-style-type: none"> Ensure that money is being targeted according to policy chosen
Actual expenditure on capital works to reduce flood risk	<ul style="list-style-type: none"> Need to ensure that these actions are in keeping with the policy chosen
Improved documentation of actual flood events: <ul style="list-style-type: none"> Number of properties/assets/ environmental sites/historic environment assets flooded Source of flooding Cause of flooding Whether due to defence failure 	<ul style="list-style-type: none"> Information on actual flood events needs to be better recorded in order to understand the relative importance of the various sources of flooding
Construction of critical infrastructure	<ul style="list-style-type: none"> May change the chosen policy if additional critical infrastructure is constructed within the floodplain

Spatial location of policy unit 2: Bedwas and Machen



Form 12.5: Summary of current and future levels of and responses to flood risk

Policy unit name/number:	Policy Unit 2: Bedwas and Machen
Current responses to flood risk within the policy unit?	<p>Defences We defend the main urban areas in policy unit two, namely Bedwas and Machen, using raised earth, concrete, brick wall and blockstone defences along both sides of the River Rhymney.</p> <p>In Bedwas and Pant Glas, we also use berms to aid the flood defences, particularly along the left hand bank of the River Rhymney. The defences in Bedwas extend along the right bank of the River Rhymney from approximately 1km upstream of the A468 road bridge downstream past the Pant Glas Industrial Estate to Broomewood, with a total length of approximately 4.2km. Two separate short reaches (approximately 150m) of defences protect properties along the left bank of the River Rhymney in the Plas-Newydd residential area.</p> <p>In Machen the defences extend along the right bank of the River Rhymney from Colliers Row to Chatham Footbridge, a length of approximately 1.2km. These were implemented in the 1980s in response to past flood events along the River Rhymney. On the left bank of the River Rhymney we protect the Chatham residential estate with a 300m earth embankment.</p> <p>Flood Warning We provide a flood warning service via Floodline Warnings Direct. Flood Warning Area 103FWFg03 covers fluvial flood risk from the River Rhymney in Bedwas and Pant Glas, and 103FWFg04 covers fluvial risk from the River Rhymney in Machen. The lead times for flood warning in policy unit two are approximately 3 hours. We aim to issue flood warnings at least 2 hours before a flood event occurs. There are currently 115 properties at flood risk during a 1% AEP fluvial flood event, 95 of which lie within the existing flood warning area. Uptake to the flood warning service is unknown.</p> <p>Maintenance of existing structures We carry out routine maintenance works on all main rivers in PU2. In Bedwas and Pant Glas we undertake: routine mowing and spraying to maintain the River Rhymney channel capacity; blockstone repairs to maintain the flood defences and tree management to maintain channel conveyance. In Machen we undertake routine mowing and spraying to maintain the River Rhymney channel capacity.</p> <p>The Bedwas and Machen policy unit is covered by three asset systems. FR19S046 and FR19S044 are low asset systems and inspected every 36 to 60 months. FR19S045, covering Machen only, is a high risk asset system inspected every 6 to 12 months. We currently spend approximately £62,000 per year on maintenance and operations in policy unit two.</p>
Standards of service that apply to flood defences within the policy unit?	<p>Standard of Protection Through Machen the only flood defence that provides a 1% AEP SoP is the left bank defence protecting the Chatham residential estate, the SoP of the defence on the right bank of the River Rhymney provides a SoP of less than 1%, offering approximately between a 2% AEP and 1.5% AEP SoP. Through Bedwas the flood defences offer a 1% AEP SoP in most places along the River Rhymney, however there are sections where the SoP is lower.</p> <p>All of these defences are likely to be overtopped when allowances are made for climate change into the future.</p> <p>Condition and maintenance of defences This information is unknown.</p>
What is currently	People

exposed to flooding?

We estimate that there are currently 236 people at risk of flooding in policy unit two from a 1% AEP fluvial flood event. The fluvial flood risk comes from the River Rhymney and the main risk to people during the 1% AEP fluvial flood event is in Machen.

Flood risk does increase during the 0.1% AEP fluvial flood event because all flood defences are overtopped but the increase in risk is low in comparison to other areas across the Eastern Valleys.

Community Disruption

We estimate that there are currently 115 properties at risk of flooding in policy unit two from a 1% AEP fluvial flood event, 105 of which are residential. Community assets at flood risk are one community centre in Pwllypant and three retail buildings.

Critical Infrastructure

We estimate that there are no critical transport routes at flood risk during a 1% AEP fluvial flood event. The only critical asset at risk is one electricity station in Bedwas.

Economic Damages

We estimate the total economic property damages resulting from the 1% AEP fluvial flood event to be £5.9 million.

We estimate the total economic agricultural damages resulting from the 1% AEP fluvial flood event to be £221,774.

Historic Environment

We estimate that 5 listed buildings are at current flood risk from a 1% AEP fluvial event.

Landscape

We estimate that there are currently no landscape receptors at risk from a 1% AEP fluvial flood event in policy unit two.

Recreation

We estimate that there are currently no recreational areas at flood risk in policy unit two from the 1% AEP fluvial flood event.

Nature conservation sites

We estimate that there are currently no designated nature conservation sites at risk of flooding in the policy unit from a 1% AEP fluvial flood event. We estimate that 9% of the Plas Machen Wood SSSI is at risk from a 0.1% AEP fluvial flood event.

BAP Habitats

The exact location of BAP habitats in the catchment is unknown, but we estimate that several locally important habitats, identified in the Caerphilly Local BAP, will be at risk of flooding. These habitats include ponds, reedbeds, rhos pastures, rivers, streams and floodplains and wet woodlands.

Species

The exact location of BAP species in the catchment is unknown, but we estimate that several locally important species, identified in the Caerphilly Local BAP, will be at risk of flooding. These species include Brown Trout, the Double Line Moth, Lapwing, Otter, Reed Bunting and White-clawed Crayfish.

Who and what are currently

Social and economic receptors

People living in areas behind flood defences are the most vulnerable to flooding

<p>most vulnerable to flood damage and losses?</p>	<p>due to the high depths and velocities of flood water that would be expected if a breach occurred in the defence scheme or the defences were overtopped. The industrial areas in Bedwas have the highest economic damages during a 1% AEP fluvial flood event.</p> <p>Environmental receptors</p> <p>The Plas Machen Wood SSSI is a woodland site with a number of streams and waterlogged areas within it. Periodic flooding of the wetland areas may have ecological benefits. However, prolonged or frequent flooding and non-fluvial flooding from other sources such as groundwater or the sewerage system could cause damage, particularly to species intolerant of waterlogged conditions.</p> <p>BAP habitats and species in the unit are at greatest risk from prolonged or frequent floodwater inundation, especially by low quality water, which can indirectly degrade habitats. However, some wetland BAP habitats, and the species they support, may benefit from increased flooding.</p> <p>The 5 listed buildings at current risk from a 1% AEP fluvial event are likely to be negatively affected. Events with high depths and velocities of flood water are likely to cause the most damage.</p>
<p>What are the key factors that could drive future flood risk?</p>	<p>Climate change</p> <p>Climate change is the main driver of future flood risk in the Eastern Valleys. Climate change will result in higher flows and higher tide levels, which will increase water levels in our rivers. This will put pressure on existing flood defences and will result in the current Standard of Protection of our channels and flood defences being reduced. Flooding under our modelled future scenarios of climate change would cause significantly more damage and pose a significantly higher risk to people and property than existing conditions.</p> <p>Land use management changes</p> <p>We have decided not to consider the impact of land use change outside of urban areas on future flood risk in this CFMP. Agricultural intensification and changes in drainage practices are unrealistic scenarios because the Eastern Valleys has poor quality soils that are unsuitable for agricultural intensification. It is also constrained by the steep gradients of the land, meaning arable farming is impossible in certain areas. We recognise that within this policy unit there is some good quality agricultural land downstream of Machen but it is very difficult for us to predict the future of agriculture in the Eastern Valleys beyond the immediate future. Also, changing to farming practices downstream will not have an impact upstream in this policy unit. It may be that extensification is a more realistic long-term scenario, where land is farmed less intensively and for environmental benefits. However, it is unlikely that extensification would have little impact on flood risk as the area is not intensively farmed at present.</p> <p>Development in the flood plain</p> <p>Increased urbanisation will result in increased flood volumes and higher peak water levels, and flooding would occur more quickly. Unless runoff from new urban development within and outside of floodplains is balanced, flood risk will increase locally and downstream. Development in the floodplain should only be considered when no other suitable land allocations are available and any buildings within floodplains should have flood resilience measures incorporated into their design, and floodplain compensation would be necessary.</p> <p>Flood defence failure</p> <p>In the event of flood defence infrastructure failing during a flood event, the resulting flood water depths and velocities would be very high. There would also be very little flood warning time for people located close to existing flood defences.</p>

	<p>Therefore, the risk of harm to life would be very high and the resulting economic damages would be very high. The areas most vulnerable to flood defence failure in policy unit two are the Chatham and Plas-Newydd residential areas as properties are built right behind defences, and the numerous industrial estates along the right bank of the River Rhymney through Bedwas.</p>
<p>What are the possible future levels of flood risk under the main scenarios?</p>	<p>Our final future scenario that we used to assess possible future levels of flood risk considered a combination of the two main drivers, climate change and urbanisation. We have identified the following. We show the total numbers at risk, with the increase from current conditions in brackets.</p> <p>People In the future, we estimate that there will be 644 (+408) people at risk of flooding from a 1% AEP fluvial flood event. The increase in people at risk during these events is mainly due to our 1% SoP flood defences overtopping.</p> <p>Community Disruption In the future, we estimate that there will be 294 (+179) properties at risk of flooding from a 1% AEP fluvial flood event, 257 (+152) of which are residential. Community assets will also be at flood risk in the future 1% AEP fluvial flood event: two community centres in Pwllypant (+2) and seven retail buildings (+4).</p> <p>Critical Infrastructure In the future, we estimate that there will be no critical transport routes at flood risk during a 1% AEP fluvial flood event. Critical assets at risk will be two electricity stations in Bedwas and Machen (+1).</p> <p>Economic Damages In the future, we estimate the total economic property damages resulting from the 1% AEP fluvial flood event will be £11.6 million (+£5.7m). In the future, we estimate the total economic agricultural damages resulting from the 1% AEP fluvial flood event will be £297,773 (+£76,000).</p> <p>Historic Environment In the future, 5 listed buildings will be at risk from a 1% AEP fluvial flood event (no change).</p> <p>Landscape In the future, we estimate that there will be no landscape receptors at risk in a 1% AEP fluvial flood event.</p> <p>Recreation In the future, we estimate that there will be no recreational areas at flood risk in a 1% AEP fluvial flood event.</p> <p>Nature conservation sites In the future, we estimate that 0.1% of the Plas Machen Wood SSSI will be at risk from a 1% AEP fluvial flood event. For a 0.1% AEP fluvial flood event the percentage area of the Plas Machen Wood SSSI at risk increases to 18%.</p> <p>BAP Habitats The exact location of BAP habitats in the catchment is unknown. However, we estimate that in the future an increasing area of the locally important BAP habitats identified above will be at risk of flooding.</p> <p>Species The exact location of BAP species in the catchment is unknown. However, we</p>

	estimate that in the future an increasing number of the locally important BAP species identified above will be at risk of flooding.		
What potential responses (or groups of responses) are being considered to manage flood risk?	Generic Response/Strategic Options	Response	
	Attenuation/retention	<ul style="list-style-type: none"> ▪ On-line storage ▪ Off-line storage 	Little scope for small-scale flood storage schemes within this policy unit that would benefit Bedwas and/or Machen. However, any storage schemes further up the Rhymney corridor (but outside of this policy unit) might provide some benefit. New development would have to not exacerbate flood risk, so urban balancing ponds might be needed as part of urban drainage schemes.
		<ul style="list-style-type: none"> ▪ SUDS - new/retrospective 	A potential method for reducing surface water runoff and should be included in all new developments.
	Increased or decreased conveyance	<ul style="list-style-type: none"> ▪ River maintenance 	Ongoing maintenance activities include mowing and spraying and tree management. Reduced/increased maintenance activities within this policy unit should be considered further.
		<ul style="list-style-type: none"> ▪ Fluvial defences 	We defend the main urban areas in this policy unit, namely Bedwas and Machen, using raised earth, concrete, brick wall and blockstone defences along both sides of the River Rhymney. In Bedwas and Pant Glas, we also use berms to aid the flood defences, particularly along the left hand bank of the River Rhymney. May be necessary to increase the SoP of certain defences to protect against future flood risk. This will be assessed through more detailed pre-feasibility studies.
	Influencing and informing	<ul style="list-style-type: none"> ▪ Flood awareness 	National campaign. Should be continued and awareness increased within this policy unit where the flood risk from fluvial and tidal flooding is very high.
		<ul style="list-style-type: none"> ▪ Flood warning and evacuation 	Two existing flood warning areas - uptake to FWD unknown but likely to be opportunity to increase. In light of future flood risk, it is likely that the flood warning area may need extending.
		<ul style="list-style-type: none"> ▪ Emergency & disaster planning/response 	Policy unit covered by Caerphilly Local Authority. Existing emergency plans in place, which should be reviewed and updated as new information becomes available.
	<ul style="list-style-type: none"> ▪ Planning policy, Development control 	Continue to follow Welsh Assembly Government policies. Caerphilly Local Authority should ensure that suitable land allocations outside flood risk areas are sought first.	

		<ul style="list-style-type: none"> Building regulations (resilience) 	To be incorporated into all new developments located within flood risk areas.
	Monitoring, advise and survey	<ul style="list-style-type: none"> Data and information 	Should continue despite policy selected.
		<ul style="list-style-type: none"> Asset inspection 	Most of policy unit is classified as low risk and therefore assets are inspected every 36-60 months. Bedwas, identified as one of the Eastern Valleys main areas, is located within this assets system. It is recommended that this be reviewed and possibly upgraded. Small area of the policy unit is classified as high risk covering most of Machen and therefore assets are inspected every 6-12 months. It is unlikely this could be increased further but should be explored.
		<ul style="list-style-type: none"> Hydrometric network 	Existing level gauge at Waterloo Bridge, Machen. It is recommended that this site could be improved by configuring a warning trigger level for this site to help improve flood warnings.
	Studies	<ul style="list-style-type: none"> Flood risk mapping 	Existing flood risk management studies undertaken in 2005/2006. All studies should be revisited as more data become available.
		<ul style="list-style-type: none"> Flood forecasting 	No existing studies. A flood forecasting study may be beneficial.
		<ul style="list-style-type: none"> Pre-feasibility 	No existing studies. If new defences and/or storage is/are considered, pre-feasibility studies may be required.
		<ul style="list-style-type: none"> Strategy plans 	Recommended that a strategy plan should be undertaken to target areas where pre-feasibility studies are needed.
		<ul style="list-style-type: none"> SAMPs 	Policy unit covered by SAMPs. Likely that they will need reviewing to take into account future flood risk. Machen classified as high risk; rest of policy unit is low risk.
		<ul style="list-style-type: none"> Urban drainage plans 	Unknown if there are any urban drainage plans in place for Bedwas and Machen but it is likely that any further significant urban expansion will need plans to ensure that flood risk will not increase within the towns or further downstream.
What gaps and uncertainties are there in knowledge, and what assumptions have been made?	<p>Broadscale modelling</p> <ul style="list-style-type: none"> Broadscale hydrology and hydraulic modelling techniques used; Where no existing models are available, these have been supplemented by other modelling techniques. Existing models were available for the River Rhymney for the majority of this policy unit. <p>Future scenarios</p> <ul style="list-style-type: none"> Although climate change projections are based on current guidance, these are still estimations; 		

- Urbanisation projections up until the year 2100 are based on current rates of urbanisation.
- Data limitations
- No data on the percentage uptake of properties located in Flood Warning Areas;
 - No data on the condition of flood defences/maintenance regime.
 - The exact locations of BAP habitats and species within the policy unit are unknown.

Broad scale Modelling Tables

Generic Response Modelling

The following tables provide a summary of how flooding will change in response to flood management options which may be adopted within policy unit two and what the implications of these changes might be. We have not applied any specific measures or schemes to the policy unit, but rather have applied what has been termed a 'generic response'. This represents the most likely outcome of a given policy, but is not specific and does not reflect any proposed scheme or project. It simply allows a broad assessment of what the impact of that policy might be.

Our broad scale models have been used to investigate the impact of these changes and have allowed us to quantify the effect on flood damages. We compare the risks for each generic response against the current base case conditions (the risk which currently exists in the catchment today). The results given below for each of the generic responses (i.e. the appropriate scenario for that part of the catchment) are for the 1% AEP fluvial flood event.

We have unit costs available for defences; however, the costs of flow attenuation schemes are not available. The cost of large scale flow attenuations scheme would be extremely high, as they form heavy structural response to flood risk. More local schemes for attenuating flow would cost less, but the costs would still be high compared to defences.

Policy unit 2: Bedwas and Machen

Generic response: Policy 1 - Withdraw/retreat defences and decreased conveyance

Description: We used our broad scale River Rhymney models to assess the combined effects of not maintaining defences and stopping river maintenance. Channel and floodplain roughness values in our broad scale models were increased from 0.04 and 0.06 to 0.075 and 0.095 respectively, to reflect the increase of roughness expected if maintenance were stopped. Defences were not removed from the model as their impact was considered negligible, due to them being overtopped.

Base case conditions (1% AEP fluvial flood event)

People at risk: Fluvial - 236	Economic risk: Fluvial – £5.9m	Properties at risk: Fluvial – 115	Environmental sites at risk: Fluvial - 0% of Plas Machen Wood SSSI is at risk
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Results of the broad scale modelling

People at risk: Fluvial – 1,076 (+356%)	Economic risk: Fluvial – £37.4m (+534%)	Properties at risk: Fluvial – 534 (+364%)	Environmental sites at risk: Fluvial - 14% of Plas Machen Wood SSSI is at risk
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			(+14%)
Conclusions			
Cost: Nothing - no active intervention			
Conclusion: The results of this modelling have indicated that if we stopped our maintenance of the defences and channels in policy unit two the risk to people, properties and the economy would increase. The impact of 'no active intervention' in this policy unit is significant, because we would be encouraging more flooding to occur. Our defences and the maintenance we undertake on the River Rhymney throughout Bedwas and Machen are important in reducing the risk of flooding and this is why the existing level of risk is quite low.			
We would withdraw our current flood warning service that we provide under this generic response.			

Policy unit 2: Bedwas and Machen			
Generic response: Policy 2 – Reduced maintenance			
Description: The active removal of the defences we maintain in and around Bedwas and Machen would not be a sustainable flood risk management strategy. The SoP of defences in this policy unit varies, but most generally have a SoP up to 1% AEP, so provide considerable protection. We could reduce our flood risk management around Bedwas and Machen by relaxing our maintenance activities, such as weed-cutting and clearing. We increased channel and floodplain roughness in the Rhymney broad scale models from 0.04 and 0.06 to 0.055 and 0.075 respectively, to reflect the increase of roughness expected if maintenance were reduced.			
Base case conditions (1% AEP fluvial flood event)			
People at risk: Fluvial - 236	Economic risk: Fluvial – £5.9m	Properties at risk: Fluvial – 115	Environmental sites at risk: Fluvial - 0% of Plas Machen Wood SSSI is at risk
Results of the broad scale modelling (1% AEP fluvial flood event)			
People at risk: Fluvial - 872 (+269%)	Economic risk: Fluvial - £20.0m (+239%)	Properties at risk Fluvial – 422 (+267%)	Environmental sites at risk: Fluvial - 6% of Plas Machen Wood SSSI is at risk (+6%)
Conclusions			
Cost: We currently spend approximately £62,000 per year on maintenance and operations in policy unit two. Under policy two we would not stop this regime, but we would scale down our programme, for example we may downgrade the high risk flood risk management system (FRMS) to a medium FRMS, or lower the funding available to the low FRMS, which may reduce funding by up to 50% (to £31,000 per year).			
Conclusion: If we were to reduce our maintenance regime, water levels would be expected to increase and bring additional risk to people. During a 1% AEP fluvial event in the future, all the defences we maintain within the policy unit would be overtopped if we did not increase them in line with future increases in water levels. By reducing our maintenance the risk to people, property, the economy and the environment would be increased further. This is because channel capacity would reduce and more flooding would occur.			

Policy unit 2: Bedwas and Machen			
Generic response: Policy 3 – Continue with existing flood defence actions only			
Description: This response to manage risk at the same level assumes that we would not undertake any alternative flood risk management actions, and that we would continue to maintain our defences at their current level. We would also continue our river maintenance, which allows the rivers to flow freely, at the same level. The current level of flood risk management under the chosen future scenario of climate change and increased urbanisation was modelled for Chapter 4.			

Base case conditions (1% AEP fluvial flood event)			
People at risk: Fluvial - 236	Economic risk: Fluvial – £5.9m	Properties at risk: Fluvial – 115	Environmental sites at risk: Fluvial - 0% of Plas Machen Wood SSSI is at risk
Results of the broad scale modelling (1% AEP fluvial flood event)			
People at risk: Fluvial – 644 (+173%)	Economic risk: Fluvial – £11.6m (+97%)	Properties at risk: Fluvial – 294 (+156%)	Environmental sites at risk: Fluvial – 0.1% of Plas Machen Wood SSSI is at risk (+0.1%)
Conclusions			
<p>Cost: The Bedwas and Machen policy unit covers three flood risk management systems, for which we currently spend approximately £62,000 per year on maintenance, assets and operations. We would continue investing this much in the future.</p> <p>Conclusion: In the past our management of flood risk has been mainly through building defences. We could continue investing in flood risk management and maintenance of these defences at the current level. To increase them into the future would require additional investment and is discussed under the P4 option. The results from this model show that if we did not undertake any maintenance of the flood defences, the risk to people, property and the economy in Bedwas and Machen, would increase.</p>			
Policy unit 2: Bedwas and Machen			
Generic response: Policy 3 – Reduced maintenance balanced by flood storage			
<p>Description: An alternative, softer approach to flood risk management is that we could relax our channel maintenance regime. This would raise water levels as channel capacity would reduce (as modelled under policy two). To compensate for this we could implement local scale flood storage schemes to reduce water levels. These would attenuate flows by up to 5%, and would operate at a local scale. We ran our broad scale models with increased channel and flood plain roughness values to assess the affects of a reduction in channel capacity, by relaxing our channel maintenance regime (roughness values as per policy two). Combined with this, we reduced the flows by 5% to reflect flood storage.</p>			
Base case conditions (1% AEP fluvial flood event)			
People at risk: Fluvial - 236	Economic risk: Fluvial – £5.9m	Properties at risk: Fluvial – 115	Environmental sites at risk: Fluvial - 0% of Plas Machen Wood SSSI is at risk
Results of the broad scale modelling (1% AEP fluvial flood event)			
People at risk: Fluvial – 858 (+264%)	Economic risk: Fluvial - £18.3 (+210%)	Properties at risk: Fluvial – 414 (+260%)	Environmental sites at risk: Fluvial - 6% of Plas Machen Wood SSSI is at risk (+6%)
Conclusions			
<p>Cost: We currently spend approximately £62,000 per year on maintenance and operations in policy unit two. If we were to scale down our regime, investment may reduce by up to 50% (to £31,000 per year). We do not have unit costs for implementing flood storage schemes but we expect that the costs would be higher than we currently spend on maintenance. Therefore the overall cost of this response is expected to be quite high, depending on the size and location of the flood storage schemes.</p> <p>Conclusion: As we discussed above for the policy two generic response, reducing maintenance encourages more flooding. If we were to combine this with reducing flows by 5%, we have shown that we could not compensate for this risk and are unable to further reduce risk beyond what is achievable with defences alone at their current level. This demonstrates that in the Bedwas and Machen policy unit, we would not be able to achieve the goal of policy three using combinations of other flood risk management options. In Bedwas and Machen we recognise the need to improve the number of people who are signed up to receive flood warnings, and we will look to improve this in the future, especially if the number of people at risk would increase under policy three.</p> <p>Policy three manages risk in the future at the current level of flood risk management activity. However, our broad scale modelling has shown that this combination of generic responses is unlikely to meet this</p>			

objective, and costs would be considerable in implementing local flood storage schemes. This suggests that a continuation of our work in inspecting and maintaining our defences is a more suitable and cost effective strategy.

Policy unit 2: Bedwas and Machen

Generic response: Policy 4 – Take further action to improve and create new flood defences

Description: This response to sustain flood risk into the future at the current level assumes that we would not undertake any alternative activities. All the increase of risk into the future would be managed by increasing and maintaining our defences. We have identified two areas within the Bedwas and Machen policy unit where there is a big increase in flood risk in the future. The first is along the right bank of the River Rhymney in Machen at the Chatham residential estate, and the second area we have identified is along the left bank of the River Rhymney at Bedwas just downstream of the Pant Glas industrial estate. The increased risk in the future is because our existing flood defences would be overtopped. We trimmed our future flood outlines to show that these areas would benefit from increasing existing defences.

Base case conditions (1% AEP fluvial flood event)

People at risk: Fluvial - 236	Economic risk: Fluvial – £5.9m	Properties at risk: Fluvial – 115	Environmental sites at risk: Fluvial - 0% of Plas Machen Wood SSSI is at risk
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Results of the broad scale modelling (1% AEP fluvial flood event)

People at risk: Fluvial – 291 (+23%)	Economic risk: Fluvial - £7.1 (+20%)	Properties at risk Fluvial – 134 (+17%)	Environmental sites at risk: Fluvial - 0% of Plas Machen Wood SSSI is at risk (No Change)
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Conclusions

Cost: We currently spend approximately £62,000 per year on inspecting and maintaining our defence assets in the Bedwas and Machen policy unit. We have based our costs on increasing existing defences costing £406 per metre. To increase the height of existing defences through Machen would cost approximately £130,000, and along the River Rhymney at Bedwas it would cost in the order of £365,000. However, there would also be the cost of undertaking pre-feasibility studies. Therefore, in total, the indicative cost could be up to £1.0m.

Conclusion: If we continued to maintain and improve our flood defences to account for the additional risk in the future in the main flood risk areas in policy unit two, there will still be a small amount of fluvial flood risk during a 1% AEP fluvial flood event. Our flood risk management approach is to, where possible, move away from the traditional form of structural responses such as defences, in favour of combinations of softer management options. In this policy unit, we feel that in comparison to the rest of the Eastern Valleys the risk and consequences to people and property is relatively low. We therefore think investment might be better targeted on improving emergency planning and flood warning service, and we may not recommend a structural response, such as hard defences, to manage the additional risk into the future in this policy unit. However, we will take this response forward for further consideration into policy appraisal.

Policy unit 2: Bedwas and Machen

Generic response: Policy 4 – Localised Flood Storage

Description: We could implement local scale flood storage schemes to reduce water levels. These would attenuate flows by up to 5%, and would operate at a local scale. Due to topographic restrictions and land constraints, flow attenuation schemes which reduce flows above 5% are not feasible. We ran our broad scale models reducing peak flows by 5% to reflect flood storage.

Base case conditions (1% AEP fluvial flood event)

People at risk: Fluvial - 236	Economic risk: Fluvial – £5.9m	Properties at risk: Fluvial – 115	Environmental sites at risk: Fluvial - 0% of Plas Machen Wood SSSI is at risk
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Results of the broad scale modelling (1% AEP fluvial flood event)

People at risk: Fluvial – 591 (+150%)	Economic risk: Fluvial - £9.8 (+66%)	Properties at risk Fluvial – 257 (+123%)	Environmental sites at risk: Fluvial - 0% of Plas Machen Wood SSSI is at risk (No Change)
Conclusions			
Cost: We do not have unit costs for implementing flood storage schemes but we expect that the costs would be quite high, dependant on the size and location of the schemes.			
Conclusion: In the future, our flood defences would be overtopped if we did not continue to improve them in-line with future increases in water levels. The aim of policy four is to sustain the current level of risk in to the future, although there may be a small amount of risk that we would have to accept. Our broad scale modelling has shown that if we were to adopt small scale flood storage responses alone, the consequences in the future to people, property and the economy would still be high in policy unit two and only slightly lower than the additional consequences shown for the policy three generic response, continue with existing flood defence actions only. This is because our existing flood defences would be overtopped into the future, leading to more flooding. With the level of investment that would be required for introducing storage schemes, compared with the small benefits they would provide, we are not considering this response further for policy unit two. In addition to this there are limited opportunities within the policy unit for implementing such schemes.			

Policy unit 2: Bedwas and Machen			
Generic response: Policy 4 – Increased maintenance			
Description: We currently undertake widespread channel maintenance across policy unit two. We have the option to increase this further, to increase channel capacity and allow flow to be conveyed more freely. This would theoretically reduce flood risk. Our broad scale model was run with channel and flood plain roughness values reduced by 10%, to simulate an increase in our maintenance.			
Base case conditions (1% AEP fluvial flood event)			
People at risk: Fluvial - 236	Economic risk: Fluvial – £5.9m	Properties at risk: Fluvial – 115	Environmental sites at risk: Fluvial - 0% of Plas Machen Wood SSSI is at risk
Results of the broad scale modelling (1% AEP fluvial flood event)			
People at risk: Fluvial – 584 (+147%)	Economic risk: Fluvial - £11.0 (+86%)	Properties at risk Fluvial – 260 (+126%)	Environmental sites at risk: Fluvial - 0% of Plas Machen Wood SSSI is at risk (No Change)
Conclusions			
Cost: We currently spend approximately £62,000 per year on maintenance and operations in Bedwas and Machen. If we were to increase our maintenance programme costs might be expected to increase by approximately 50% (to £93,000 per year).			
Conclusion: In the future, our flood defences would be overtopped if we did not continue to improve them in-line with future increases in water levels. The aim of policy four is to sustain the current level of risk in to the future, although there may be a small amount of risk that we would have to accept. By increasing our channel maintenance throughout the policy unit, we would increase channel capacity. This would allow more water to be contained within the channel, and reduce the flood risk. By undertaking this response alone in Bedwas and Machen, the consequences in the future to people, property and the economy would still be high and only slightly lower than the additional consequences shown for the policy three generic response, continue with existing flood defence actions only. Therefore, this generic response is considered not to be suitable for policy unit two. We already carry out significant maintenance within this policy unit, and it is unlikely that we would be able to increase our current maintenance activities significantly. In addition, the benefits gained from further activities would not out way the additional costs involved. In light of these considerations, we will not be considering this as a generic response to take forward to policy appraisal.			

Policy unit 2: Bedwas and Machen

Generic response: Policy 5 – Take further action to improve and create new flood defences

Description: Taking further action to improve and create new flood defences to reduce flood risk, both now and into the future, assumes that sustaining the current level of risk would be unacceptable. There is not currently a significant fluvial flood risk in policy unit two in comparison to other areas in the Eastern Valleys. However, we have identified under the policy four generic response - take further action to improve and create new defences, two main areas where defences could to be improved. Under policy five, we could take further action to reduce flood risk by building new defences in the following areas: Draethen along the Nant y Draethen, through Machen, and several locations through Bedwas. However, the scheme along the Nant y Draethen would not be economically feasible as cost (see below), would not offset the economic benefit. Therefore, we only trimmed our future fluvial flood outlines (further than the defences P4 generic response) in Bedwas and Machen. This showed that these areas would benefit from new defences.

Base case conditions (1% AEP fluvial flood event)

People at risk: Fluvial - 236	Economic risk: Fluvial – £5.9m	Properties at risk: Fluvial – 115	Environmental sites at risk: Fluvial - 0% of Plas Machen Wood SSSI is at risk
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Results of the broad scale modelling (1% AEP fluvial flood event)

People at risk: Fluvial – 39 (-83%)	Economic risk: Fluvial - £525,000 (-91%)	Properties at risk Fluvial – 9 (-92%)	Environmental sites at risk: Fluvial - 0% of Plas Machen Wood SSSI is at risk (No Change)
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Conclusions

Cost: We currently spend approximately £62,000 per year on inspecting and maintaining our defence assets in the Bedwas and Machen policy unit. We have based our costs on a new flood wall costing £1,500 per metre and increasing existing defences costing £406 per metre. On top of the costs we estimated in policy four (up to £1.0m), we estimated the additional costs under policy five if new defences were built in our selected areas. However, as discussed above and in the conclusion, having weighed up the costs against the benefits, we selected only some fluvial risk areas to be considered under policy five.

Discounted areas

- 300m new defence at Draethen along the Nant y Draethen would cost approximately £450,000.

Selected areas

- 350m new defence along the right bank of the River Rhymney upstream of the Chatham residential estate would cost approximately £525,000.
- Increasing the height of approximately 700m of the existing flood defence along the left bank of River Rhymney through Machen would cost approximately £285,000.
- A combination of raising existing & building new flood defences (550m) along the right bank of River Rhymney in Bedwas adjacent to the Plas Newydd residential area would cost approximately £825,000.
- Raising 700m of existing flood defences along the left bank of River Rhymney in Bedwas (Bedwas Road) would cost approximately £284,000.
- Building new and raising existing flood defences on the left bank of the River Rhymney upstream of Bedwas would cost just under £500,000.

Therefore, the total indicative cost under policy five would be in excess of £3.4m.

Conclusion: We recognise that into the future we must be aware of the potential consequences from fluvial flood events. By increasing the height of existing and building new defences we are taking more action to manage flood risks into the future. Some areas may benefit from new or improved flood defences, although this will be confirmed through more detailed pre-feasibility studies. These areas will be taken forward in our consideration of policy five in the policy appraisal forms

- Building a new defence along the right bank of the River Rhymney upstream of the Chatham residential estate at a cost of £525,000 would protect 16 properties and reduce economic damages by up to £720,000.
- Increasing the height of existing flood defences along the left bank of River Rhymney through

Machen at a cost of £285,000 would protect 47 properties and reduce economic damages by up to £1.3 million.

- A combination of raising existing & building new flood defences along the right bank of River Rhymney adjacent to the Plas Newydd residential area at a cost of £825,000 would protect 47 properties and reduce economic damages by approximately £2.5m.
- Raising existing defences along the left bank of River Rhymney in Bedwas (Bedwas Road) at a cost of approximately £284,000 would protect 6 properties and reduce economic damages by up to £1.5m.
- A combination of raising existing & building new flood defences along the left bank of the River Rhymney upstream of Bedwas at a cost of just under £500,000, would protect 9 properties and reduce economic damages by just over £530,000.

However, we recognise that reducing flood risk in the following areas would not be economically feasible as the benefits would not offset the level of investment:

- Building defences along the Nant y Draethen at Draethen at a cost of approximately £450,000 would only provide protection to approximately 5 properties and reduce economic damages by up to £165,000.

In consideration of the relatively low current fluvial flood risk in this policy unit, under policy five, we suggest that investment should also be targeted towards reviewing existing flood warning areas. Flood warning areas may need to be extended to include Draethen and a small area of Pwllypant. In addition to this, larger areas behind defences may need to be covered by the flood warning service, as it is these communities that are at greatest risk if defences were to breach and/or overtop.

Policy unit 2: Bedwas and Machen

Generic response: Policy 6 – Attenuation

Description: The creation of flow attenuation areas in the Bedwas and Machen policy unit is not feasible. Responses that deliberately promote large scale flooding are not considered as sustainable methods for reducing risk. Setting back defences within either of the two main areas in this policy unit; Bedwas and Machen, is not an option, as much of the floodplain has been developed. In addition to this, the agricultural land downstream of Machen is already being extensively used as floodplains for naturally storing floodwater, and there is no further scope to increase this. This would not help relieve flood risk to the two main areas upstream. There is no scope for broad scale modelling under policy six for the Bedwas and Machen policy unit, so no further action has been undertaken.

Base case conditions (1% AEP fluvial flood event)

People at risk: Fluvial - 236	Economic risk: Fluvial – £5.9m	Properties at risk: Fluvial – 115	Environmental sites at risk: Fluvial - 0% of Plas Machen Wood SSSI is at risk
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Results of the broad scale modelling (1% AEP fluvial flood event)

People at risk: N/A	Economic risk: N/A	Properties at risk: N/A	Environmental sites at risk: N/A
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Conclusions

Cost: N/A

Conclusion: Taking action to increase the frequency of flooding is not feasible in the Bedwas and Machen policy unit, as such, there is not scope for carrying out policy six in this policy unit. Increased frequency of flooding to make space for water would result in high number of people at risk and high economic damages. Deliberately promoting flooding through schemes, which make space for water, would cause large scale community disruption.

The following table summarises the findings of the generic response modelling for policy unit two (Bedwas and Machen). The responses or combination of responses chosen for each policy will be taken forward and compared against the objectives and indicators in table 12.6.

Policy	Generic response
1	Withdraw / retreat defences and stop maintenance
2	Reduced maintenance
3	Risk cannot be managed at the same level of risk by any combination of softer options, such as reducing maintenance and balancing with local flood storage schemes.
4	We have demonstrated that local flood storage schemes and increased maintenance have very little effect for reducing risk in to the future in policy unit two. Using these schemes in combination would not be cost effective given that the costs are not proportional to the benefits they bring. Therefore a response of defences alone has been chosen.
5	A combination of defences and alternative flood risk management options would not be suitable. Therefore a defences alone option has been chosen, although measures such as flood warning and evacuation procedures will be considered as well.
6	Not technically feasible in this policy unit.

Form 12.6: Screening of policy options against appraisal objectives

Policy unit name/number:		Policy unit 2: Bedwas and Machen								
No.	Specific (appraisal) objectives	Indicators	Current baseline	Future baseline	Policy Options					
					P1 No active intervention	P2 Reduce existing actions	P3 Continue with existing actions to maintain current risk	P4 Take further action to sustain current risk	P5 Take further action to reduce current risk	P6 Take further action to increase frequency of flooding
Generic Response					Decreased conveyance Monitoring, advise & survey	Decreased conveyance Influencing and Informing Monitoring, advise & survey Studies	Increased conveyance Influencing and Informing Monitoring, advise & survey Studies	Increased conveyance Influencing and Informing Monitoring, advise & survey Studies	Increased conveyance Influencing and Informing Monitoring, advise & survey Studies	No generic responses applicable as there is no scope for carrying out policy six in this policy unit
PEOPLE										
1.	Reduce the risk of harm to life in Machen	The number of people within the 1% AEP fluvial flood extent where depths of water exceed 0.5m	There are 167 people at risk where depths exceed 0.5m during a 1% AEP fluvial flood event	There will be 491 people at risk where depths exceed 0.5m during a 1% AEP fluvial flood event	There would be 850 people at risk where depths exceed 0.5m during a 1% AEP fluvial flood event	There would be 692 people at risk where depths exceed 0.5m during a 1% AEP fluvial flood event	There would be 491 people at risk where depths exceed 0.5m during a 1% AEP fluvial flood event	There would be 241 people at risk where depths exceed 0.5m during a 1% AEP fluvial flood event	There would be 8 people at risk where depths exceed 0.5m during a 1% AEP fluvial flood event	There is no scope for carrying out policy six in this policy unit. Increased frequency of flooding to make space for water could result in a

Policy unit name/number:		Policy unit 2: Bedwas and Machen								
No.	Specific (appraisal) objectives	Indicators	Current baseline	Future baseline	Policy Options					
					P1 No active intervention	P2 Reduce existing actions	P3 Continue with existing actions to maintain current risk	P4 Take further action to sustain current risk	P5 Take further action to reduce current risk	P6 Take further action to increase frequency of flooding
		The number of properties that are at risk during the 1% AEP fluvial flood event but not within an existing flood warning area	20 properties that are at flood risk during a 1% AEP fluvial flood event are not within an existing flood warning area	85 properties that will be at flood risk during a 1% AEP fluvial flood event would not be within an existing flood warning area	Flood warning areas would be removed under this policy and therefore all properties would not be within a flood warning area. 534 properties that would be at flood risk during a 1% AEP fluvial flood event would not be within an existing flood warning area	Flood warning areas would be removed under this policy and therefore all properties would not be within a flood warning area. 422 properties that would be at flood risk during a 1% AEP fluvial flood event would not be within an existing flood warning area	85 properties that would be at flood risk during a 1% AEP fluvial flood event would not be within an existing flood warning area	23 properties that would be at flood risk during a 1% AEP fluvial flood event would not be within an existing flood warning area	7 properties that would be at flood risk during a 1% AEP fluvial flood event would not be within an existing flood warning area	significant increase in harm to life. Deliberately flooding specific areas to make space for water would cause large-scale community disruption in those areas. We have not identified any areas in the policy unit where we could do this without increasing harm to life.
2.	Reduce community disruption caused by flooding in Machen	The number of community assets at risk during the 1% AEP fluvial flood event	There is 1 community centre (Pwllypant) and 3 retail buildings at flood risk during the 1% AEP fluvial flood event	There will be 2 community centres (Pwllypant) and 7 retail buildings at flood risk during the 1% AEP fluvial flood event	There would be 2 health services (Bedwas, Machen), 1 school (Bedwas), 7 community centres (Bedwas, Machen, Pwllypant, Waterloo) and 28 retail buildings at flood risk during the 1% AEP fluvial flood event	There would be 5 community centres (Bedwas, Pwllypant, Waterloo) and 18 retail buildings at flood risk during the 1% AEP fluvial flood event	There would be 2 community centres (Pwllypant) and 7 retail buildings at flood risk during the 1% AEP fluvial flood event	There would be 2 community centres (Pwllypant) and 5 retail buildings at flood risk during the 1% AEP fluvial flood event	There would be 2 community centres (Pwllypant) at flood risk during the 1% AEP fluvial flood event	There is no scope for carrying out policy six in this policy unit. Increased frequency of flooding to make space for water could result in a significant increase in community disruption.

Policy unit name/number:		Policy unit 2: Bedwas and Machen								
No.	Specific (appraisal) objectives	Indicators	Current baseline	Future baseline	Policy Options					
					P1 No active intervention	P2 Reduce existing actions	P3 Continue with existing actions to maintain current risk	P4 Take further action to sustain current risk	P5 Take further action to reduce current risk	P6 Take further action to increase frequency of flooding
		<p>The number of residential properties at flood risk during the 1% AEP fluvial flood event</p> <p>The duration of flooding (<1 day, 1 day to 5 days, > 5 days)</p> <p>The area of flooding during the 1% AEP fluvial flood event where depth of flooding exceeds 0.5 metres</p>	<p>There are 105 residential properties at flood risk during the 1% AEP fluvial flood event</p> <p>The duration of flooding is between one to five days for the 1% AEP fluvial flood event</p> <p>The flooded area where depths exceed 0.5 metres is 1.3km² (Bedwas) during a 1% AEP fluvial flood event</p>	<p>There will be 257 residential properties at flood risk during the 1% AEP fluvial flood event</p> <p>The duration of flooding will be between one to five days for the 1% AEP fluvial flood event</p> <p>The flooded area where depths exceed 0.5 metres will be 1.8km² (Bedwas, Machen) during a 1% AEP fluvial flood event</p>	<p>There would be 393 residential properties at flood risk during the 1% AEP fluvial flood event</p> <p>The duration of flooding would be between one to five days for the 1% AEP fluvial flood event</p> <p>The flooded area where depths exceed 0.5 metres would be 2.9km² (Bedwas, Machen) during a 1% AEP fluvial flood event</p>	<p>There would be 355 residential properties at flood risk during the 1% AEP fluvial flood event</p> <p>The duration of flooding would be between one to five days for the 1% AEP fluvial flood event</p> <p>The flooded area where depths exceed 0.5 metres would be 2.4km² (Bedwas, Machen) during a 1% AEP fluvial flood event</p>	<p>There would be 257 residential properties at flood risk during the 1% AEP fluvial flood event</p> <p>The duration of flooding would be between one to five days for the 1% AEP fluvial flood event</p> <p>The flooded area where depths exceed 0.5 metres would be 1.8km² (Bedwas, Machen) during a 1% AEP fluvial flood event</p>	<p>There would be 122 residential properties at flood risk during the 1% AEP fluvial flood event</p> <p>The duration of flooding would be between one to five days for the 1% AEP fluvial flood event</p> <p>The flooded area where depths exceed 0.5 metres would be 1.7km² (Bedwas) during a 1% AEP fluvial flood event</p>	<p>There would be 7 residential properties at flood risk during the 1% AEP fluvial flood event</p> <p>The duration of flooding would be between one to five days for the 1% AEP fluvial flood event</p> <p>The flooded area where depths exceed 0.5 metres would be 1.5km² (Bedwas) during a 1% AEP fluvial flood event</p>	<p>Deliberately flooding specific areas to make space for water would cause large-scale community disruption in those areas. We have not identified any areas in the policy unit where we could do this without increasing community disruption.</p>
ECONOMICS										
3.	Reduce flood risk to critical transport routes and critical assets in Bedwas and Machen	The number, length and type of critical asset (police, ambulance, fire station), infrastructure	There is 1 electricity station (Bedwas) and 1.2km of the A468 between Caerphilly and Bedwas at flood risk during the	There will be 2 electricity stations (Bedwas, Machen) and 1.2km of the A468 between Caerphilly and Bedwas at flood	There would be 4 electricity stations (Bedwas, Machen) and 1.7km of the A468 between Caerphilly and Bedwas at flood	There would be 4 electricity stations (Bedwas, Machen) and 1.3km of the A468 between Caerphilly and Bedwas at flood	There would be 2 electricity stations (Bedwas, Machen) and 1.2km of the A468 between Caerphilly and Bedwas at flood	There would be 1 electricity stations (Bedwas) and 1.3km of the A468 between Caerphilly and Bedwas at flood risk during the	There would be 1.2km of the A468 between Caerphilly and Bedwas and no critical assets at flood risk during	There is no scope for carrying out policy six in this policy unit. Increased frequency of flooding to make

Policy unit name/number:		Policy unit 2: Bedwas and Machen									
No.	Specific (appraisal) objectives	Indicators	Current baseline	Future baseline	Policy Options						
					P1 No active intervention	P2 Reduce existing actions	P3 Continue with existing actions to maintain current risk	P4 Take further action to sustain current risk	P5 Take further action to reduce current risk	P6 Take further action to increase frequency of flooding	
		(STW, WTW, gas, electricity, rail or major roads) at risk during the 1% AEP fluvial flood event	1% AEP fluvial flood event	risk during the 1% AEP fluvial flood event	risk during the 1% AEP fluvial flood event	risk during the 1% AEP fluvial flood event	risk during the 1% AEP fluvial flood event	risk during the 1% AEP fluvial flood event	1% AEP fluvial flood event	the 1% AEP fluvial flood event	space for water could result in a significant increase in risk to critical assets and critical transport routes. Deliberately flooding specific areas to make space for water would cause large-scale community disruption in those areas. We have not identified any areas in the policy unit where we could do this without increasing risk to critical assets and critical transport routes
4.	Reduce economic damages caused by flooding in Bedwas and Machen	The total cost of property economic damages during the 1% AEP fluvial flood event	The 1% AEP fluvial flood economic property damages are £5.9m	The 1% AEP fluvial flood economic property damages will be £11.6m	The 1% AEP fluvial flood economic property damages would be £37.4m	The 1% AEP fluvial flood economic property damages would be £20.0m	The 1% AEP fluvial flood economic property damages will be £11.6m	The 1% AEP fluvial flood economic property damages would be £7.1m	The 1% AEP fluvial flood economic property damages would be £525,000	There is no scope for carrying out policy six in this policy unit. Increased frequency of flooding to make	

Policy unit name/number:		Policy unit 2: Bedwas and Machen								
No.	Specific (appraisal) objectives	Indicators	Current baseline	Future baseline	Policy Options					
					P1 No active intervention	P2 Reduce existing actions	P3 Continue with existing actions to maintain current risk	P4 Take further action to sustain current risk	P5 Take further action to reduce current risk	P6 Take further action to increase frequency of flooding
		The total cost of agricultural damages during the 1% AEP fluvial flood extent	The 1% AEP fluvial flood agricultural damages are £221,774	The 1% AEP fluvial flood agricultural damages will be £297,773	The 1% AEP fluvial flood agricultural damages would be £404,957	The 1% AEP fluvial flood agricultural damages would be £356,032	The 1% AEP fluvial flood agricultural damages will be £297,773	The 1% AEP fluvial flood agricultural damages would be £281,635	The 1% AEP fluvial flood agricultural damages would be £255,362	space for water could result in a significant increase in risk to critical assets and critical transport routes. Deliberately flooding specific areas to make space for water would cause large-scale community disruption in those areas. We have not identified any areas in the policy unit where we could do this without increasing risk to critical assets and critical transport routes
5.	Optimise the level of Flood Risk Management expenditure. Ensure investment is proportional to the risks	The indicative costs of our flood risk management actions	We currently spend approximately £62,000 per year on maintenance and operations	We will spend more than we currently spend on maintenance and operations as risk is going to increase in the future in the Eastern Valleys, placing more demand on our resources and	No construction or maintenance costs associated with undertaking this policy but it would be necessary to devise a strategy, and withdraw over a number of years, monitoring the situation once this	We would expect costs to reduce by half to £31,000 per year. However, the risks would significantly increase	We would continue to spend £62,000 per year on maintenance and operations. However, the risks would increase	Indicative costs to improve and build new defences would cost approximately £1.0 million. Maintenance costs will increase as a result.	Indicative costs to improve and build new defences would cost approximately £3.4 million. Maintenance costs will increase as a result.	There is no scope for carrying out policy six in this policy unit. Constructing formal flood storage areas would cost many millions of pounds. Deliberately promoting flooding

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No.	Specific (appraisal) objectives	Indicators	Current baseline	Future baseline	Policy Options						
					P1 No active intervention	P2 Reduce existing actions	P3 Continue with existing actions to maintain current risk	P4 Take further action to sustain current risk	P5 Take further action to reduce current risk	P6 Take further action to increase frequency of flooding	
				expenditure.	had been done.						through schemes that make space for water would cause large scale community disruption to Bedwas and Machen and the Eastern Valleys as a whole
ENVIRONMENT											
6.	Ensure no deterioration of designated international and national nature conservation sites, in particular the Plas Machen Wood SSSI	The percentage area of each SSSI affected during the 1% AEP fluvial flood event	There are no SSSIs at risk during the 1% AEP fluvial flood event.	0.1% of the Plas Machen Wood SSSI will be at risk during the 1% AEP fluvial flood event.	14% of the Plas Machen Wood SSSI would be at risk during the 1% AEP fluvial flood event. This could negatively impact on habitats and species intolerant of waterlogging, particularly if flooding is by low quality water, but benefit wet woodland and waterlogged habitats on the site.	6% of the Plas Machen Wood SSSI would be at risk during the 1% AEP fluvial flood event. This could negatively impact on habitats and species intolerant of waterlogging, particularly if flooding is by low quality water, but benefit wet woodland and waterlogged habitats on the site.	0.1% of the Plas Machen Wood SSSI would be at risk during the 1% AEP fluvial flood event. As such a small area is affected the impact is likely to be neutral.	There would be no SSSIs at risk during the 1% AEP fluvial flood event.	There would be no SSSIs at risk during the 1% AEP fluvial flood event.	There is no scope for carrying out policy six in this policy unit. Increased frequency of flooding to make space for water would result in a higher percentage area of risk to designated sites. Deliberately promoting flooding through schemes that make space for water would cause large scale community disruption to Bedwas and	

Policy unit name/number:		Policy unit 2: Bedwas and Machen								
No.	Specific (appraisal) objectives	Indicators	Current baseline	Future baseline	Policy Options					
					P1 No active intervention	P2 Reduce existing actions	P3 Continue with existing actions to maintain current risk	P4 Take further action to sustain current risk	P5 Take further action to reduce current risk	P6 Take further action to increase frequency of flooding
										Machen and the Eastern Valleys as a whole
7.	Protect and improve habitats and species diversity, particularly BAP habitats and those relying on freshwater.	BAP habitats and species at risk during the 1% AEP fluvial flood event	<p>The following BAP habitats are at risk during a 1% AEP fluvial flood event:</p> <ul style="list-style-type: none"> • Ponds • Reedbeds • Rhos pastures • Rivers, streams and floodplains • Wet woodland <p>The following BAP species are at risk during a 1% AEP fluvial flood event:</p> <ul style="list-style-type: none"> • Brown Trout • Double Line Moth • Lapwing • Otter • Reed Bunting • White-clawed Crayfish. 	<p>The following BAP habitats are likely to experience more frequent and longer duration of flooding in the future:</p> <ul style="list-style-type: none"> • Ponds • Reedbeds • Rhos pastures • Rivers, streams and floodplains • Wet woodland <p>The following BAP species are likely to experience more frequent and longer duration of flooding in the future:</p> <ul style="list-style-type: none"> • Brown Trout • Double Line Moth • Lapwing • Otter • Reed Bunting • White-clawed Crayfish. 	<p>The following BAP habitats are likely to experience more frequent and longer duration flooding as a result of Policy 1:</p> <ul style="list-style-type: none"> • Ponds • Reedbeds • Rhos pastures • Rivers, streams and floodplains • Wet woodland <p>The following BAP species are likely to experience more frequent and longer duration flooding as a result of Policy 1:</p> <ul style="list-style-type: none"> • Brown Trout • Double Line Moth • Lapwing • Otter • Reed Bunting • White-clawed Crayfish 	<p>The following BAP habitats are likely to experience more frequent and longer duration flooding as a result of Policy 2:</p> <ul style="list-style-type: none"> • Ponds • Reedbeds • Rhos pastures • Rivers, streams and floodplains • Wet woodland <p>The following BAP species are likely to experience more frequent and longer duration flooding as a result of Policy 2:</p> <ul style="list-style-type: none"> • Brown Trout • Double Line Moth • Lapwing • Otter • Reed Bunting • White-clawed Crayfish. 	<p>The following BAP habitats are likely to experience more frequent and longer duration flooding as a result of Policy 3:</p> <ul style="list-style-type: none"> • Ponds • Reedbeds • Rhos pastures • Rivers, streams and floodplains • Wet woodland <p>The following BAP species are likely to experience more frequent and longer duration flooding as a result of Policy 3:</p> <ul style="list-style-type: none"> • Brown Trout • Double Line Moth • Lapwing • Otter • Reed Bunting • White-clawed Crayfish. 	<p>The following BAP habitats are likely to be at risk to the same extent as under current baseline conditions, as a result of Policy 4:</p> <ul style="list-style-type: none"> • Ponds • Reedbeds • Rhos pastures • Rivers, streams and floodplains • Wet woodland <p>The following BAP species are likely to be at risk to the same extent as under current baseline conditions, as a result of Policy 4:</p> <ul style="list-style-type: none"> • Brown Trout • Double Line Moth • Lapwing • Otter • Reed Bunting 	<p>The following BAP habitats are likely to experience less frequent and shorter duration flooding as a result of Policy 5:</p> <ul style="list-style-type: none"> • Ponds • Reedbeds • Rhos pastures • Rivers, streams and floodplains • Wet woodland <p>The following BAP species are likely to experience less frequent and shorter duration flooding as a result of Policy 5:</p> <ul style="list-style-type: none"> • Brown Trout • Double Line Moth • Lapwing • Otter 	There is no scope for carrying out policy six in this policy unit. Increased frequency of flooding to make space for water would result in an increased number of BAP species being at risk from flooding. Deliberately promoting flooding through schemes that make space for water would cause large scale community disruption to Bedwas and Machen and the Eastern Valleys as a whole

Policy unit name/number:		Policy unit 2: Bedwas and Machen								
No.	Specific (appraisal) objectives	Indicators	Current baseline	Future baseline	Policy Options					
					P1 No active intervention	P2 Reduce existing actions	P3 Continue with existing actions to maintain current risk	P4 Take further action to sustain current risk	P5 Take further action to reduce current risk	P6 Take further action to increase frequency of flooding
								<ul style="list-style-type: none"> White-clawed Crayfish. 	<ul style="list-style-type: none"> Reed Bunting White-clawed Crayfish. 	
8.	Manage flood risk to Listed Buildings in Bedwas and Machen and ensure sites which are currently 'safe' do not become at risk of flooding.	The number of Listed Buildings within the 1% AEP fluvial flood extent	There are 5 Listed Buildings at risk during the 1% AEP fluvial flood event.	There will be 5 Listed Buildings at risk during the 1% AEP fluvial flood event.	There would be 6 Listed Buildings at risk during the 1% AEP fluvial flood event.	There would be 6 Listed Buildings at risk during the 1% AEP fluvial flood event.	There would be 6 Listed Buildings at risk during the 1% AEP fluvial flood event.	There would be 5 Listed Buildings at risk during the 1% AEP fluvial flood event.	There would be 3 Listed Buildings at risk during the 1% AEP fluvial flood event.	There is no scope for carrying out policy six in this policy unit. Deliberately promoting flooding through schemes that make space for water would cause large scale community disruption to Bedwas and Machen and the Eastern Valleys as a whole.

Form 12.7: Summary of the relative overall losses (including flood risk management costs) and gains (including flood alleviation benefits), thus demonstrating the rationale behind selecting the preferred option

Policy unit name/number:	Policy unit 2: Bedwas and Machen		
Policy options	Losses	Gains	Preferred policy option
Policy option P1			
Environmental	<p>LOW- A 14% increase in the area of Plas Machen Wood SSSI at risk from a 1% AEP fluvial flood event. This would negatively impact upon habitats and species intolerant of waterlogging on the site. In particular, flooding from non-fluvial sources, such as groundwater or the sewerage system would have negative impacts.</p> <p>LOW- More frequent and longer duration flooding may adversely affect habitats intolerant of waterlogging. Impacts will be particularly severe if inundation is from low quality water or non-fluvial sources.</p> <p>LOW- Increase in BAP species at risk of flooding from a 1% AEP fluvial flood event.</p> <p>LOW- One additional listed building would be at risk from a 1% AEP fluvial flood event.</p>	<p>LOW+ 14% increase in the area of Plas Machen Wood SSSI at risk from a 1% fluvial flood event. This is unlikely to negatively affect, and may positively benefit, wet woodland and waterlogged habitats on the site.</p> <p>LOW+ More frequent and longer duration flooding may enhance water-dependent habitats.</p> <p>LOW+ Stopping river maintenance and not maintaining defences may benefit BAP species through reduced disturbance. In particular, Otter, Reed Bunting and White-clawed Crayfish are likely to benefit.</p>	Not preferred option – in comparison to risk and consequences as a result of flooding across other areas of the Eastern Valleys, flood risk is comparatively low, and further investment towards a structural response is considered not to be justified.
Social	<p>HIGH- 840 additional people at risk from flooding</p> <p>HIGH- 683 additional people located within flood risk areas where flood depths exceed 0.5 metres</p> <p>MEDIUM- 288 additional residential properties at risk from flooding</p> <p>MEDIUM- 253 additional properties would not be within an existing flood warning area</p> <p>MEDIUM- 2 additional health services, 1 school, 6 community centres and 25 retail buildings at risk from flooding</p> <p>MEDIUM- An additional 1.6km² of land where depths exceed 0.5 metres at risk from flooding</p>		
Economic	<p>HIGH- £31.5m increase in economic damages to properties</p> <p>MEDIUM- 3 additional electricity stations at risk from flooding</p> <p>LOW- £183,183 increase in agricultural damages</p> <p>LOW- 0.5km increase in length of A468 at risk from flooding</p>	<p>MEDIUM+ - £62,000 ASM saving due to stopping maintenance activities</p>	

Policy unit name/number:	Policy unit 2: Bedwas and Machen		
Policy options	Losses	Gains	Preferred policy option
Policy option P2			
Environmental	<p>LOW- A 6% increase in the area of Plas Machen Wood SSSI at risk from a 1% AEP fluvial flood event. This would negatively impact upon habitats and species intolerant of waterlogging on the site. In particular, flooding from non-fluvial sources, such as groundwater or the sewerage system would have negative impacts.</p> <p>LOW- More frequent and longer duration flooding may adversely affect habitats intolerant of waterlogging. Impacts will be particularly severe if inundation is from low quality water or non-fluvial sources.</p> <p>LOW- Increase in BAP species at risk of flooding from a 1% AEP fluvial flood event.</p> <p>LOW- One additional listed building would be at risk from a 1% AEP fluvial flood event.</p>	<p>LOW+ A 6% increase in the area of Plas Machen Wood SSSI at risk from a 1% fluvial flood event. This is unlikely to negatively affect, and may positively benefit, wet woodland and waterlogged habitats on the site.</p> <p>LOW+ More frequent and longer duration flooding may enhance water-dependent habitats.</p> <p>LOW+ Reduced maintenance may benefit BAP species through reduced disturbance. In particular, Otter, Reed Bunting and White-clawed Crayfish are likely to benefit.</p>	Not preferred option – in comparison to risk and consequences as a result of flooding across other areas of the Eastern Valleys, flood risk is comparatively low, and further investment towards a structural response is considered not to be justified.
Social	<p>HIGH- 636 additional people at risk from flooding</p> <p>HIGH- 525 additional people located within flood risk areas where flood depths exceed 0.5 metres</p> <p>MEDIUM- 250 additional residential properties at risk from flooding</p> <p>MEDIUM- 160 additional properties would not be within an existing flood warning area</p> <p>MEDIUM- 4 additional community centres and 15 retail buildings at risk from flooding</p> <p>MEDIUM- An additional 1.1km² of land where depths exceed 0.5 metres at risk from flooding</p>		
Economic	<p>HIGH- £14.1m increase in economic damages to properties</p> <p>MEDIUM- 3 additional electricity stations at risk from flooding</p> <p>LOW- £134,258 increase in agricultural damages</p> <p>LOW- 0.1km increase in length of A468 at risk from flooding</p>	<p>MEDIUM+ - £31,000 ASM saving due to reducing maintenance activities</p>	
Policy option P3			
Environmental	<p>NEUTRAL = A 0.1% increase in the area of the Plas Machen Wood SSSI at risk from a 1% AEP fluvial flood event is unlikely to negatively affect the site as the area affected is so small.</p>		<p>✓ Continue with existing or alternative actions to manage flood risk at the</p>

Policy unit name/number:	Policy unit 2: Bedwas and Machen		
Policy options	Losses	Gains	Preferred policy option
	<p>LOW- One additional listed building would be at risk from a 1% AEP fluvial flood event.</p> <p>LOW- More frequent and longer duration flooding may adversely affect habitats intolerant of waterlogging. Impacts will be particularly severe if inundation is from low quality water or non-fluvial sources.</p> <p>LOW- Increase in BAP species at risk of flooding from a 1% AEP fluvial flood event.</p>	<p>LOW+ More frequent and longer duration flooding may enhance water-dependent habitats.</p>	<p>current level – preferred policy</p> <p>In comparison to other areas across the Eastern Valleys flood risk into the future is low, and it is considered that the risk that will be present can be managed through influencing and informing.</p>
Social	<p>MEDIUM- 408 additional people at risk from flooding</p> <p>MEDIUM- 327 additional people located within flood risk areas where flood depths exceed 0.5 metres</p> <p>MEIDUM- 152 additional residential properties at risk from flooding</p> <p>LOW- 65 additional properties would not be within an existing flood warning area</p> <p>LOW- 1 additional community centres and 4 retail buildings at risk from flooding</p> <p>LOW- An additional 0.4km² of land where depths exceed 0.5 metres at risk from flooding</p>		
Economic	<p>NEUTRAL= no change in critical transport routes at risk from flooding</p> <p>NEUTRAL= no change in maintenance and operations expenditure</p> <p>LOW- £5.7m increase in economic damages to properties</p> <p>LOW- 1 additional electricity stations at risk from flooding</p> <p>LOW- £75,999 increase in agricultural damages</p>		
Policy option P4			
Environmental	<p>NEUTRAL = No SSSIs at risk from a 1% AEP fluvial flood event in the policy unit.</p> <p>NEUTRAL = No change in the frequency or duration of flooding to BAP habitats or species.</p> <p>NEUTRAL= No increase in the number of listed buildings at risk from a 1% AEP fluvial flood event in the policy unit.</p>		<p>Not preferred option – in comparison to risk and consequences as a result of flooding across other areas of the Eastern Valleys, flood risk is comparatively low,</p>

Policy unit name/number:	Policy unit 2: Bedwas and Machen		
Policy options	Losses	Gains	Preferred policy option
	<p>MEDIUM- Delivery of CFMP policy to sustain current flood risk may reduce the quality and quantity of the BAP habitat and species within the policy unit. Rivers, streams and floodplains, Brown Trout, Otter and White-clawed Crayfish are likely to be particularly affected.</p> <p>LOW- Delivery of CFMP policy to sustain current flood risk may negatively affect the Plas Machen Wood SSSI.</p>		and further investment towards a structural response is considered not to be justified.
Social	<p>LOW- 55 additional people at risk from flooding</p> <p>LOW- 74 additional people located within flood risk areas where flood depths exceed 0.5 metres</p> <p>LOW- 17 additional residential properties at risk from flooding</p> <p>LOW- 3 additional properties would not be within an existing flood warning area</p> <p>LOW- 1 additional community centres and 2 retail buildings at risk from flooding</p> <p>LOW- An additional 0.3km² of land where depths exceed 0.5 metres at risk from flooding.</p>		
Economic	<p>NEUTRAL= no change in critical assets at risk from flooding</p> <p>NEUTRAL= no change in critical transport routes at risk from flooding</p> <p>LOW- £1.2m increase in economic damages to properties</p> <p>LOW- £59,861 increase in agricultural damages</p>		
Policy option P5			
Environmental	<p>NEUTRAL = No SSSIs at risk from a 1% AEP fluvial flood event in the policy unit.</p>		Not preferred option – in comparison to risk and consequences as a result of

Policy unit name/number:	Policy unit 2: Bedwas and Machen		
Policy options	Losses	Gains	Preferred policy option
	<p>MEDIUM- Delivery of CFMP policy to reduce current flood risk may reduce the quality and quantity of the BAP habitat and species within the policy unit. Rivers, streams and floodplains, Brown Trout, Otter and White-clawed Crayfish are likely to be particularly affected.</p> <p>LOW- Less frequent and shorter duration flooding of BAP habitats may adversely affect habitats dependent on waterlogging.</p> <p>LOW- Delivery of CFMP policy to reduce current flood risk may negatively affect the Plas Machen Wood SSSI.</p>	<p>LOW+ Less frequent and shorter duration flooding of BAP habitats will benefit BAP habitats intolerant of waterlogging.</p> <p>LOW+ A decrease in the number of BAP species at risk from a 1% AEP fluvial flood event.</p> <p>LOW+ The number of listed buildings at risk from a 1% AEP fluvial flood event reduces from 5 to 3.</p>	flooding across other areas of the Eastern Valleys, flood risk is comparatively low, and further investment towards a structural response is considered not to be justified.
Social	<p>LOW- An additional 0.15km² of land where depths exceed 0.5 metres at risk from flooding</p>	<p>MEDIUM+ 39 people (-197) at risk from flooding</p> <p>MEDIUM+ 8 people (-159) located within flood risk areas where flood depths exceed 0.5 metres</p> <p>MEDIUM+ 7 properties (-13) would not be within an existing flood warning area</p> <p>MEDIUM+ 7 residential properties (-98) at risk from flooding</p> <p>LOW+ - No retail buildings at risk from flooding (-3), two community centres at risk from flooding (+1)</p>	
Economic	<p>NEUTRAL= no change in critical transport routes at risk from flooding</p> <p>LOW- £353,588 increase in agricultural damages</p>	<p>MEDIUM+ £525,000 economic damages to properties (-£5.3m)</p> <p>LOW+ - No critical assets at risk from flooding (-1 electricity station)</p>	
Policy option P6			
Environmental	There is no scope for carrying out policy six in this policy unit. Increased frequency of flooding to make space for water would result in a very high number of people at risk and very high economic damages. Deliberately promoting flooding through schemes that make space for water would cause large-scale community disruption to Bedwas and Machen and the Eastern Valleys as a whole.		Not preferred option – there is no scope for carrying out policy six in this policy unit.

Policy unit name/number:	Policy unit 2: Bedwas and Machen		
Policy options	Losses	Gains	Preferred policy option
Social			There is very limited opportunity for increasing the frequency of flooding as a flood risk management option within this policy unit.
Economic			

Key

HIGH:	<p>High negative</p> <p>A policy has a 'high negative' effect where it could contribute to a social, economic or environmental objective in a significantly negative way.</p> <p>A 'high negative' effect could be:</p> <ul style="list-style-type: none"> (i) a very large increase in current flood risk; (ii) very large projected increases in flood risk under future conditions, and/or; (iii) significant additional social, economic and/or environmental losses.
MEDIUM:	<p>Medium negative</p> <p>A policy has a 'medium negative' effect where it could contribute to a social, economic or environmental objective in a negative way.</p> <p>A 'medium negative' effect could be:</p> <ul style="list-style-type: none"> (i) an increase in current flood risk; (ii) a projected increase in flood risk under future conditions, and/or; (iii) social, economic and/or environmental losses.
LOW:	<p>Low negative</p> <p>A policy has a 'low negative' effect where it could make a limited contribution to a social, economic or environment objective, but where the overall contribution would be negative.</p> <p>A 'low negative' effect could be:</p> <ul style="list-style-type: none"> (i) an overall increase in current flood risk; (ii) an overall increase in flood risk under future conditions, and/or; (iii) overall social, economic and/or environmental losses.
NEUTRAL:	<p>Neutral</p> <p>A policy has a 'neutral' effect where it makes neither a positive or negative contribution to a social, economic or environmental objective.</p> <p>A 'neutral' effect could be:</p> <ul style="list-style-type: none"> (i) no change in current level of risk. In this instance the current level of risk would have to be low, so that the residual risk after a neutral policy was implemented remained acceptable; (ii) no change in flood risk under future conditions. In this instance projected future risk would need to be low so that the residual risk after a neutral policy was implemented remained acceptable, and/or; (iii) no additional social, economic and/or environmental gains or losses. <p>Policy options may also be 'neutral' where they are not relevant in a particular policy unit, or where it is not feasible for a policy option to contribute to an objective.</p>
HIGH:	<p>High positive</p> <p>A policy has a 'high positive' effect where it could contribute to a social, economic or environmental objective in a significantly positive way.</p> <p>A 'high positive' effect could be:</p> <ul style="list-style-type: none"> (i) a very large reduction in current flood risk; (ii) avoiding/reducing very large projected increases in flood risk under future conditions, and/or; (iii) significant additional social, economic and/or environmental gains.
MEDIUM:	<p>Medium positive</p> <p>A policy has a 'medium positive' effect where it could contribute to a social, economic or environmental objective in a positive way.</p> <p>A 'medium positive' effect could be:</p> <ul style="list-style-type: none"> (i) a reduction in current flood risk; (ii) avoiding/reducing projected increases in flood risk under future conditions, and/or; (iii) additional social, economic and/or environmental gains.
LOW:	<p>Low positive</p> <p>A policy has a 'low positive' effect where it could make a limited contribution to a social, economic or environment objective, but where the overall contribution would be positive.</p> <p>A 'low positive' effect could be:</p> <ul style="list-style-type: none"> (i) an overall reduction in current flood risk; (ii) an overall avoidance/reduction in flood risk under future conditions,

Form 12.8: Summary of the preferred policy

Policy Unit name/number:	<p>Policy Unit 2: Bedwas and Machen</p> <p>The policy unit is located within the mid reaches of the Eastern Valleys CFMP area. The policy unit covers the main areas of Bedwas and Machen.</p>
Problem / risk:	<p>The main river within this policy unit is the River Rhymney. There is also another minor right bank tributary, the Nant y Draethen, which flows through the village of Draethen and joins the River Rhymney downstream of Machen. The main source of flooding within this policy unit is fluvial. Other secondary sources of flooding within this policy unit include surface and sewer flooding. We currently spend approximately £62,000 per year on maintenance and operations in this policy unit.</p> <p>Current fluvial risk within the policy unit presents some flood risk but is considered to be low in comparison to the rest of the Eastern Valleys.</p> <p>Under both current and future conditions the risk to people and property is relatively high for the 0.1% AEP extreme fluvial events.</p>
Policy selected	<p>Policy 3 – continue with existing or alternative actions to manage flood risk at the current level</p> <p>We have selected this policy based on the risk posed by inland flooding sources and tidal flooding sources. By selecting this policy we are accepting that flood risk will increase in time from the current level of risk. We consider that the additional risk that will be present in the future can be minimised through influencing and informing.</p> <p>If the risks posed by tidal flooding were removed from the policy appraisal process, preliminary estimates suggest that this policy would remain a P3. This is because there is no tidal flood risk in this policy unit.</p> <p>The flood risk in the Bedwas and Machen is considered to be managed appropriately and should not change in the future.</p>
Justification and alternative policies considered	<p>Policy 3 sets a framework where we will continue with existing or alternative actions to manage flood risk at the current level. This policy is appropriate for this policy unit for the following reasons:</p> <ul style="list-style-type: none"> - The current level of flood risk is low in comparison to other areas of the Eastern Valleys - The increase in flood risk into the future is low in comparison to other areas of the Eastern Valleys - The additional risk into the future can be minimised through continued and improved influencing and informing - Community disruption under this option remains relatively low - Risk to critical assets and transport routes under this option remains low - The existing flood defences should be maintained in order to maintain water levels through Bedwas and Machen - The current level of maintenance should be continued as existing activities help to improve conveyance, reducing the impacts of flooding and maintaining water levels. <p>The main areas of Bedwas and Machen are situated along the middle reaches of the River Rhymney. The existing floodplain of the River Rhymney through Bedwas and Machen is restricted by the presence of flood defences along several stretches of both the right and left banks, the majority of which were constructed in the 1980s. There is also a residual risk of these defences breaching, so properties located behind these flood defences are extremely vulnerable.</p> <p>The current scale of fluvial flood risk during a 1% AEP flood event in the main areas of Bedwas and Machen is relatively low in comparison to other areas in the Eastern Valleys. The estimated total property damages for Bedwas and Machen are £138,000 and £102,000 for a 10% AEP fluvial flood event and £700,000 and</p>

	<p>£1.4 million for the 1% AEP fluvial flood event. The level of risk increases for the 0.1% AEP fluvial flood event, with estimated total property damages being £30 million and £7.5 million, respectively. It can be seen that the damages principally arise from the more extreme events, which is due to our flood defences (with varying SoPs up to 1% AEP) overtopping. Across the policy unit the 1% AEP fluvial flood event would affect approximately 115 properties, and critical assets and transport routes at flood risk are one electricity station in Bedwas and a 1.2km stretch of the A468.</p> <p>In the future, the 1% AEP fluvial flood event damages for the main areas of Bedwas and Machen will increase. We will accept and manage the additional risk through influencing and informing because when compared to other areas of the Eastern Valleys, the increase in flood risk into the future is relatively low, and it will be necessary for us to target our investment in higher risk areas where consequences to people and property are more significant. Property damages in Bedwas and Machen will increase to £1.7 million and £5.0 million, respectively. Across the policy unit 294 properties will be at risk from flooding and the critical assets and transport routes at flood risk will be two electricity stations and 1.2km of the A468.</p> <p>The expected current annual damages in the main areas of Bedwas and Machen are £51,000/yr and £91,000/yr respectively. The expected annual damages could increase by over 50% in the future as a result of the impacts of climate change and further development planned within the policy unit.</p>
<p>Justification and alternative policies considered</p>	<p>Gains and losses under preferred policy (policy three)</p> <p><i>Social</i> Policy three gives three low and three medium losses against our social CFMP objectives and indicators. We would be accepting some flood risk by selecting policy three as our preferred policy but the social consequences are low in comparison to other areas of the Eastern Valleys. For more extreme events such as the 0.1% AEP flood event, we accept that we cannot protect people, property and the economy from flooding.</p> <p><i>Economic</i> Policy three gives three low and two neutral losses against our economic CFMP objectives and indicators. The risk to critical assets and transport routes are low in policy unit two, and the economic damages we are accepting are mainly a result of flooding to industrial areas.</p> <p><i>Environmental</i> Policy three gives one neutral, three low losses and one low gain against our environmental CFMP objectives and indicators. There are a limited number of environmental sites within the policy unit and we do not expect that an increase in flooding will have a significant negative impact on environmental sites.</p> <p>Alternative policies considered</p> <p>Policy one – <i>No active intervention</i>. The increased risk to people (+840), properties (+419) and the economy (+£31.5m) would be high and there would be significant and high increases in risks in the future.</p> <p>Policy two – <i>Reduce current levels of flood risk management</i>. The increased risk to people (+636), properties (+307) and the economy (+£14m) would be high and there would be significant and high increases in risks in the future.</p> <p>Policy four – <i>Take further action to sustain the current level of flood risk into the future</i>. In comparison to risk and consequences as a result of flooding across other areas of the Eastern Valleys, flood risk is comparatively low, and further investment towards a structural response is considered not to be justified.</p>

	<p>Policy five – <i>Take further action to reduce flood risk (now and/or into the future)</i>. In comparison to risk and consequences as a result of flooding across other areas of the Eastern Valleys, flood risk is comparatively low, and further investment towards a structural response is considered not to be justified.</p> <p>Policy six – <i>Take action with others to store water or manage run-off in locations that provide overall flood risk reduction or environmental benefits, locally or elsewhere in the catchment</i>. There is no scope for carrying out policy six in this policy unit. There is very limited opportunity for increasing the frequency of flooding as a flood risk management option within this policy unit.</p>
Catchment-wide opportunities & constraints	<p>There may be opportunities to use alternative maintenance activities throughout the policy unit to enable gradual enhancement of channel habitats.</p> <p>There are few opportunities within this policy unit to reconnect the river with its floodplain in this policy unit as the river corridor downstream of Bedwas and Machen are already used for floodplain storage.</p>
Actions	<ul style="list-style-type: none"> • Initiate urban drainage studies for Bedwas and Machen to identify surface water drainage issues and potential for remediation. • Review asset management systems. • In partnership with Caerphilly Local Authority we should enforce stringent building controls on new development within flood risk areas. Suitable land allocations for new development should first be sought outside of flood risk areas. • SUDs and building regulations (resilience) should be incorporated, where appropriate, into all new developments.
Risks, uncertainties & dependencies	<p>The damages across the Bedwas and Machen policy unit from flooding are estimates that are considered sufficiently accurate to justify selecting policy three. However, there are uncertainties surrounding the choice of future scenarios and this policy has been selected based on our future scenario that used a combination of high climate change and low urbanisation projections.</p> <p>An existing model of the River Rhymney between Bedwas and Machen was used, this was supplemented by more a small section of broadscale modeling to ensure all the risk was assessed in the policy unit. There is more uncertainty with the broadscale modeling than areas with existing models.</p>

Form 12.9: Requirements for further policy development and appraisal

Is there a need for further policy development?	No
If yes, then mark Policy Options for more detailed development. Some complex policies may require more detailed development, probably at Strategy Plan level.	
Is there a need for further more detailed appraisal?	No
If yes, take forward to Strategy study.	

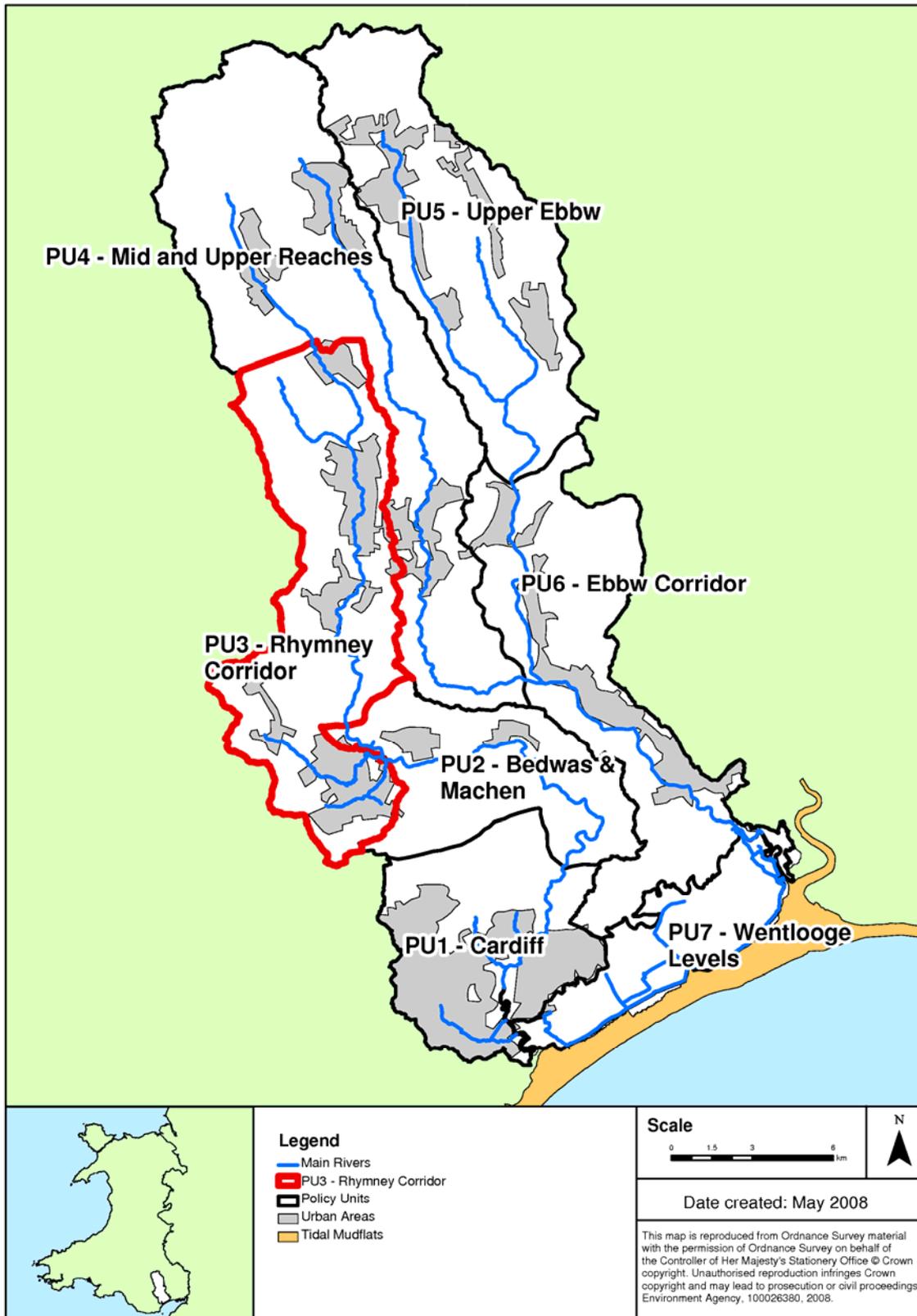
Form 12.10: Indicators for monitoring, review and evaluation

Set out the indicators that need to be included in the policy implementation plan, for policy monitoring, drawing on the residual risks and likely impacts identified above. This will allow better review and evaluation of the policy when implemented.	
Monitoring	Significance/impact
Hydrometric monitoring of river flows and levels, rainfall and groundwater levels throughout the catchment in order to monitor changes in climate	<ul style="list-style-type: none"> • Additional data may change our assessment of current or future conditions

Set out the indicators that need to be included in the policy implementation plan, for policy monitoring, drawing on the residual risks and likely impacts identified above. This will allow better review and evaluation of the policy when implemented.

Monitoring	Significance/impact
Scientific advancements in flood risk management	<ul style="list-style-type: none"> Improved predictions in changes to river flows
Land use change monitored using satellite imagery	<ul style="list-style-type: none"> Further information on land use change may change future predictions of flood risk
Actual development rates	<ul style="list-style-type: none"> Need to check if urbanisation predictions made are realistic in light of current and future development undertaken
Designation and condition of environmental sites	<ul style="list-style-type: none"> May change the chosen policy if additional sites are designated. Monitoring of site condition will confirm that chosen CFMP policies have not adversely affect designated sites
Designation and condition of historic environmental assets	<ul style="list-style-type: none"> May change the chosen policy if additional sites are designated. Monitoring of site condition will confirm that chosen CFMP policies have not adversely affect designated sites
Detrimental impacts of flood risk management projects on BAP habitats and species	<ul style="list-style-type: none"> To ensure that specific flood risk management projects do not adversely affect BAP habitats and species
Level of uptake of flood warning services	<ul style="list-style-type: none"> Monitor whether the community are aware of the flood risks
Condition of flood defences	<ul style="list-style-type: none"> Need to maintain defences in line with the policy chosen
Actual expenditure on maintenance activities by policy unit, subdivided into activities.	<ul style="list-style-type: none"> Ensure that money is being targeted according to policy chosen
Actual expenditure on capital works to reduce flood risk	<ul style="list-style-type: none"> Need to ensure that these actions are in keeping with the policy chosen
Improved documentation of actual flood events: <ul style="list-style-type: none"> Number of properties/assets/ environmental sites/historic environment assets flooded Source of flooding Cause of flooding Whether due to defence failure 	<ul style="list-style-type: none"> Information on actual flood events needs to be better recorded in order to understand the relative importance of the various sources of flooding
Construction of critical infrastructure	<ul style="list-style-type: none"> May change the chosen policy if additional critical infrastructure is constructed within the floodplain

Spatial location of policy unit 3: Rhymney Corridor



Form 12.5: Summary of current and future levels of and responses to flood risk

Policy unit name/number:	Policy Unit 3: Rhymney Corridor
Current responses to flood risk within the policy unit?	<p>Defences We defend the main urban areas in policy unit three, namely Ystrad Mynach (including Llanbradach) and Caerphilly, using raised earth, concrete and blockstone defences with berms along both sides of the River Rhymney. River-re-sectioning has also been used in Caerphilly. A new flood defence scheme in New Tredegar is currently being built.</p> <p>The defences in Ystrad Mynach were constructed in 1985/86. The defences extend from Ystrad Mynach to Cooper’s Bridge on the right bank of the River Rhymney, and from Cooper’s Bridge to Duffryn Industrial Estate on the left bank. The areas protected by these defences include: the council office and Ystrad Mynach Hospital; Duffryn Industrial Estate; properties at Coed-Y-Pia, Telor-Y-Coed and Bryngwennol; an area to the west of the A469 road bridge.</p> <p>The defence along the River Rhymney in Caerphilly were constructed in the late 1960s. There is also a defence scheme along the Nant Y Aber in Caerphilly.</p> <p>Flood Warning We provide a flood warning service via Floodline Warnings Direct. Flood Warning Area 103FWFg03 covers fluvial flood risk from the River Rhymney in Ystrad Mynach and Llanbradach (including Duffryn Industrial Estate), and 103FWFg04 covers fluvial risk from the River Rhymney in Caerphilly and New Tredegar. The lead times for flood warning in policy unit three are approximately 3 hours. We aim to issue flood warnings at least 2 hours before a flood event occurs. There are currently 722 properties at flood risk during a 1% AEP fluvial flood event, 324 of which lie within the existing flood warning areas. Uptake to the flood warning service is unknown.</p> <p>Maintenance of existing structures We carry out routine maintenance works on all main rivers in policy unit three. In Ystrad Mynach and Llanbradach we undertake: routine mowing and spraying to maintain the River Rhymney channel capacity; blockstone repairs to maintain the flood defences; shoal removal to maintain the River Rhymney channel capacity and tree management to maintain channel conveyance. In Caerphilly we undertake: routine mowing and spraying to maintain the River Rhymney channel capacity and trashing and obstruction removal to ensure channel conveyance along Porset Brook at Lansbury Park.</p> <p>The Rhymney Corridor policy unit is covered by four asset systems. FR19S050, FR19S049 and FR19S047 are high risk asset systems and inspected every 6-12 months. FR19S048 is a medium risk asset system, inspected every 18 to 24 months. We currently spend approximately £105,000 per year on maintenance and operations in policy unit three.</p>
Standards of service that apply to flood defences within the policy unit?	<p>Standard of Protection All of the flood defences in the Rhymney Corridor policy unit offer a 1% AEP Standard of Protection (SoP) in most places, apart from the Nant Y Aber defence scheme where the SoP is unknown.</p> <p>All of these defences are likely to be overtopped when allowances are made for climate change into the future.</p> <p>Condition and maintenance of defences This information is unknown.</p>
What is currently	People

exposed to flooding?

We estimate that there are currently 1,467 people at risk of flooding in policy unit three from a 1% AEP fluvial flood event. The fluvial flood risk comes from the River Rhymney, Porset Brook, Nant Y Aber, Nant Cylla and an unnamed tributary, and the main risk to people during the 1% AEP fluvial flood event is in Ystrad Mynach and Caerphilly.

Flood risk does increase significantly during the 0.1% AEP fluvial flood event because all flood defences are overtopped.

Community Disruption

We estimate that there are currently 722 properties at risk of flooding in policy unit three from a 1% AEP fluvial flood event, 621 of which are residential. Community assets at flood risk are two health services in Lansbury Park, two schools in Hengoed and 77 retail buildings.

Critical Infrastructure

We estimate that there is 0.8km of the A472 through Ystrad Mynach at flood risk during a 1% AEP fluvial flood event. The only critical asset at risk is one electricity station in Caerphilly.

Economic Damages

We estimate the total economic property damages resulting from the 1% AEP fluvial flood event to be £26.6 million.

We estimate the total economic agricultural damages resulting from the 1% AEP fluvial flood event to be £213,728.

Historic Environment

We estimate that six listed buildings are at current flood risk from a 1% AEP fluvial flood event.

Landscape

We estimate that there are currently no landscape receptors at flood risk from a 1% AEP fluvial flood event in policy unit three.

Recreation

We estimate that there are currently no recreational areas at flood risk in policy unit three from the 1% AEP fluvial flood event.

Nature conservation sites

We estimate that there are currently no designated nature conservation sites at flood risk from a 1% AEP fluvial flood event in policy unit three.

BAP Habitats

The exact location of BAP habitats in the catchment is unknown, but we estimate that several locally important habitats, identified in the Caerphilly Local BAP, will be at risk of flooding. These habitats include; blanket bog, fens, lakes and reservoirs, ponds, reedbeds, rhos pastures, rivers, streams and floodplains, and wet woodland.

Species

The exact location of BAP species in the catchment is unknown, but we estimate that several locally important species, identified in the Caerphilly Local BAP, will be at risk of flooding. These species include Brown Trout, the Double Line Moth, Great Crested Newt, Lapwing, Marsh Fritillary Butterfly, Otter and Reed Bunting.

Who and what

Social and economic receptors

<p>are currently most vulnerable to flood damage and losses?</p>	<p>People living in areas behind flood defences are the most vulnerable to flooding due to the high depths and velocities of flood water that would be expected if a breach occurred in the defence scheme or the defences were overtopped. The residential areas in Caerphilly have the highest economic damages during a 1% AEP fluvial flood event.</p> <p>Environmental receptors</p> <p>The 6 listed buildings at current risk from a 1% AEP fluvial event are likely to be negatively affected by flooding.</p> <p>BAP habitats and species in the unit are at greatest risk from prolonged or frequent floodwater inundation, especially by low quality water, which can indirectly degrade habitats. However, some wetland BAP habitats, and the species they support, may benefit from increased flooding.</p>
<p>What are the key factors that could drive future flood risk?</p>	<p>Climate change</p> <p>Climate change is the main driver of future flood risk in the Eastern Valleys. Climate change will result in higher flows and higher tide levels, which will increase water levels in our rivers. This will put pressure on existing flood defences and will result in the current Standard of Protection of our channels and flood defences being reduced. Flooding under our modelled future scenarios of climate change would cause significantly more damage and pose a significantly higher risk to people and property than existing conditions.</p> <p>Land use management changes</p> <p>We have decided not to consider the impact of land use change outside of urban areas on future flood risk in this CFMP. Agricultural intensification and changes in drainage practices are unrealistic scenarios because the Eastern Valleys has poor quality soils that are unsuitable for agricultural intensification. It is also constrained by the steep gradients of the land, meaning arable farming is impossible in certain areas. It is very difficult for us to predict the future of agriculture in the Eastern Valleys beyond the immediate future. It may be that extensification is a more realistic long-term scenario, where land is farmed less intensively and for environmental benefits. However, it is unlikely that extensification would have little impact on flood risk as the area is not intensively farmed at present.</p> <p>Development in the flood plain</p> <p>Increased urbanisation will result in increased flood volumes and higher peak water levels, and flooding would occur more quickly. Unless runoff from new urban development within and outside of floodplains is balanced flood risk will increase locally and downstream. Development in the floodplain should only be allowed when no other suitable land allocations are available and any buildings within floodplains should have flood resilience measures incorporated into their design, and floodplain compensation would be necessary.</p> <p>Flood defence failure</p> <p>In the event of flood defence infrastructure failing during a flood event, the resulting flood water depths and velocities would be very high. There would also be very little flood warning time for people located close to existing flood defences. Therefore, the risk of harm to life would be very high and the resulting economic damages would be very high. The areas most vulnerable to flood defence failure in policy unit three are Ystrad Mynach, Caerphilly and Llanbradach residential areas as properties are built right behind defences.</p>
<p>What are the possible future levels of flood risk under the main</p>	<p>Our final future scenario that we used to assess possible future levels of flood risk considered a combination of the two main drivers, climate change and urbanisation. We have identified the following. We show the total numbers at risk, with the increase from current conditions in brackets:</p>

scenarios?	<p>People</p> <p>In the future, we estimate that there will be 2855 (+1,388) people at risk of flooding from a 1% AEP fluvial flood event. The increase in people at risk during these events is mainly due to our 1% SoP flood defences overtopping.</p>	
	<p>Community Disruption</p> <p>In the future, we estimate that there will be 1,308 (+586) properties at risk of flooding from a 1% AEP fluvial flood event, 1,130 (+509) of which are residential. Community assets will also be at flood risk in the future 1% AEP fluvial flood event: two health services in Lansbury Park (+0), three schools in Hengoed and Llanbradach (+1), two hospitals in Ystrad Mynach (+2), five community centres in Ystrad Mynach, Abertridwr, Lansbury Park and Aberbargoed (+5) and 83 retail buildings (+6).</p>	
<p>Critical Infrastructure</p> <p>In the future, we estimate that there will be 1.1km (+0.3km) of the A472 through Ystrad Mynach and 0.5km (+0.5km) of the A469 through Llanbradach at flood risk during a 1% AEP fluvial flood event. Critical assets at risk will be one police station in Llanbradach (+1) and four electricity stations in Caerphilly, Llanbradach and Ystrad Mynach (+3).</p>		
<p>Economic Damages</p> <p>In the future, we estimate the total economic property damages resulting from the 1% AEP fluvial flood event will be £61.3 million (+£34.7m).</p> <p>In the future, we estimate the total economic agricultural damages resulting from the 1% AEP fluvial flood event will be £321,306 (+£107,578).</p>		
<p>Historic Environment</p> <p>In the future, two additional listed buildings will be at risk from a 1% AEP fluvial flood event. Therefore, eight listed buildings in total will be affected.</p>		
<p>Landscape</p> <p>In the future, we estimate that there will be no landscape receptors at flood risk from a 1% AEP fluvial flood event in policy unit three.</p>		
<p>Recreation</p> <p>In the future, we estimate that there will be one recreational area (+1) at flood risk in a 1% AEP fluvial flood event.</p>		
<p>Nature conservation sites</p> <p>In the future, we estimate that there will be no nature conservation sites at flood risk from a 1% AEP fluvial flood event in policy unit three.</p>		
<p>BAP Habitats</p> <p>The exact location of BAP habitats in the catchment is unknown. However, we estimate that in the future an increasing area of the locally important BAP habitats identified above will be at risk of flooding.</p>		
<p>Species</p> <p>The exact location of BAP species in the catchment is unknown. However, we estimate that in the future an increasing number of the locally important BAP species identified above will be at risk of flooding.</p>		
What potential	Generic Response/Strategic	Response

responses (or groups of responses) are being considered to manage flood risk?	Attenuation/retention	<ul style="list-style-type: none"> ▪ On-line storage ▪ Off-line storage 	<p>Could be opportunities for small-scale FSR within this policy unit. Particularly balancing of new development, particularly on the tributaries of the Rhymney.</p>
		<ul style="list-style-type: none"> ▪ SUDS - new/retrospective 	<p>A potential method for reducing surface water runoff and should be included in all new developments.</p>
	Increased or decreased conveyance	<ul style="list-style-type: none"> ▪ River maintenance 	<p>Ongoing maintenance activities include mowing and spraying, shoal removal, blockstone repairs, tree management, and trashing and obstruction removal particularly through Caerphilly. Reduced/increased maintenance activities within this policy unit should be considered further.</p>
		<ul style="list-style-type: none"> ▪ Fluvial defences 	<p>We defend the main areas in this policy unit, namely Caerphilly and Ystrad Mynach, using raised earth, concrete and blockstone defences with berms along both sides of the River Rhymney. River resectioning was also carried out. There are also defences along the Nant Yr Aber through Caerphilly. New Tredegar is currently undefended although there are plans in place for a new scheme. Fluvial flood risk in this policy unit is high and this strategic option will likely be a key response.</p>
	Influencing and informing	<ul style="list-style-type: none"> ▪ Flood awareness 	<p>National campaign. Should be continued and awareness increased within this policy unit where the flood risk from fluvial flooding is high.</p>
		<ul style="list-style-type: none"> ▪ Flood warning and evacuation 	<p>Existing flood warning areas - uptake to FWD unknown but likely to be opportunity to increase. In light of future flood risk, it is likely that the flood warning area may need extending, particularly in Ystrad Mynach.</p>
		<ul style="list-style-type: none"> ▪ Emergency & disaster planning/response 	<p>Policy unit covered by Caerphilly Local Authority. Existing emergency plans in place, which should be reviewed and updated as new information becomes available.</p>
		<ul style="list-style-type: none"> ▪ Planning policy, Development control 	<p>Continue to follow Welsh Assembly Government policies. Caerphilly Local Authority should ensure that suitable land allocations outside flood risk areas are sought first.</p>
		<ul style="list-style-type: none"> ▪ Relocation of properties 	<p>May need to be considered over the long-term in New Tredegar.</p>
		<ul style="list-style-type: none"> ▪ Building regulations (resilience) 	<p>To be incorporated into all new developments located within flood risk areas.</p>

	Monitoring, advise and survey	<ul style="list-style-type: none"> Data and information 	To continue despite policy selected.
		<ul style="list-style-type: none"> Asset inspection 	Half of the policy unit (including Caerphilly and Ystrad Mynach) is classified as high risk and therefore assets are inspected every 6-12 months. Upstream of Ystrad Mynach the policy unit is classified as medium risk and assets are inspected every 18-24 months. It is recommended that once the scheme in New Tredegar is finished, this area be increased to high risk to ensure more regular asset inspection, as fluvial flood risk is high.
		<ul style="list-style-type: none"> Hydrometric network 	One flood warning level gauge at Bargoed on the Rhymney, and triggers are in place for Flood Watch, Flood Warning and Severe Flood Warning. Due to the high flood risk from tributaries through Caerphilly and Ystrad Mynach, it is recommended that these tributaries may benefit from level gauges to provide improved flood warning.
	Studies	<ul style="list-style-type: none"> Flood risk mapping 	Existing flood risk management studies undertaken in 2005/2006. All studies should be revisited as more data become available.
		<ul style="list-style-type: none"> Flood forecasting 	No existing studies. A flood forecasting study may be beneficial.
		<ul style="list-style-type: none"> Pre-feasibility 	Pre-feasibility has been undertaken in New Tredegar where there is a planned scheme. Further pre-feasibility studies may be necessary particularly on the tributaries presenting high flood risks to Caerphilly and Ystrad Mynach.
		<ul style="list-style-type: none"> Strategy plans 	Recommended that a strategy plan should be undertaken to target areas where pre-feasibility studies are needed.
		<ul style="list-style-type: none"> SAMPs 	Policy unit covered by SAMPs. Likely that they will need reviewing to take into account future flood risk.
		<ul style="list-style-type: none"> Urban drainage plans 	Expected that there are existing plans for Caerphilly and Ystrad Mynach. Further significant urban expansion will need plans to ensure that flood risk will not increase within the towns or further downstream.
	What gaps and uncertainties are there in knowledge, and what assumptions have been made?	<p>Broadscale modelling</p> <ul style="list-style-type: none"> Broadscale hydrology and hydraulic modelling techniques used; Where no existing models are available, these have been supplemented by other modelling techniques. Existing models were available for the River Rhymney between Ystrad Mynach and Caerphilly, as was a smaller model for New Tredegar. <p>Future scenarios</p> <ul style="list-style-type: none"> Although climate change projections are based on current guidance, these are 	

still estimations;

- Urbanisation projections up until the year 2100 are based on current rates of urbanisation.

Data limitations

- No data on the percentage uptake of properties located in Flood Warning Areas;
- No data on the condition of flood defences/maintenance regime.
- The exact locations of BAP habitats and species within the policy unit are unknown.

Broad scale Modelling Tables

Generic Response Modelling

The following tables provide a summary of how flooding will change in response to flood management options which may be adopted within policy unit two and what the implications of these changes might be. We have not applied any specific measures or schemes to the policy unit, but rather have applied what has been termed a 'generic response'. This represents the most likely outcome of a given policy, but is not specific and does not reflect any proposed scheme or project. It simply allows a broad assessment of what the impact of that policy might be.

Our broad scale models have been used to investigate the impact of these changes and have allowed us to quantify the effect on flood damages. We compare the risks for each generic response against the current base case conditions (the risk which currently exists in the catchment today). The results given below for each of the generic responses (i.e. the appropriate scenario for that part of the catchment) are for the 1% AEP fluvial flood event.

We have unit costs available for defences; however, the costs of flow attenuation schemes are not available. The cost of large scale flow attenuations scheme would be extremely high, as they form heavy structural response to flood risk. More local schemes for attenuating flow would cost less, but the costs would still be high compared to defences.

Policy Unit 3: Rhymney Corridor

Generic Response: Policy 1 - Withdraw/retreat defences and decreased conveyance

Description: We used our broad scale River Rhymney, Porset Brook, Nant Y Aber and Nant Cylla models to assess the combined effects of not maintaining defences and stopping river maintenance. Channel and floodplain roughness values in our broad scale models were increased from 0.04 and 0.06 to 0.075 and 0.095 respectively, to reflect the increase of roughness expected if maintenance were stopped. Defences were not removed from the model as their impact was considered negligible, due to them being overtopped.

Base case conditions (1% AEP fluvial flood event)

People at risk: Fluvial – 1,467	Economic risk: Fluvial – £26.6m	Properties at risk: Fluvial – 722	Environmental sites at risk: N/A
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Results of the broad scale modelling (1% AEP fluvial flood event)

People at risk: Fluvial – 4,226 (+188%)	Economic risk: Fluvial – £95.0m (+257%)	Properties at risk: Fluvial – 1,899 (+163%)	Environmental sites at risk: N/A
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Conclusions

Cost: Nothing - no active intervention

Conclusion: The results of this modelling have indicated that if we stopped our maintenance of the defences and channels in policy unit three the risk to people, properties and the economy would increase. The impact of 'no active intervention' in this policy unit is significant, because we would be encouraging more flooding to occur. Our defences and the maintenance we undertake on the River Rhymney, Nant Y Aber and Porset Brook throughout the Rhymney Corridor policy unit are important in reducing the risk of flooding.

We would withdraw our current flood warning service that we provide under this generic response.

Policy Unit 3: Rhymney Corridor

Generic Response: Policy 2 – Reduced maintenance

Description: The active removal of the defences we maintain in and around the Rhymney Corridor would not be a sustainable flood risk management strategy. The SoP of defences in this policy unit varies, but most generally have a SoP up to 1% AEP, so provide considerable protection. We could reduce our flood risk management around the Rhymney Corridor policy unit by relaxing our maintenance activities, such as weed-cutting and clearing. We increased channel and floodplain roughness in the Rhymney broad scale models from 0.04 and 0.06 to 0.055 and 0.075 respectively, to reflect the increase of roughness expected if maintenance were reduced.

Base case conditions (1% AEP fluvial flood event)

People at risk: Fluvial – 1,467	Economic risk: Fluvial – £26.6m	Properties at risk: Fluvial – 722	Environmental sites at risk: N/A
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Results of the broad scale modelling (1% AEP fluvial flood event)

People at risk: Fluvial – 3,648 (+149%)	Economic risk: Fluvial - £83.9m (+215%)	Properties at risk: Fluvial – 1,684 (+133%)	Environmental sites at risk: N/A
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Conclusions

Cost: We currently spend approximately £105,000 per year on maintenance and operations in policy unit three. Under policy two we would not stop this regime, but we would scale down our programme, for example we may downgrade a high risk flood risk management system (FRMS) to a medium FRMS, or lower the funding available to a medium FRMS, which may reduce funding by up to 50% (to £52,500 per year).

Conclusion:

If we were to reduce our maintenance regime, water levels would be expected to increase and bring additional risk to people. During a 1% AEP fluvial event in the future, all the defences we maintain within the policy unit would be overtopped if we did not increase them in line with future increases in water levels. By reducing our maintenance the risk to people, property, the economy and the environment would be increased further. This is because channel capacity would reduce and more flooding would occur.

Policy Unit 3: Rhymney Corridor

Generic Response: Policy 3 – Continue with existing flood defence actions only

Description: This response to manage risk at the same level assumes that we would not undertake any alternative flood risk management actions, and that we would continue to maintain our defences at their current level. We would also continue our river maintenance, which allows the rivers to flow freely, at the same level. The current level of flood risk management under the chosen future scenario of climate change and increased urbanisation was modelled for Chapter 4.

Base case conditions (1% AEP fluvial flood event)

People at risk: Fluvial – 1,467	Economic risk: Fluvial – £26.6m	Properties at risk: Fluvial – 722	Environmental sites at risk: N/A
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Results of the broad scale modelling (1% AEP fluvial flood event)

People at risk: Fluvial – 2,855 (+95%)	Economic risk: Fluvial - £61.3m (+130%)	Properties at risk: Fluvial – 1,308 (+81%)	Environmental sites at risk: N/A
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Conclusions

Cost: The Rhymney Corridor policy unit covers four flood risk management systems, for which we currently spend approximately £105,000 per year on maintenance, assets and operations. We would continue investing this much in the future.

Environment Agency Wales

Conclusion: In the past our management of flood risk has been mainly through building defences. We could continue investing in flood risk management and maintenance of these defences at the current level. To increase them into the future would require additional investment and is discussed under the P4 option. The results from this model show that if we did not undertake any maintenance of the flood defences, the risk to people, property and the economy in Ystrad Mynach and Caerphilly, would increase.

Policy Unit 3: Rhymney Corridor

Generic Response: Policy 3 – Reduced maintenance balanced by flood storage

Description: An alternative, softer approach to flood risk management is that we could relax our channel maintenance regime. This would raise water levels as channel capacity would reduce (as modelled under policy two). To compensate for this we could implement local scale flood storage schemes to reduce water levels. These would attenuate flows by up to 5%, and would operate at a local scale. We ran our broad scale models with increased channel and flood plain roughness values to assess the affects of a reduction in channel capacity, by relaxing our channel maintenance regime (roughness values as per policy two). Combined with this, we reduced the flows by 5% to reflect flood storage.

Base case conditions (1% AEP fluvial flood event)

People at risk: Fluvial – 1,467	Economic risk: Fluvial – £26.6m	Properties at risk: Fluvial – 722	Environmental sites at risk: N/A
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Results of the broad scale modelling (1% AEP fluvial flood event)

People at risk: Fluvial – 2,859 (+95%)	Economic risk: Fluvial - £65.1m (+145%)	Properties at risk: Fluvial – 1,319 (+83%)	Environmental sites at risk: N/A
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Conclusions

Cost: We currently spend approximately £105,000 per year on maintenance and operations in policy unit three. If we were to scale down our regime, investment may reduce by up to 50% (to £52,500 per year). We do not have unit costs for implementing flood storage schemes but we expect that the costs would be higher than we currently spend on maintenance. Therefore the overall cost of this response is expected to be quite high, depending on the size and location of the flood storage schemes.

Conclusion: As we discussed above for the policy two generic response, reducing maintenance encourages more flooding. If we were to combine this with reducing flows by 5%, we have shown that we could not compensate for this risk and are unable to further reduce risk beyond what is achievable with defences alone at their current level. This demonstrates that in the Rhymney Corridor policy unit, we would not be able to achieve the goal of policy three using combinations of other flood risk management options. In Caerphilly (particularly close to Porset Brook and Nant Y Aber) we recognise the need to improve the number of people who are signed up to receive flood warnings, and we will look to improve this in the future, especially if the number of people at risk would increase under policy three. In addition, the costs of implementing flood storage schemes would not be economically justifiable when the risk is not reduced further than keeping defences as they are now.

Policy three manages risk in the future at the current level of flood risk management activity. However, our broad scale modelling has shown that this combination of generic responses is unlikely to meet this objective, and costs would be considerable in implementing local flood storage schemes. This suggests that a continuation of our work in inspecting and maintaining our defences is a more suitable and cost effective strategy.

Policy Unit 3: Rhymney Corridor

Generic Response: Policy 4 – Take further action to improve and create new flood defences

Description: This response to sustain flood risk into the future at the current level assumes that we would not undertake any alternative activities. We have identified five areas within the Rhymney Corridor policy unit where there is a big increase in flood risk in the future. These are: 1) along the right bank of Nant Cylla in Ystrad Mynach, adjacent to Pantycelyn Street; 2) along the right bank of the River Rhymney in Ystrad Mynach at Coedcae Mawr; 3) along the left bank of the River Rhymney at Duffryn Business Park; 4) along the right bank of the River Rhymney, north of Llanbradach, adjacent to Coed-Y-Pia; 5) along the right bank of the River Rhymney at Llanbradach. The increased risk in the future is because our existing flood defences would be overtopped in places. We trimmed our future flood outlines to show that

these areas would benefit from increasing existing or building new defences.

Base case conditions (1% AEP fluvial flood event)

People at risk: Fluvial – 1,467	Economic risk: Fluvial – £26.6m	Properties at risk: Fluvial – 722	Environmental sites at risk: N/A
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Results of the broad scale modelling (1% AEP fluvial flood event)

People at risk: Fluvial – 1,632 (+11%)	Economic risk: Fluvial - £29.8m (+12%)	Properties at risk: Fluvial – 790 (+9%)	Environmental sites at risk: N/A
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Conclusions

Cost: We currently spend approximately £105,000 per year on inspecting and maintaining our defence assets in the Rhymney Corridor policy unit. We have based our costs on building new defences costing £1,500 per metre, and increasing existing defences costing £406 per metre. To increase the height of existing defences and build new defences in the five areas listed above would cost approximately £2.4 million. However, there would also be the cost of undertaking pre-feasibility studies. Therefore, in total, the indicative cost could be in excess of £2.5 million.

Conclusion: If we continued to maintain and improve our flood defences to account for the additional risk in the future in the main flood risk areas in policy unit three, there will still be a high amount of fluvial flood risk during a 1% AEP fluvial flood event. Our flood risk management approach is to, where possible, move away from the traditional form of structural responses such as defences, in favour of combinations of softer management options. Improving existing and building new defences along the River Rhymney and Nant Cylla will provide protection to approximately 563 properties, reducing economic damages by approximately £32.3m.

Policy Unit 3: Rhymney Corridor

Generic Response: Policy 4 – Localised Flood Storage

Description: We could implement local scale flood storage schemes to reduce water levels. These would attenuate flows by up to 5%, and would operate at a local scale. Due to topographic restrictions and land constraints, flow attenuation schemes which reduce flows above 5% are not feasible. We ran our broad scale models reducing peak flows by 5% to reflect flood storage.

Base case conditions (1% AEP fluvial flood event)

People at risk: Fluvial – 1,467	Economic risk: Fluvial – £26.6m	Properties at risk: Fluvial – 722	Environmental sites at risk: N/A
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Results of the broad scale modelling (1% AEP fluvial flood event)

People at risk: Fluvial – 2,777 (+89%)	Economic risk: Fluvial - £59.3m (+123%)	Properties at risk: Fluvial – 1,279 (+77%)	Environmental sites at risk: N/A
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Conclusions

Cost: We do not have unit costs for implementing flood storage schemes but we expect that the costs would be quite high, dependant on the size and location of the schemes.

Conclusion: In the future, our flood defences would be overtopped if we did not continue to improve them in-line with future increases in water levels. The aim of policy four is to sustain the current level of risk in to the future, although there may be a small amount of risk that we would have to accept. Our broad scale modelling has shown that if we were to adopt small scale flood storage responses alone, the consequences in the future to people, property and the economy would still be high in policy unit three and only slightly lower than the additional consequences shown for the policy three generic response, continue with existing flood defence actions only. This is because our existing flood defences would be overtopped into the future, leading to more flooding. With the level of investment that would be required for introducing storage schemes, compared with the small benefits they would provide, we are not considering this response further for policy unit three. In addition to this there are limited opportunities within the policy unit for implementing such schemes.

Policy Unit 3: Rhymney Corridor			
Generic Response: Policy 4 – Increased maintenance			
Description: We currently undertake widespread channel maintenance across policy unit three. We have the option to increase this further, to increase channel capacity and allow flow to be conveyed more freely. This would theoretically reduce flood risk. Our broad scale model was run with channel and flood plain roughness values reduced by 10%, to simulate an increase in our maintenance.			
Base case conditions (1% AEP fluvial flood event)			
People at risk: Fluvial – 1,467	Economic risk: Fluvial – £26.6m	Properties at risk: Fluvial – 722	Environmental sites at risk: N/A
Results of the broad scale modelling (1% AEP fluvial flood event)			
People at risk: Fluvial – 2,800 (+91%)	Economic risk: Fluvial - £61.0m (+129%)	Properties at risk: Fluvial – 1,290 (+79%)	Environmental sites at risk: N/A
Conclusions			
Cost: We currently spend approximately £105,000 per year on maintenance and operations in the Rhymney Corridor policy unit. If we were to increase our maintenance programme costs might be expected to increase by approximately 50% (to £157,500 per year).			
Conclusion: In the future, our flood defences would be overtopped if we did not continue to improve them in-line with future increases in water levels. The aim of policy four is to sustain the current level of risk in to the future, although there may be a small amount of risk that we would have to accept. By increasing our channel maintenance throughout the policy unit, we would increase channel capacity. This would allow more water to be contained within the channel, and reduce the flood risk. By undertaking this response alone in the Rhymney Corridor policy unit, the consequences in the future to people, property and the economy would still be high and only slightly lower than the additional consequences shown for the policy three generic response, continue with existing flood defence actions only. Therefore, this generic response is considered not to be suitable for policy unit three. We already carry out significant maintenance within this policy unit, and it is unlikely that we would be able to increase our current maintenance activities significantly. In addition, the benefits gained from further activities would not out way the additional costs involved. In light of these considerations, we will not be considering this as a generic response to take forward to policy appraisal.			

Policy unit 3: Rhymney Corridor			
Generic response: Policy 5 – Take further action to improve and create new flood defences			
Description: Taking further action to improve and create new flood defences to reduce flood risk, both now and into the future, assumes that sustaining the current level of risk would be unacceptable. There is currently a very significant fluvial flood risk in policy unit three in comparison to other areas in the Eastern Valleys. We have identified under the policy four generic response - take further action to improve and create new defences, five main areas where defences could to be improved or new ones built. Under policy five, we could take further action to reduce flood risk by building new defences in the following areas: 1) four locations along Porset Brook in Caerphilly; 2) along the River Rhymney in Llanbradach; 3) along Nant Cylla and the unnamed tributary in Ystrad Mynach; 4) along Nant Cylla in Pen-Pedair Heol; 5) two locations along the River Rhymney in New Tredegar. However, two of the schemes along Porset Brook would not be economically feasible as cost (see below), would not offset the economic benefit. Therefore, we only trimmed our future fluvial flood outlines (further than the defences P4 generic response) in the remaining locations. This showed that these areas would benefit from new defences.			
Base case conditions (1% AEP fluvial flood event)			
People at risk: Fluvial - 1467	Economic risk: Fluvial – £26.6m	Properties at risk: Fluvial – 722	Environmental sites at risk: N/A
Results of the broad scale modelling (1% AEP fluvial flood event / 0.5% AEP tidal flood event)			
People at risk: Fluvial – 208 (-86%)	Economic risk: Fluvial - £3.6m (-86%)	Properties at risk: Fluvial – 56 (-92%)	Environmental sites at risk: N/A
Conclusions			

Cost: We currently spend approximately £105,000 per year on inspecting and maintaining our defence assets in the Rhymney Corridor policy unit. We have based our costs on a new flood wall costing £1,500 per metre and increasing existing defences costing £406 per metre. We have based costs of upgrading existing culverts costing £399 per metre. On top of the costs we estimated in policy four (in excess of £2.5m), we estimated the additional costs under policy five if new defences were built in our selected areas. However, as discussed above and in the conclusion, having weighed up the costs against the benefits, we selected only some fluvial risk areas to be considered under policy five.

Selected areas

- 140m of new defences at Llanbradach along the right bank of the River Rhymney would cost approximately £210,000.
- 900m of new defence at Ystrad Mynach along both Nant Cylla (right bank) and the unnamed tributary (left bank) would cost approximately £1.35 million.
- 750m of new defences at Pen Pedair Heol along the left bank of Nant Cylla would cost approximately £1.2 million.
- 1.1km of new defences at New Tredegar along the right and left banks of the River Rhymney would cost approximately £1.7 million.
- 115m new defence at Caerphilly along the Porset Brook, adjacent to Bedwas Road, would cost approximately £172,500.
- 827m of new defences at Caerphilly along the left and right banks of Porset Brook, adjacent to Virginia Park and Lansbury Park, would cost approximately £1.2 million.
- Upgrading 1000m of existing culvert at Caerphilly, along Porset Brook close to Caerphilly Castle, would cost approximately £500,000.

Discounted areas

- 366m of new defences at Caerphilly, along the left and right banks of Porset Brook, adjacent to Crescent Road, would cost approximately £549,000.

Therefore, the total indicative cost under policy five would be in excess of £9m, including costs from the P4 defences generic response and the cost of undertaking pre-feasibility studies.

Conclusion: We recognise that into the future we must be aware of the potential consequences from fluvial flood events. By increasing the height of existing and building new defences we are taking more action to manage flood risks into the future. We suggest that the current and future risk in the following areas is high and the benefits that would be gained from building defences may warrant new investment and should be explored further. These areas will be taken forward in our consideration of policy five in the policy appraisal forms:

- Building a new defence at Llanbradach along the right bank of the River Rhymney at a cost of £210,000 would protect 12 properties and reduce economic damages by up to £216,000.
- Building a new defence at Ystrad Mynach along the right bank of Nant Cylla and the left bank of the unnamed tributary, at a cost of £1.35 million, would protect 202 properties and reduce economic damages by up to £6.2 million.
- Building a new defence at Pen Pedair Heol along the left bank of Nant Cylla at a cost of £1.2 million would protect 96 properties and reduce economic damages by up to £1.7 million.
- Building a new defence at New Tredegar along the left and right banks of the River Rhymney at a cost of £1.7 million would protect 107 properties and reduce economic damages by up to £5 million.
- Building a new defence at Caerphilly, along the left bank of Porset Brook adjacent to Bedwas Road, at a cost of £172,500, would protect 5 properties and reduce economic damages by up to £241,000.
- Building a new defence at Caerphilly, along the left and right banks of Porset Brook adjacent to Virginia Park and Lansbury Park, at a cost of £1.2 million would protect 178 properties and reduce economic damages by up to £5.3 million.
- Upgrading the existing culvert at Caerphilly along Porset Brook close to Caerphilly Castle, at a cost of £500,000 would protect 80 properties and reduce economic damages by up to £4.8 million.

However, we recognise that reducing flood risk in the following areas would not be economically feasible as the benefits would not offset the level of investment:

- Building a new defence at Caerphilly, along the left and right banks of Porset Brook adjacent to Crescent Road, at a cost of £549,000, would protect 14 properties and reduce economic damages by up to £329,000.

Policy Unit 3: Rhymney Corridor

Generic Response: Policy 6 – Attenuation

Description: The creation of flow attenuation areas in the Rhymney Corridor policy unit is not feasible. Responses that deliberately promote large scale flooding are not considered as sustainable methods for reducing risk. Setting back defences within any of the main areas in this policy unit; Ystrad Mynach and Caerphilly, is not an option, as much of the floodplain has been developed. There is no scope for broad scale modelling under policy six for the Rhymney Corridor policy unit, so no further action has been undertaken.

Base case conditions (1% AEP fluvial flood event)

People at risk: Fluvial - 1467	Economic risk: Fluvial – £26.6m	Properties at risk: Fluvial – 722	Environmental sites at risk: N/A
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Results of the broad scale modelling (1% AEP fluvial flood event)

Economic risk: N/A	People at risk: N/A	Properties at risk: N/A	Environmental sites at risk: N/A
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Conclusions

Cost: N/A

Conclusion: Taking action to increase the frequency of flooding is not feasible in the Rhymney Corridor policy unit, as such, there is not scope for carrying out policy six in this policy unit. Increased frequency of flooding to make space for water would result in high number of people at risk and high economic damages. Deliberately promoting flooding through schemes, which make space for water, would cause large scale community disruption.

The following table summarises the findings of the generic response modelling for policy unit three (Rhymney Corridor). The responses or combination of responses chosen for each policy will be taken forward and compared against the objectives and indicators in table 12.6.

Policy	Generic response
1	Withdraw / retreat defences and stop maintenance.
2	Reduced maintenance.
3	Risk cannot be managed at the same level of risk by any combination of softer options, such as reducing maintenance and balancing with local flood storage schemes.
4	We have demonstrated that local flood storage schemes and increased maintenance have very little effect for reducing risk in to the future in policy unit three. Using these schemes in combination would not be cost effective given that the costs are not proportional to the benefits they bring. Therefore a response of defences alone has been chosen.
5	A combination of defences and alternative flood risk management options would not be suitable. Therefore a defences alone option has been chosen, although measures such as flood warning and evacuation procedures will be considered as well.
6	Not technically feasible in this policy unit.

Form 12.6: Screening of policy options against appraisal objectives

Policy unit name/number:		Policy unit 3: Rhymney Corridor								
N o.	Specific (appraisal) objectives	Indicators	Current baseline	Future baseline	Policy Options					
					P1 No active intervention	P2 Reduce existing actions	P3 Continue with existing actions to maintain current risk	P4 Take further action to sustain current risk	P5 Take further action to reduce current risk	P6 Take further action to increase frequency of flooding
Generic Response					Decreased conveyance Monitoring, advise & survey	Decreased conveyance Influencing and Informing Monitoring, advise & survey Studies	Increased or decreased conveyance Attenuation/retention Influencing and Informing Monitoring, advise & survey Studies	Increased or decreased conveyance Attenuation/retention Influencing and Informing Monitoring, advise & survey Studies	Increased or decreased conveyance Attenuation/retention Influencing and Informing Monitoring, advise & survey Studies	Increased or decreased conveyance Attenuation/retention Influencing and Informing Monitoring, advise & survey Studies
PEOPLE										
1.	Reduce the risk of harm to life in Caerphilly, New Tredegar and Ystrad Mynach	The number of people within the 1% AEP fluvial flood extent where depths of water exceed 0.5m	There are 642 people at risk where depths exceed 0.5m during a 1% AEP fluvial flood event	There will be 1,727 people at risk where depths exceed 0.5m during a 1% AEP fluvial flood event	There would be 2,688 people at risk where depths exceed 0.5m during a 1% AEP fluvial flood event	There would be 2,386 people at risk where depths exceed 0.5m during a 1% AEP fluvial flood event	There would be 1,727 people at risk where depths exceed 0.5m during a 1% AEP fluvial flood event	There would be 791 people at risk where depths exceed 0.5m during a 1% AEP fluvial flood event	There would be 130 people at risk where depths exceed 0.5m during a 1% AEP fluvial flood event	There is no scope for carrying out policy six in this policy unit. Increased frequency of flooding to make space for water could result in a

Policy unit name/number:		Policy unit 3: Rhymney Corridor								
N o.	Specific (appraisal) objectives	Indicators	Current baseline	Future baseline	Policy Options					
					P1 No active intervention	P2 Reduce existing actions	P3 Continue with existing actions to maintain current risk	P4 Take further action to sustain current risk	P5 Take further action to reduce current risk	P6 Take further action to increase frequency of flooding
		The number of properties that are at risk during the 1% AEP fluvial flood event but not within an existing flood warning area	398 properties that are at flood risk during a 1% AEP fluvial flood event are not within an existing flood warning area	477 properties that will be at flood risk during a 1% AEP fluvial flood event would not be within an existing flood warning area	Flood warning areas would be removed under this policy and therefore all properties would not be within a flood warning area 1,899 properties that would be at flood risk during a 1% AEP fluvial flood event would not be within an existing flood warning area	797 properties that would be at flood risk during a 1% AEP fluvial flood event would not be within an existing flood warning area	477 properties that would be at flood risk during a 1% AEP fluvial flood event would not be within an existing flood warning area	465 properties that would be at flood risk during a 1% AEP fluvial flood event would not be within an existing flood warning area	46 properties that would be at flood risk during a 1% AEP fluvial flood event would not be within an existing flood warning area	significant increase in harm to life. Deliberately flooding specific areas to make space for water would cause large-scale community disruption in those areas. We have not identified any areas in the policy unit where we could do this without increasing harm to life.
2.	Reduce community disruption caused by flooding in Caerphilly, New Tredegar and Ystrad Mynach	The number of community assets at risk during the 1% AEP fluvial flood event	There is 2 health services (Lansbury Park), 2 schools (Hengoed) and 77 retail buildings at flood risk during the 1% AEP fluvial flood event	There will be 2 health services (Lansbury Park), 3 schools (Hengoed, Llanbradach), 2 hospitals (Ystrad Mynach), 5 community centres (Ystrad Mynach, Abertridwr, Lansbury Park, Aberbargoed) and 83 retail buildings at flood risk during the 1% AEP fluvial flood event	There would be 3 health services (Lansbury Park, Ystrad Mynach), 7 schools (Energlyn, Hengoed, Llanbradach), 2 hospitals (Ystrad Mynach), 5 community centres (Ystrad Mynach, Abertridwr, Lansbury Park, Aberbargoed) and 104 retail buildings at flood risk during the 1% AEP fluvial flood event	There would be 3 health services (Lansbury Park, Ystrad Mynach), 5 schools (Energlyn, Hengoed, Llanbradach), 2 hospitals (Ystrad Mynach), 5 community centres (Abertridwr, Lansbury Park, Aberbargoed) and 100 retail buildings at flood risk during the 1% AEP fluvial flood event	There would be 2 health services (Lansbury Park), 3 schools (Hengoed, Llanbradach), 2 hospitals (Ystrad Mynach), 5 community centres (Ystrad Mynach, Abertridwr, Lansbury Park, Aberbargoed) and 83 retail buildings at flood risk during the 1% AEP fluvial flood event	There would be 3 health services (Lansbury Park, Ystrad Mynach), 3 schools (Hengoed, Llanbradach), 4 community centres (Abertridwr, Lansbury Park, Aberbargoed) and 78 retail buildings at flood risk during the 1% AEP fluvial flood event	There would be 2 health services (Lansbury Park), 3 community centres (Abertridwr, Lansbury Park) and 2 retail buildings at flood risk during the 1% AEP fluvial flood event	There is no scope for carrying out policy six in this policy unit. Increased frequency of flooding to make space for water could result in a significant increase in community disruption. Deliberately flooding specific areas to make space for water would cause large-scale community disruption in those

Policy unit name/number:		Policy unit 3: Rhydney Corridor								
N o.	Specific (appraisal) objectives	Indicators	Current baseline	Future baseline	Policy Options					
					P1 No active intervention	P2 Reduce existing actions	P3 Continue with existing actions to maintain current risk	P4 Take further action to sustain current risk	P5 Take further action to reduce current risk	P6 Take further action to increase frequency of flooding
		The number of residential properties at flood risk during the 1% AEP fluvial flood event	There are 621 residential properties at flood risk during the 1% AEP fluvial flood event	There will be 1,130 residential properties at flood risk during the 1% AEP fluvial flood event	There would be 1,677 residential properties at flood risk during the 1% AEP fluvial flood event	There would be 1,472 residential properties at flood risk during the 1% AEP fluvial flood event	There would be 1,130 residential properties at flood risk during the 1% AEP fluvial flood event	There would be 677 residential properties at flood risk during the 1% AEP fluvial flood event	There would be 45 residential properties at flood risk during the 1% AEP fluvial flood event	areas. We have not identified any areas in the policy unit where we could do this without increasing community disruption.
		The duration of flooding (<1 day, 1 day to 5 days, > 5 days)	The duration of flooding is less than 1 day for the 1% AEP fluvial flood event	The duration of flooding will be less than 1 day for the 1% AEP fluvial flood event	The duration of flooding would be less than 1 day for the 1% AEP fluvial flood event	The duration of flooding would be less than 1 day for the 1% AEP fluvial flood event	The duration of flooding would be less than 1 day for the 1% AEP fluvial flood event	The duration of flooding would be less than 1 day for the 1% AEP fluvial flood event	The duration of flooding would be less than 1 day for the 1% AEP fluvial flood event	
		The area of flooding during the 1% AEP fluvial flood event where depth of flooding exceeds 0.5 metres	The flooded area where depths exceed 0.5 metres is 1.28km ² (New Tredegar) during a 1% AEP fluvial flood event	The flooded area where depths exceed 0.5 metres will be 1.98km ² (New Tredegar, Llanbradach) during a 1% AEP fluvial flood event	The flooded area where depths exceed 0.5 metres would be 2.58km ² (New Tredegar, Llanbradach) during a 1% AEP fluvial flood event	The flooded area where depths exceed 0.5 metres would be 2.29km ² (New Tredegar, Llanbradach) during a 1% AEP fluvial flood event	The flooded area where depths exceed 0.5 metres would be 1.98km ² (New Tredegar, Llanbradach) during a 1% AEP fluvial flood event	The flooded area where depths exceed 0.5 metres would be 1.48km ² (New Tredegar) during a 1% AEP fluvial flood event	The flooded area where depths exceed 0.5 metres would be 1.27km ² (New Tredegar) during a 1% AEP fluvial flood event	
ECONOMICS										
3.	Reduce flood risk to critical transport routes and critical assets Caerphilly and Ystrad Mynach	The number, length and type of critical asset (police, ambulance, fire station), infrastructure (STW, WTW, gas, electricity, rail or major roads) at risk during the 1%	There is 1 electricity station (Caerphilly) and 0.8km of the A472 in Ystrad Mynach at flood risk during the 1% AEP fluvial flood event	There will be 1 police station (Llanbradach), 4 electricity stations (Caerphilly, Llanbradach, Ystrad Mynach), 1.1km of the A472 in Ystrad Mynach and 0.5km of the A469 in Llanbradach at flood risk during the	There would be 1 police station (Llanbradach), 1 fire station (Energlyn), 1 ambulance station (Energlyn), 8 electricity stations (Caerphilly, Llanbradach, Ystrad Mynach), 1.1km of the A472 in Ystrad Mynach	There would be 1 police station (Llanbradach), 1 fire station (Energlyn), 7 electricity stations (Caerphilly, Llanbradach, Ystrad Mynach), 1km of the A472 in Ystrad Mynach and 0.6km of the A469 in Llanbradach at	There would be 1 police station (Llanbradach), 4 electricity stations (Caerphilly, Llanbradach, Ystrad Mynach), 1.1km of the A472 in Ystrad Mynach and 0.5km of the A469 in Llanbradach at	There would be 1 electricity station (Caerphilly) and 0.8km of the A472 in Ystrad Mynach at flood risk during the 1% AEP fluvial flood event	There would be 0.7km of the A472 in Ystrad Mynach and no critical assets at flood risk during the 1% AEP fluvial flood event	There is no scope for carrying out policy six in this policy unit. Increased frequency of flooding to make space for water could result in a significant increase in risk to critical assets and critical transport routes.

Policy unit name/number:		Policy unit 3: Rhymney Corridor								
N o.	Specific (appraisal) objectives	Indicators	Current baseline	Future baseline	Policy Options					
					P1 No active intervention	P2 Reduce existing actions	P3 Continue with existing actions to maintain current risk	P4 Take further action to sustain current risk	P5 Take further action to reduce current risk	P6 Take further action to increase frequency of flooding
		AEP fluvial flood event		1% AEP fluvial flood event	and 0.8km of the A469 in Llanbradach at flood risk during the 1% AEP fluvial flood event	flood risk during the 1% AEP fluvial flood event	1% AEP fluvial flood event			Deliberately flooding specific areas to make space for water would cause large-scale community disruption in those areas. We have not identified any areas in the policy unit where we could do this without increasing risk to critical assets and critical transport routes
4.	Reduce economic damages caused by flooding in Caerphilly, New Tredegar and	The total cost of property economic damages during the 1% AEP fluvial flood event	The 1% AEP fluvial flood economic property damages are £26.6m	The 1% AEP fluvial flood economic property damages will be £61.3m	The 1% AEP fluvial flood economic property damages would be £95.0m	The 1% AEP fluvial flood economic property damages would be £83.9m	The 1% AEP fluvial flood economic property damages would be £61.3m	The 1% AEP fluvial flood economic property damages would be £29.8m	The 1% AEP fluvial flood economic property damages would be £3.6m	There is no scope for carrying out policy six in this policy unit. Increased frequency of flooding to make

Policy unit name/number:		Policy unit 3: Rhymney Corridor								
N o.	Specific (appraisal) objectives	Indicators	Current baseline	Future baseline	Policy Options					
					P1 No active intervention	P2 Reduce existing actions	P3 Continue with existing actions to maintain current risk	P4 Take further action to sustain current risk	P5 Take further action to reduce current risk	P6 Take further action to increase frequency of flooding
	Ystrad Mynach	The total cost of agricultural damages during the 1% AEP fluvial flood extent	The 1% AEP fluvial flood agricultural damages are £213,728	The 1% AEP fluvial flood agricultural damages will be £321,306	The 1% AEP fluvial flood agricultural damages would be £400,278	The 1% AEP fluvial flood agricultural damages would be £368,280	The 1% AEP fluvial flood agricultural damages would be £321,306	The 1% AEP fluvial flood agricultural damages would be £242,474	The 1% AEP fluvial flood agricultural damages would be £188,941	space for water could result in a significant increase in economic damages. Deliberately flooding specific areas to make space for water would cause large-scale community disruption in those areas. We have not identified any areas in the policy unit where we could do this without significantly increasing economic damages.
5.	Optimise the level of Flood Risk Management expenditure. Ensure investment is proportional to the risks	The indicative costs of our flood risk management actions	We currently spend approximately £105,000 per year on maintenance and operations	We will spend more than we currently spend on maintenance and operations as risk is going to increase in the future in the Eastern Valleys, placing more demand on our resources and expenditure.	No construction or maintenance costs associated with undertaking this policy but it would be necessary to devise a strategy, and withdraw over a number of years, monitoring the situation once this had been done.	We would expect costs to reduce by half to £52,500 per year. However, the risks would significantly increase	We would continue to spend £105,000 per year on maintenance and operations. However, the risks would significantly increase	Indicative costs to improve and build new defences would cost approximately £2.5 million. Fluvial flood risk would remain high. Maintenance costs will increase as a result.	Indicative costs to improve and build new defences would cost approximately £9 million. Fluvial flood risk would be significantly reduced. Maintenance costs will increase as a result.	There is no scope for carrying out policy six in this policy unit. Constructing formal flood storage areas would cost many millions of pounds. Deliberately promoting flooding through schemes that make space for water would cause large scale community disruption to the Rhymney Corridor

Policy unit name/number:		Policy unit 3: Rhymney Corridor									
N O.	Specific (appraisal) objectives	Indicators	Current baseline	Future baseline	Policy Options						
					P1 No active intervention	P2 Reduce existing actions	P3 Continue with existing actions to maintain current risk	P4 Take further action to sustain current risk	P5 Take further action to reduce current risk	P6 Take further action to increase frequency of flooding	
										and the Eastern Valleys as a whole	
ENVIRONMENT											
6.	Ensure no deterioration of designated international and national nature conservation sites	The percentage area of each SSSI affected during the 1% AEP fluvial and 0.5% AEP tidal flood events	There are no SSSIs at flood risk during the 1% AEP fluvial flood event	There will be no SSSIs at flood risk during the 1% AEP fluvial flood event	There would be no SSSIs at flood risk during the 1% AEP fluvial flood event	There would be no SSSIs at flood risk during the 1% AEP fluvial flood event	There would be no SSSIs at flood risk during the 1% AEP fluvial flood event	There would be no SSSIs at flood risk during the 1% AEP fluvial flood event	There would be no SSSIs at flood risk during the 1% AEP fluvial flood event	There would be no SSSIs at flood risk during the 1% AEP fluvial flood event	There is no scope for carrying out policy six in this policy unit. Increased frequency of flooding to make space for water would result in a higher percentage area of risk to designated sites.
7.	Protect and improve habitats and species diversity, particularly BAP habitats and those relying on freshwater	BAP habitats and species at risk during the 1% AEP fluvial flood event	The following BAP habitats are at flood risk during a 1% AEP fluvial flood event: <ul style="list-style-type: none"> Blanket bog Fens Lakes and reservoirs Ponds Reedbeds Rhos pastures Rivers, streams and floodplains Wet woodland <p>The following BAP species are at flood risk during a 1% AEP fluvial flood event:</p> <ul style="list-style-type: none"> Brown Trout 	The following BAP habitats are likely to experience more frequent and longer duration of flooding in the future: <ul style="list-style-type: none"> Blanket bog Fens Lakes and reservoirs Ponds Reedbeds Rhos pastures Rivers, streams and floodplains Wet woodland <p>The following BAP species are likely to experience more frequent and longer duration of flooding</p>	The following BAP habitats are likely to experience more frequent and longer duration flooding as a result of Policy 1: <ul style="list-style-type: none"> Blanket bog Fens Lakes and reservoirs Ponds Reedbeds Rhos pastures Rivers, streams and floodplains Wet woodland <p>The following BAP species are likely to experience more frequent and longer duration flooding as</p>	The following BAP habitats are likely to experience more frequent and longer duration flooding as a result of Policy 2: <ul style="list-style-type: none"> Blanket bog Fens Lakes and reservoirs Ponds Reedbeds Rhos pastures Rivers, streams and floodplains Wet woodland <p>The following BAP species are likely to experience more frequent and longer duration flooding as</p>	The following BAP habitats are likely to experience more frequent and longer duration flooding as a result of Policy 3: <ul style="list-style-type: none"> Blanket bog Fens Lakes and reservoirs Ponds Reedbeds Rhos pastures Rivers, streams and floodplains Wet woodland <p>The following BAP species are likely to experience more frequent and longer duration flooding as</p>	The following BAP habitats are likely to be at risk to the same extent as under current baseline conditions, as a result of Policy 4: <ul style="list-style-type: none"> Blanket bog Fens Lakes and reservoirs Ponds Reedbeds Rhos pastures Rivers, streams and floodplains Wet woodland <p>The following BAP species are likely to be at risk to the</p>	The following BAP habitats are likely to experience less frequent and shorter duration flooding as a result of Policy 5: <ul style="list-style-type: none"> Blanket bog Fens Lakes and reservoirs Ponds Reedbeds Rhos pastures Rivers, streams and floodplains Wet woodland <p>The following BAP species are</p>	There is no scope for carrying out policy six in this policy unit. Increased frequency of flooding to make space for water would result in an increased number of BAP species being at risk from flooding. Deliberately promoting flooding through schemes that make space for water would cause large scale damage to BAP habitats and species in the	

Policy unit name/number:		Policy unit 3: Rhymney Corridor								
N o.	Specific (appraisal) objectives	Indicators	Current baseline	Future baseline	Policy Options					
					P1 No active intervention	P2 Reduce existing actions	P3 Continue with existing actions to maintain current risk	P4 Take further action to sustain current risk	P5 Take further action to reduce current risk	P6 Take further action to increase frequency of flooding
			<ul style="list-style-type: none"> • Double Line Moth • Great Crested Newt • Lapwing • Marsh Fritillary Butterfly • Otter • Reed Bunting 	in the future: <ul style="list-style-type: none"> • Brown Trout • Double Line Moth • Great Crested Newt • Lapwing • Marsh Fritillary Butterfly • Otter • Reed Bunting 	a result of Policy 1: <ul style="list-style-type: none"> • Brown Trout • Double Line Moth • Great Crested Newt • Lapwing • Marsh Fritillary Butterfly • Otter • Reed Bunting 	a result of Policy 2: <ul style="list-style-type: none"> • Brown Trout • Double Line Moth • Great Crested Newt • Lapwing • Marsh Fritillary Butterfly • Otter • Reed Bunting 	a result of Policy 3: <ul style="list-style-type: none"> • Brown Trout • Double Line Moth • Great Crested Newt • Lapwing • Marsh Fritillary Butterfly • Otter • Reed Bunting 	same extent as under current baseline conditions, as a result of Policy 4: <ul style="list-style-type: none"> • Brown Trout • Double Line Moth • Great Crested Newt • Lapwing • Marsh Fritillary Butterfly • Otter • Reed Bunting 	likely to experience less frequent and shorter duration flooding as a result of Policy 5: <ul style="list-style-type: none"> • Brown Trout • Double Line Moth • Great Crested Newt • Lapwing • Marsh Fritillary Butterfly • Otter • Reed Bunting 	Rhymney Corridor and the Eastern Valleys as a whole
8.	Manage flood risk to Listed Buildings in Caerphilly, Ystrad Mynach, Bargoed, Hengoed and New Tredegar and ensure sites which are currently 'safe' do not become at risk of flooding.	The number of Listed Buildings within the 1% AEP fluvial flood extent	There are 6 Listed Buildings at flood risk during the 1% AEP fluvial flood event	There will be 8 Listed Buildings at flood risk during the 1% AEP fluvial flood event	There would be 9 Listed Buildings at flood risk during the 1% AEP fluvial flood event	There would be 9 Listed Buildings at flood risk during the 1% AEP fluvial flood event	There would be 8 Listed Buildings at flood risk during the 1% AEP fluvial flood event	There would be 6 Listed Buildings at flood risk during the 1% AEP fluvial flood event	There would be 4 Listed Buildings at flood risk during the 1% AEP fluvial flood event	There is no scope for carrying out policy six in this policy unit. Deliberately promoting flooding through schemes that make space for water would cause large scale community disruption to the Rhymney Corridor and the Eastern Valleys as a whole.

Form 12.7: Summary of the relative overall losses (including flood risk management costs) and gains (including flood alleviation benefits), thus demonstrating the rationale behind selecting the preferred option

Policy unit name/number:	Policy unit 3: Rhymney Corridor		
Policy options	Losses	Gains	Preferred policy option
Policy option P1			
Environmental	<p>LOW- More frequent and longer duration flooding may adversely affect habitats intolerant of waterlogging. Impacts will be particularly severe if inundation is from low quality water or non-fluvial sources.</p> <p>LOW- Increase in BAP species at risk of flooding from a 1% AEP fluvial flood event.</p> <p>LOW- Three additional listed buildings would be at flood risk from a 1% AEP fluvial flood event.</p>	<p>LOW+ More frequent and longer duration flooding may enhance water-dependent habitats.</p> <p>LOW+ Stopping river maintenance and not maintaining defences may benefit BAP species through reduced disturbance. In particular, Otter and Reed Bunting are likely to benefit.</p>	Not preferred option – risk to people, property and the economy would remain very high and there would be very significant and high increases in risks in the future
Social	<p>HIGH- 2,759 additional people at risk from flooding</p> <p>HIGH- 2,046 additional people located within flood risk areas where flood depths exceed 0.5 metres</p> <p>HIGH- 1,056 additional residential properties at risk from flooding</p> <p>HIGH- 1,501 additional properties would not be within an existing flood warning area</p> <p>HIGH- 1 additional health service, 5 schools, 2 hospitals, 5 community centres and 27 retail buildings at risk from flooding</p> <p>MEDIUM- An additional 1.3km² of land where depths exceed 0.5 metres at risk from flooding</p>		
Economic	<p>HIGH- £68.4m increase in economic damages to properties</p> <p>HIGH- 1 additional police station, 1 fire station, 1 ambulance station and 7 electricity stations at risk from flooding</p> <p>LOW- £186,550 increase in agricultural damages</p> <p>MEDIUM- 0.3km increase in length of the A472 and 0.8km of the A469 at risk from flooding</p>	<p>MEDIUM+ - £105,000 ASM saving due to stopping maintenance activities</p>	
Policy option P2			

Policy unit name/number:	Policy unit 3: Rhymney Corridor		
Policy options	Losses	Gains	Preferred policy option
Environmental	<p>LOW- More frequent and longer duration flooding may adversely affect habitats intolerant of waterlogging. Impacts will be particularly severe if inundation is from low quality water or non-fluvial sources.</p> <p>LOW- Increase in BAP species at risk of flooding from a 1% AEP fluvial flood event.</p> <p>LOW- Three additional listed buildings would be at flood risk from a 1% AEP fluvial flood event.</p>	<p>LOW+ More frequent and longer duration flooding may enhance water-dependent habitats.</p> <p>LOW+ Reduced maintenance may benefit BAP species through reduced disturbance. In particular, Otter and Reed Bunting are likely to benefit.</p>	Not preferred option – reducing flood risk management in any areas of the Rhymney Corridor policy unit would result high increases in risk to people, property and the economy.
Social	<p>HIGH- 2,181 additional people at risk from flooding</p> <p>HIGH- 1,744 additional people located within flood risk areas where flood depths exceed 0.5 metres</p> <p>HIGH- 851 additional residential properties at risk from flooding</p> <p>HIGH- 399 additional properties would not be within an existing flood warning area</p> <p>HIGH- 1 additional health service, 3 schools, 2 hospitals, 5 community centres and 23 retail buildings at risk from flooding</p> <p>MEDIUM- An additional 1.01km² of land where depths exceed 0.5 metres at risk from flooding</p>		
Economic	<p>HIGH- £57.3m increase in economic damages to properties at risk from flooding</p> <p>HIGH- 1 additional police station, 1 fire station, 6 electricity stations at risk from flooding</p> <p>LOW- £154,552 increase in agricultural damages</p> <p>LOW- 0.2km increase in length of the A472 and 0.6km of the A469 at risk from flooding</p>	<p>MEDIUM+ - £52,500 ASM saving due to reducing maintenance activities</p>	
Policy option P3			
Environmental	<p>LOW- More frequent and longer duration flooding may adversely affect habitats intolerant of waterlogging. Impacts will be particularly severe if inundation is from low quality water or non-fluvial sources.</p> <p>LOW- Increase in BAP species at risk of flooding from a 1% AEP fluvial flood event.</p> <p>LOW- Two additional listed buildings would be at flood risk from a 1% AEP fluvial flood event.</p>	<p>LOW+ More frequent and longer duration flooding may enhance water-dependent habitats.</p>	Not preferred option – maintaining our current level of management is not a sustainable option in this policy unit. Risk to people, property and the economy

Policy unit name/number:	Policy unit 3: Rhymney Corridor		
Policy options	Losses	Gains	Preferred policy option
Social	<p>HIGH- 1,388 additional people at risk from flooding</p> <p>HIGH- 1,085 additional people located within flood risk areas where flood depths exceed 0.5 metres</p> <p>MEDIUM- 509 additional residential properties at risk from flooding</p> <p>LOW- 79 additional properties would not be within an existing flood warning area</p> <p>MEDIUM- 1 additional school, 2 hospitals, 5 community centres and 6 retail buildings at risk from flooding</p> <p>LOW- An additional 0.7km² of land where depths exceed 0.5 metres at risk from flooding</p>		would significantly increase in the future under this option.
Economic	<p>HIGH- £34.7m increase in economic damages to properties</p> <p>MEDIUM- 1 additional police station and 3 electricity stations at risk from flooding</p> <p>LOW- £107,578 increase in agricultural damages</p> <p>LOW- 0.3km increase in length of the A472 and 0.5km of the A469 at risk from flooding</p> <p>NEUTRAL= no change in maintenance and operations expenditure</p>		
Policy option P4			
Environmental	<p>NEUTRAL = No change in the frequency or duration of flooding to BAP habitats or species.</p> <p>NEUTRAL = No additional listed buildings would be at flood risk from a 1% AEP fluvial flood event.</p> <p>MEDIUM- Delivery of CFMP policy to sustain current flood risk may reduce the quality and quantity of the BAP habitat and species within the policy unit. Rivers, streams and floodplains, Brown Trout and Otter are likely to be particularly affected.</p>	<p>NEUTRAL = No change in the frequency or duration of flooding to BAP habitats or species.</p> <p>NEUTRAL = No additional listed buildings would be at flood risk from a 1% AEP fluvial flood event.</p>	Not preferred option –Fluvial flood risk is currently high, and risks to people and the economy remain significantly high into the future.
Social	<p>MEDIUM- 165 additional people at risk from flooding</p> <p>MEDIUM- 149 additional people located within flood risk areas where flood depths exceed 0.5 metres</p> <p>LOW- 56 additional residential properties at risk from flooding</p> <p>LOW- 67 additional properties would not be within an existing flood warning area</p> <p>MEDIUM- 1 additional health service, 1 school, 4 community centres and 1 retail building at risk from flooding</p> <p>LOW- An additional 0.2km² of land where depths exceed 0.5 metres at risk from flooding</p>		

Policy unit name/number:	Policy unit 3: Rhymney Corridor		
Policy options	Losses	Gains	Preferred policy option
Economic	<p>LOW- £3.2m increase in economic damages to properties</p> <p>LOW- £28,746 increase in agricultural damages</p> <p>NEUTRAL= no change in critical assets at risk from flooding</p> <p>NEUTRAL= no change in critical transport routes at risk from flooding</p>		
Policy option P5			
Environmental	<p>MEDIUM- Delivery of CFMP policy to reduce current flood risk may reduce the quality and quantity of the BAP habitat and species within the policy unit. Rivers, streams and floodplains, Brown Trout and Otter are likely to be particularly affected.</p> <p>LOW- Less frequent and shorter duration flooding of BAP habitats may adversely affect habitats dependent on waterlogging.</p>	<p>LOW+ Less frequent and shorter duration flooding of BAP habitats will benefit BAP habitats intolerant of waterlogging.</p> <p>LOW+ A decrease in the number of BAP species at flood risk from a 1% AEP fluvial flood event.</p> <p>LOW+ The number of listed buildings at flood risk from a 1% AEP fluvial flood event would reduce from 6 to 4. Two additional listed buildings would be protected from a 1% AEP fluvial flood event.</p>	<p>✓ Reduce flood risk now and in the future</p> <p>Undertaking small and large-scale works could significantly reduce risk to people, property and the economy. Taking action to reduce flood risk would be economically justifiable in this policy unit.</p>
Social		<p>HIGH+ 208 people (-1259) at risk from flooding</p> <p>HIGH+ 130 people (-512) located within flood risk areas where flood depths exceed 0.5 metres</p> <p>HIGH+ 46 properties (-352) would not be within an existing flood warning area</p> <p>HIGH+ 45 residential properties (-576) at risk from flooding</p> <p>LOW+ two retail buildings (-75), three community centres (+3) and two health services (+0) at risk from flooding</p> <p>LOW+ An reduction of 0.01km² of land where depths exceed 0.5 metres at risk from flooding</p>	
Economic		<p>HIGH+ £3.6m economic damages to properties (-23.0m)</p> <p>LOW+ No critical assets at risk from flooding (-1 electricity station)</p> <p>LOW+ 0.7km of the A472 at risk from flooding (-0.1km)</p> <p>LOW+ £188,941 agricultural damages (-£24,787)</p>	
Policy option P6			
Environmental	There is no scope for carrying out policy six in this policy unit. Increased frequency of flooding to make space for water would result in a very high number of people at risk and very high	There is no scope for carrying out policy six in this policy unit. Increased frequency of flooding to make space for water would result in a very high number of people at risk and very high	Not preferred option – there is no scope for carrying out policy six in this policy unit.

Policy unit name/number:	Policy unit 3: Rhymney Corridor		
Policy options	Losses	Gains	Preferred policy option
Social	economic damages. Deliberately promoting flooding through schemes that make space for water would cause large-scale community disruption to the Rhymney Corridor and the Eastern Valleys as a whole.	economic damages. Deliberately promoting flooding through schemes that make space for water would cause large-scale community disruption to the Rhymney Corridor and the Eastern Valleys as a whole.	There is very limited opportunity for increasing the frequency of flooding as a flood risk management option within this policy unit.
Economic			

Key

HIGH:	<p>High negative</p> <p>A policy has a 'high negative' effect where it could contribute to a social, economic or environmental objective in a significantly negative way.</p> <p>A 'high negative' effect could be:</p> <ul style="list-style-type: none"> (i) a very large increase in current flood risk; (ii) very large projected increases in flood risk under future conditions, and/or; (iii) significant additional social, economic and/or environmental losses.
MEDIUM:	<p>Medium negative</p> <p>A policy has a 'medium negative' effect where it could contribute to a social, economic or environmental objective in a negative way.</p> <p>A 'medium negative' effect could be:</p> <ul style="list-style-type: none"> (i) an increase in current flood risk; (ii) a projected increase in flood risk under future conditions, and/or; (iii) social, economic and/or environmental losses.
LOW:	<p>Low negative</p> <p>A policy has a 'low negative' effect where it could make a limited contribution to a social, economic or environment objective, but where the overall contribution would be negative.</p> <p>A 'low negative' effect could be:</p> <ul style="list-style-type: none"> (i) an overall increase in current flood risk; (ii) an overall increase in flood risk under future conditions, and/or; (iii) overall social, economic and/or environmental losses.
NEUTRAL:	<p>Neutral</p> <p>A policy has a 'neutral' effect where it makes neither a positive or negative contribution to a social, economic or environmental objective.</p> <p>A 'neutral' effect could be:</p> <ul style="list-style-type: none"> (i) no change in current level of risk. In this instance the current level of risk would have to be low, so that the residual risk after a neutral policy was implemented remained acceptable; (ii) no change in flood risk under future conditions. In this instance projected future risk would need to be low so that the residual risk after a neutral policy was implemented remained acceptable, and/or; (iii) no additional social, economic and/or environmental gains or losses. <p>Policy options may also be 'neutral' where they are not relevant in a particular policy unit, or where it is not feasible for a policy option to contribute to an objective.</p>
HIGH:	<p>High positive</p> <p>A policy has a 'high positive' effect where it could contribute to a social, economic or environmental objective in a significantly positive way.</p> <p>A 'high positive' effect could be:</p> <ul style="list-style-type: none"> (i) a very large reduction in current flood risk; (ii) avoiding/reducing very large projected increases in flood risk under future conditions, and/or; (iii) significant additional social, economic and/or environmental gains.
MEDIUM:	<p>Medium positive</p> <p>A policy has a 'medium positive' effect where it could contribute to a social, economic or environmental objective in a positive way.</p> <p>A 'medium positive' effect could be:</p> <ul style="list-style-type: none"> (i) a reduction in current flood risk; (ii) avoiding/reducing projected increases in flood risk under future conditions, and/or; (iii) additional social, economic and/or environmental gains.
LOW:	<p>Low positive</p> <p>A policy has a 'low positive' effect where it could make a limited contribution to a social, economic or environment objective, but where the overall contribution would be positive.</p> <p>A 'low positive' effect could be:</p> <ul style="list-style-type: none"> (i) an overall reduction in current flood risk; (ii) an overall avoidance/reduction in flood risk under future conditions,

Form 12.8: Summary of the preferred policy

Policy Unit name/number:	<p>Policy Unit 3: Rhymney Corridor</p> <p>The policy unit is located within the middle and upper reaches of the Eastern Valleys CFMP area. The policy unit covers the main areas of New Tredegar, Ystrad Mynach and Caerphilly.</p>
Problem / risk:	<p>The main rivers within this policy unit are the River Rhymney, Porset Brook, Nant y Aber and Nant Cylla. There is also another minor unnamed tributary which flows through Ystrad Mynach and joins the River Rhymney close to where Nant Cylla joins. The main source of flooding within this policy unit is fluvial. Other secondary sources of flooding within this policy unit include surface and sewer flooding. We currently spend approximately £105,000 per year on maintenance and operations in this policy unit.</p> <p>Current fluvial risk within the policy unit presents very significant flood risk in comparison to the rest of the Eastern Valleys.</p> <p>Under both current and future conditions the risk to people and property is high for the 0.1% AEP extreme fluvial events.</p>
Policy selected	<p>Policy 5 – take further action to reduce flood risk (now and/or in the future)</p> <p>We have selected this policy based on the risk posed by inland flooding sources and tidal flooding sources. Our goal for selecting policy five for the Rhymney Corridor policy unit is to reduce the currently high fluvial flood risk, which in the future would also be significantly worse based on our projections of increased river flows as a result of climate change. Taking further action to reduce flood risk now and into the future is important as Caerphilly is an important growth area in the Eastern Valleys.</p> <p>If the risks posed by tidal flooding were removed from the policy appraisal process, preliminary estimates suggest that this policy would remain a P5. This is because there is no tidal flood risk in this policy unit.</p>
Justification and alternative policies considered	<p>Policy 5 sets a framework that reduces flood risk now and/or into the future. This policy is appropriate for this policy unit for the following reasons:</p> <ul style="list-style-type: none"> - The level of fluvial flood risk is high now and into the future, and the risks present severe consequences for harm to life. - Risks for extreme fluvial events (0.1% AEP) are high now and into the future. - There are a significant number of residential and commercial properties at current flood risk, as well as numerous critical assets. - There are a significant number of properties now and in the future that are or will be at flood risk but are not covered by the existing flood warning areas, and therefore new investment in flood warning will be necessary now and in the future. <p>The main area of New Tredegar is situated in the upper reaches of the River Rhymney. The main areas of Ystrad Mynach and Caerphilly are located in the middle reaches of the River Rhymney. Nant Cylla and an unnamed tributary join the River Rhymney at Ystrad Mynach, and Porset Brook and Nant y Aber join the River Rhymney at Caerphilly. The existing floodplain of the River Rhymney in Ystrad Mynach and Caerphilly is restricted by the presence of flood defences, constructed in the 1960s and 1980s. There is also a residual risk of these defences breaching, so properties located behind these flood defences are extremely vulnerable.</p> <p>The current scale of fluvial flood risk during a 1% AEP flood event in the main areas of New Tredegar, Ystrad Mynach and Caerphilly is high. The estimated total property damages for New Tredegar, Ystrad Mynach and Caerphilly are £6.3 million, £4.7 million and £6.1 million, respectively, for a 10% AEP fluvial flood event. These are the highest damages for a low return period flood event in the</p>

Eastern Valleys. In the 1% AEP fluvial flood event, the estimated total property damages for New Tredegar, Ystrad Mynach and Caerphilly are £6.9 million, £6 million and £15.1 million, respectively. The level of risk for the 0.1% AEP fluvial flood event increases significantly with estimated total property damages being £8.1 million for New Tredegar, £57.1 million for Ystrad Mynach and £41.1 million for Caerphilly. The high increase in damages principally arise from our flood defences, which have a SoP of 1% AEP, overtopping. The 1% AEP fluvial flood event would affect approximately 148 properties in New Tredegar, 210 properties in Ystrad Mynach and 330 in Caerphilly, and numerous critical assets and critical transport routes. We expect the flood water depths and velocities to be particularly high in New Tredegar under current conditions.

In the future, the 1% AEP fluvial flood event damages for the main areas of New Tredegar, Ystrad Mynach and Caerphilly are high. Damages significantly increase to £39.5 million for Ystrad Mynach and to £16 million for Caerphilly, affecting approximately 797 and 335 properties, respectively. This large increase is due to our flood defences overtopping.

The expected annual damages in the main areas of New Tredegar, Ystrad Mynach and Caerphilly are £1.3million/yr, £1.3million/yr and £1.6million/yr, respectively which amounts to 60% of the total annual damages within the Eastern Valleys CFMP. The expected annual damages could increase by over 50% in the future as a result of the impacts of climate change and further development planned within the catchment.

Justification and alternative policies considered

Gains and losses under preferred policy (policy five)

Social

Policy five gives four high and two low gains against our social CFMP objectives and indicators. Gains would be both local (to areas of high current risk) and distributed (to larger areas that we would expect to be at risk under future conditions if we did not take additional action). Flood risk would be significantly reduced for 1% AEP fluvial flood event now and into the future. We accept that there would still be a small number of people at flood risk during the 1% AEP fluvial flood event. For more extreme events such as the 0.1% AEP flood event, we accept that we cannot build structural defences to protect the people, property and the economy, and that there would be significant consequences during such extreme events.

Economic

Policy five gives one high and three low gains against our economic CFMP objectives and indicators. Reducing flood risk to critical assets and critical transport routes, and significantly reducing economic damages under policy five is essential for this policy unit where the current economic damages are high in fluvial flood events.

Environmental

Policy five gives three low gains, and one medium and one low loss against our environmental CFMP objectives and indicators. There are a limited number of environmental sites within the policy unit and we do not expect that an increase in flooding will have a significant negative impact on environmental sites.

Alternative policies considered

Policy one – *No active intervention*. The increased risk to people (+2,759), properties (+1,177) and the economy (+£68m) would be very high and there would be very significant and high increases in risks in the future.

Policy two – *Reduce current levels of flood risk management*. The increased risk to people (+2,181), properties (+960) and the economy (+£57m) would be very high and there would be very significant and high increases in risks in the future.

	<p>Policy three – <i>Maintain current levels of flood risk management.</i> The increased risk to people (+1,400), properties (+590) and the economy (+£35m) would be high and there would be very significant and high increases in risks in the future.</p> <p>Policy four – <i>Take further action to sustain the current level of flood risk into the future.</i> Current fluvial risks for the 1% AEP flood event are high and these would not be reduced by selecting policy four for this policy unit, with 1,630 people and 790 properties at risk for this policy.</p> <p>Policy six – <i>Take action with others to store water or manage run-off in locations that provide overall flood risk reduction or environmental benefits, locally or elsewhere in the catchment.</i> There is no scope for carrying out policy six in this policy unit. There is very limited opportunity for increasing the frequency of flooding as a flood risk management option within this policy unit.</p>
<p>Catchment-wide opportunities & constraints</p>	<p>The greatest opportunity in policy unit three is for us to significantly reduce or eliminate the risk of flooding to people, property and the economy; these risks are currently very high and have the potential to significantly increase in the future. In order to do this we need to take further action as the current approach to flood risk management is unsustainable in the long-term.</p> <p>Significant redevelopment is planned in Caerphilly over the next 50 years. Much of this development will take place in areas that could be at high risk of flooding under future conditions.</p> <p>There may be opportunities to use alternative maintenance activities throughout the policy unit to enable gradual enhancement of channel habitats.</p> <p>There are few opportunities within this policy unit to reconnect the river with its floodplain as this policy unit is urbanised and increasing the frequency of flooding in most locations would affect more people and property.</p>
<p>Actions</p>	<ul style="list-style-type: none"> • The scale of the expected economic damages and risk to people and property indicates that we should develop a Strategy Plan for the Rhymney Corridor within the next 5 years. This will consider where investment for structural responses can and should be implemented to reduce flood risk in the policy unit. Moving forward from the Strategy Plan, Pre-feasibility studies will be needed. • Initiate urban drainage studies for Ystrad Mynach and Caerphilly to identify surface water drainage issues and potential for remediation. • In partnership with Caerphilly Local Authority we should enforce stringent building controls on new development within flood risk areas. Suitable land allocations for new development should first be sought outside of flood risk areas. • SUDs and building regulations (resilience) should be incorporated, where appropriate, into all new developments.
<p>Risks, uncertainties & dependencies</p>	<p>The damages to the Rhymney Corridor from flooding are estimates that are considered sufficiently accurate to justify the cost of further investigations into the appropriate intervention to reduce flood risk. More detailed assessments will be required to identify the actual level of investment that can be justified and its relative priority with other flood risk reduction work.</p> <p>An existing model of the River Rhymney between Ystrad Mynach and Caerphilly was used, as was a small model of New Tredegar. These were supplemented by more broadscale modeling (particularly of the tributaries in Ystrad Mynach and Caerphilly) to ensure all the risk was assessed in the policy unit. There is more uncertainty with the broadscale modeling than areas with existing models.</p> <p>For this policy to be successful, appropriate policies and actions must be implemented throughout the River Rhymney catchment.</p>

Form 12.9: Requirements for further policy development and appraisal

Is there a need for further policy development?	No
If yes, then mark Policy Options for more detailed development. Some complex policies may require more detailed development, probably at Strategy Plan level.	
Is there a need for further more detailed appraisal?	No
If yes, take forward to Strategy study.	

Form 12.10: Indicators for monitoring, review and evaluation

Set out the indicators that need to be included in the policy implementation plan, for policy monitoring, drawing on the residual risks and likely impacts identified above. This will allow better review and evaluation of the policy when implemented.	
Monitoring	Significance/impact
Hydrometric monitoring of river flows and levels, rainfall and groundwater levels throughout the catchment in order to monitor changes in climate	<ul style="list-style-type: none"> Additional data may change our assessment of current or future conditions
Scientific advancements in flood risk management	<ul style="list-style-type: none"> Improved predictions in changes to river flows
Land use change monitored using satellite imagery	<ul style="list-style-type: none"> Further information on land use change may change future predictions of flood risk
Actual development rates	<ul style="list-style-type: none"> Need to check if urbanisation predictions made are realistic in light of current and future development undertaken
Designation and condition of environmental sites	<ul style="list-style-type: none"> May change the chosen policy if additional sites are designated. Monitoring of site condition will confirm that chosen CFMP policies have not adversely affect designated sites
Designation and condition of historic environmental assets	<ul style="list-style-type: none"> May change the chosen policy if additional sites are designated. Monitoring of site condition will confirm that chosen CFMP policies have not adversely affect designated sites
Detrimental impacts of flood risk management projects on BAP habitats and species	<ul style="list-style-type: none"> To ensure that specific flood risk management projects do not adversely affect BAP habitats and species
Level of uptake of flood warning services	<ul style="list-style-type: none"> Monitor whether the community are aware of the flood risks
Condition of flood defences	<ul style="list-style-type: none"> Need to maintain defences in line with the policy chosen
Actual expenditure on maintenance activities by policy unit, subdivided into activities.	<ul style="list-style-type: none"> Ensure that money is being targeted according to policy chosen
Actual expenditure on capital works to reduce flood risk	<ul style="list-style-type: none"> Need to ensure that these actions are in keeping with the policy chosen
Improved documentation of actual flood events: <ul style="list-style-type: none"> Number of properties/assets/ environmental sites/historic environment assets flooded Source of flooding Cause of flooding Whether due to defence failure 	<ul style="list-style-type: none"> Information on actual flood events needs to be better recorded in order to understand the relative importance of the various sources of flooding
Construction of critical infrastructure	<ul style="list-style-type: none"> May change the chosen policy if additional critical infrastructure is constructed within the floodplain

Spatial location of policy unit 4: Mid and Upper Reaches



Form 12.5: Summary of current and future levels of and responses to flood risk

Policy unit name/number:	Policy Unit 4: Mid and Upper Reaches
Current responses to flood risk within the policy unit?	<p>Defences We defend the main area of Ynysddu in policy unit four using a raised flood defence wall along the left bank of the River Sirhowy. The date that these were implemented is unknown.</p> <p>Flood Warning We provide a flood warning service via Floodline Warnings Direct. Flood Warning Area 103FWFg11 covers fluvial flood risk from the River Sirhowy in Ynysddu. The lead times for flood warning in policy unit four are unknown. We aim to issue flood warnings at least 2 hours before a flood event occurs. There are currently 87 properties at flood risk during a 1% AEP fluvial flood event, 53 of which lie within the existing flood warning area. Uptake to the flood warning service is unknown.</p> <p>Maintenance of existing structures We carry out routine maintenance works on all main rivers in PU4. In Ynysddu we undertake: routine mowing and spraying to maintain the River Sirhowy channel capacity; tree management to maintain channel conveyance and trashing and obstruction removal to ensure channel conveyance is maintained.</p> <p>The Mid and Upper Reaches policy unit is covered by eight asset systems. FR19S105, FR19S099, FR19S111 and FR19S113 are low risk asset systems and inspected every 36 to 60 months. FR19S048 and FR18S138 are medium risk asset systems inspected every 18-24 months. FR19S137 and FR19S064 are high risk asset systems inspected every 6 to 12 months. We currently spend approximately £45,000 per year on maintenance and operations in policy unit four.</p>
Standards of service that apply to flood defences within the policy unit?	<p>Standard of Protection The only defence in policy unit 4, along the left bank of the River Sirhowy through Ynysddu, offers a 1% AEP Standard of Protection. This defence is likely to be overtopped when allowances are made for climate change into the future.</p> <p>Condition and maintenance of defences This information is unknown.</p>
What is currently exposed to flooding?	<p>People We estimate that there are currently 274 people at risk of flooding in policy unit four from a 1% AEP fluvial flood event. The fluvial flood risk comes from the River Sirhowy and River Rhymney and the main risk to people during the 1% AEP fluvial flood event is in Ynysddu, over the right bank where there is no existing flood defence. Flood risk does not increase significantly for the 0.1% AEP fluvial flood event in this policy unit.</p> <p>Community Disruption We estimate that there are currently 87 properties at risk of flooding in policy unit four from a 1% AEP fluvial flood event, 82 of which are residential. Community assets at flood risk are two community centres in Ynysddu and one retail building.</p> <p>Critical Infrastructure We estimate that there are no critical transport routes or critical assets at flood risk during a 1% AEP fluvial flood event in policy unit four.</p> <p>Economic Damages We estimate the total economic property damages resulting from the 1% AEP</p>

	<p>fluvial flood event to be £5.8million. We estimate the total economic agricultural damages resulting from the 1% AEP fluvial flood event to be £131,000.</p> <p>Historic Environment We estimate that there are seven listed buildings at flood risk from a 1% AEP fluvial flood event.</p> <p>Landscape We estimate that there are currently no landscape receptors at flood risk from a 1% AEP fluvial flood event in policy unit four.</p> <p>Recreation We estimate that there are currently no recreational areas at flood risk in policy unit four from the 1% AEP fluvial flood event.</p> <p>Nature conservation sites We estimate that there are currently no designated nature conservation sites at flood risk from a 1% AEP fluvial flood event in policy unit four.</p> <p>BAP Habitats The exact location of BAP habitats in the catchment is unknown, but we estimate that several locally important habitats, identified in the Caerphilly and Blaenau Gwent Local BAPs, will be at risk from fluvial flooding. These habitats include; blanket bog; lakes and reservoirs; ponds; reedbeds; rhos pastures and rivers, streams and floodplains.</p> <p>Species The exact location of BAP species in the catchment is unknown, but we estimate that several locally important species, identified in the Caerphilly and Blaenau Gwent Local BAPs, will be at risk of flooding from fluvial sources. These species include Brown Trout; the Double Line Moth; Lapwing and Reed Bunting.</p>
<p>Who and what are currently most vulnerable to flood damage and losses?</p>	<p>Social and economic receptors People living in areas behind flood defences are the most vulnerable to flooding due to the high depths and velocities of flood water that would be expected if a breach occurred in the defence scheme or the defences were overtopped. The area at highest risk from this scenario would be Ynysddu. The area of Ynysddu has the highest economic damages during a 1% AEP fluvial flood event, most of which are as a result of flooding to residential properties, over the right bank of the River Sirhowy.</p> <p>Environmental receptors BAP habitats and species in the unit are at greatest risk from prolonged or frequent floodwater inundation, especially by low quality water, which can indirectly degrade habitats. However, some wetland BAP habitats, and the species they support, may benefit from increased flooding.</p> <p>The seven listed buildings at current flood risk from a 1% AEP fluvial flood event are likely to be negatively affected. Flood events with high depths and velocities of flood water are likely to cause the most damage.</p>
<p>What are the key factors that could drive future flood risk?</p>	<p>Climate change Climate change is the main driver of future flood risk in the Eastern Valleys. Climate change will result in higher flows and higher tide levels, which will increase water levels in our rivers. This will put pressure on existing flood defences and will result in the current Standard of Protection of our channels and flood defences</p>

being reduced. Flooding under our modelled future scenarios of climate change would cause significantly more damage and pose a significantly higher risk to people and property than existing conditions.

Land use management changes

We have decided not to consider the impact of land use change outside of urban areas on future flood risk in this CFMP. Agricultural intensification and changes in drainage practices are unrealistic scenarios because the Eastern Valleys has poor quality soils that are unsuitable for agricultural intensification. It is also constrained by the steep gradients of the land, meaning arable farming is impossible in certain areas. It is very difficult for us to predict the future of agriculture in the Eastern Valleys beyond the immediate future. It may be that extensification is a more realistic long-term scenario, where land is farmed less intensively and for environmental benefits. However, it is unlikely that extensification would have little impact on flood risk as the area is not intensively farmed at present.

Development in the flood plain

Increased urbanisation will result in increased flood volumes and higher peak water levels, and flooding would occur more quickly. Unless runoff from new urban development within and outside of floodplains is balanced flood risk will increase locally and downstream. Development in the floodplain should only be allowed when no other suitable land allocations are available and any buildings within floodplains should have flood resilience measures incorporated into their design, and floodplain compensation would be necessary.

Flood defence failure

In the event of flood defence infrastructure failing during a flood event, the resulting flood water depths and velocities would be very high. There would also be very little flood warning time for people located close to existing flood defences. Therefore, the risk of harm to life would be very high and the resulting economic damages would be very high. The area most vulnerable to flood defence failure in policy unit four is Ynysddu as properties are built right behind defences.

What are the possible future levels of flood risk under the main scenarios?

Our final future scenario that we used to assess possible future levels of flood risk considered a combination of the two main drivers, climate change and urbanisation. We have identified the following. We show the total numbers at risk, with the increase from current conditions in brackets:

People

In the future, we estimate that there will be 320 (+46) people at risk of flooding from a 1% AEP fluvial flood event. The increase in the number of people at risk is mainly in Ynysddu and Crosskeys.

Community Disruption

In the future, we estimate that there will be 150 (+63) properties at risk of flooding from a 1% AEP fluvial flood event, 140 (+58) of which are residential. Community assets will also be at flood risk in the future 1% AEP fluvial flood event: two community centres in Ynysddu (+0) and one retail building (+0).

Critical Infrastructure

In the future, we estimate that there will be no critical transport routes or critical assets at flood risk during a 1% AEP fluvial flood event.

Economic Damages

In the future, we estimate the total economic property damages resulting from the 1% AEP fluvial flood event will be £9.3 million (+£3.5m).

In the future, we estimate the total economic agricultural damages resulting from the 1% AEP fluvial flood event will be £200,000 (+£69,000).

Historic Environment

We estimate that the seven listed buildings at current flood risk from a 1% AEP fluvial flood event will remain at risk in the future. No additional listed buildings will be at risk from a 1% AEP fluvial flood event in the future.

Landscape

In the future, we estimate that no landscape receptors will be at flood risk from a 1% AEP fluvial flood event in policy unit four.

Recreation

In the future, we estimate that there will be no recreational areas at flood risk in a 1% AEP fluvial flood event.

Nature conservation sites

In the future, we estimate that no designated nature conservation sites will be at flood risk from a 1% AEP fluvial flood event in policy unit four.

BAP Habitats

The exact location of BAP habitats in the catchment is unknown. However, we estimate that in the future an increasing area of the locally important BAP habitats identified above will be at risk of flooding.

Species

The exact location of BAP species in the catchment is unknown. However, we estimate that in the future an increasing number of the locally important BAP species identified above will be at risk of flooding.

What potential responses (or groups of responses) are being considered to manage flood risk?

Generic Response/Strategic	Response
Attenuation/retention <ul style="list-style-type: none"> ▪ On-line storage ▪ Off-line storage 	Significant 'existing' storage in the headwaters of the Rhymney. Increasing this storage is considered generally not to be feasible due to land constraints and topography, and it is felt for the costs involved the benefits downstream would be minimal. Any increases would not have any benefits for this policy unit. In the lower reaches of the policy unit which cover the Sirhowy catchment, the flood risk is low and therefore local FSR schemes are not considered appropriate to reduce the risk.
	<ul style="list-style-type: none"> ▪ SUDS - new/retrospective A potential method for reducing surface water runoff and should be included in all new developments.
Increased conveyance <ul style="list-style-type: none"> ▪ River maintenance 	Ongoing maintenance activities include mowing and spraying, petriflex and blockstone repairs, tree management, and trashing and obstruction removal particularly through Caerphilly district. Due to the low flood risk within this policy unit it is expected that reducing maintenance activities should be considered further.

	Influencing and informing	<ul style="list-style-type: none"> Flood awareness 	National campaign. Should be continued but not explicitly increased.
		<ul style="list-style-type: none"> Flood warning and evacuation 	Existing flood warning area covers Ynysddu on the Sirhowy. However, flood risk is low and therefore decreasing current flood warnings could be explored.
		<ul style="list-style-type: none"> Emergency & disaster planning/response 	Policy unit covered by Caerphilly and Blaenau Gwent Local Authorities. Existing emergency plans in place, which should be reviewed and updated as new information becomes available.
		<ul style="list-style-type: none"> Planning policy, Development control 	Continue to follow Welsh Assembly Government policies. Caerphilly and Blaenau Gwent Local Authorities should ensure that suitable land allocations outside flood risk areas are sought first.
		<ul style="list-style-type: none"> Building regulations (resilience) 	To be incorporated into all new developments located within flood risk areas.
	Monitoring, advise and survey	<ul style="list-style-type: none"> Data and information 	Should continue despite policy selected.
		<ul style="list-style-type: none"> Asset inspection 	Policy unit is covered by low, medium and high asset systems, and therefore inspections will vary from 6 to 60 months. Asset classifications should be reviewed and may be the potential to down grade some of the asset systems.
		<ul style="list-style-type: none"> Hydrometric network 	No existing flood warning gauges within the upper Rhymney catchment. Although flood risk within the policy unit is low, the upper reaches of the Rhymney (upstream of New Tredegar) may benefit from a level gauge to improve existing flood warnings to the policy unit downstream. Two level gauges are installed along the Sirhowy.
	Studies	<ul style="list-style-type: none"> Flood Risk Mapping 	To improve the demarcation of the flood maps and confirm that flood risk within this policy unit is low, could be beneficial to undertake a flood mapping study, but should be given a low priority.
		<ul style="list-style-type: none"> SAMPs 	Policy unit covered by SAMPs.
<ul style="list-style-type: none"> Urban Drainage Plans 		Further significant urban expansion will need plans to ensure that flood risk will not increase within the towns or further downstream.	
What gaps and uncertainties are there in knowledge, and what assumptions	<p>Broadscale modelling</p> <ul style="list-style-type: none"> Broadscale hydrology and hydraulic modelling techniques used; Where no existing models are available, these have been supplemented by other modelling techniques. There were no existing models available for the River Sirhowy or River Rhymney in this policy unit; Due to lack of data for the River Sirhowy, no structures are included in the broadscale model. 		

have been made?

Future scenarios

- Although climate change projections are based on current guidance, these are still estimations;
- Urbanisation projections up until the year 2100 are based on current rates of urbanisation.

Data limitations

- No data on the percentage uptake of properties located in Flood Warning Areas;
- No data on the condition of flood defences/maintenance regime.
- The exact locations of BAP habitats and species within the policy unit are unknown.

Broad scale Modelling Tables**Generic Response Modelling**

The following tables provide a summary of how flooding will change in response to flood management options which may be adopted within policy unit four and what the implications of these changes might be. We have not applied any specific measures or schemes to the policy unit, but rather have applied what has been termed a 'generic response'. This represents the most likely outcome of a given policy, but is not specific and does not reflect any proposed scheme or project. It simply allows a broad assessment of what the impact of that policy might be.

Our broad scale models have been used to investigate the impact of these changes and have allowed us to quantify the effect on flood damages. We compare the risks for each generic response against the current base case conditions (the risk which currently exists in the catchment today). The results given below for each of the generic responses (i.e. the appropriate scenario for that part of the catchment) are for the 1% AEP fluvial flood event.

We have unit costs available for defences; however, the costs of flow attenuation schemes are not available. The cost of large scale flow attenuations scheme would be extremely high, as they form heavy structural response to flood risk. More local schemes for attenuating flow would cost less, but the costs would still be high compared to defences.

Policy unit 4: Mid and Upper Reaches**Generic response: Policy 1 - Withdraw/retreat defences and decreased conveyance**

Description: We used our broad scale River Sirhowy and River Rhymney models to assess the combined effects of not maintaining defences and stopping river maintenance. Channel and floodplain roughness values in our broad scale models were increased from 0.04 and 0.06 to 0.075 and 0.095 respectively, to reflect the increase of roughness expected if maintenance were stopped. Defences were not removed from the models as their impact was considered negligible, due to them being overtopped.

Base case conditions (1% AEP fluvial flood event)

People at risk: Fluvial - 274	Economic risk: Fluvial – £5.8m	Properties at risk: Fluvial – 87	Environmental sites at risk: Fluvial – No SSSIs at risk
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Results of the broad scale modelling (1% AEP fluvial flood event)

People at risk: Fluvial – 415 (+51%)	Economic risk: Fluvial – £11.3m (+95%)	Properties at risk: Fluvial – 169 (+94%)	Environmental sites at risk: Fluvial – No SSSIs at risk (no change)
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Conclusions

Cost: Nothing - no active intervention

Conclusion: The results of this modelling have indicated that if we stopped our maintenance of the defences and channels in policy unit four the risk to people, properties and the economy would increase. The impact of 'no active intervention' in this policy unit does increase flood risk, but not as much as the

rest of the policy units in the Eastern Valley. Our defences and the maintenance we undertake on the River Sirhowy in Ynysddu are important in reducing the risk of flooding and this is why the existing level of risk is quite low.

We would withdraw our current flood warning service that we provide under this generic response.

Policy unit 4: Mid and Upper Reaches

Generic response: Policy 2 – Reduced maintenance

Description: The active removal of the defences we maintain in Ynysddu would not be a sustainable flood risk management strategy. The SoP of this defence is up to a 1% AEP, so provides considerable protection. We could reduce our flood risk management around Ynysddu by relaxing our maintenance activities, such as weed-cutting and clearing. We increased channel and floodplain roughness in the River Sirhowy and River Rhymney broad scale models from 0.04 and 0.06 to 0.055 and 0.075 respectively, to reflect the increase of roughness expected if maintenance were reduced.

Base case conditions (1% AEP fluvial flood event)

People at risk: Fluvial - 274	Economic risk: Fluvial – £5.8m	Properties at risk: Fluvial – 87	Environmental sites at risk: Fluvial – No SSSIs at risk
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Results of the broad scale modelling (1% AEP fluvial flood event)

People at risk: Fluvial - 343 (+25%)	Economic risk: Fluvial - £10.3m (+78%)	Properties at risk: Fluvial – 155 (+78%)	Environmental sites at risk: Fluvial – No SSSIs at risk (no change)
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Conclusions

Cost: We currently spend approximately £45,000 per year on maintenance and operations in policy unit four. Under policy two we would not stop this regime, but we would scale down our programme, for example we may downgrade a high risk flood risk management system (FRMS) to a medium FRMS, or lower the funding available to a low FRMS, which may reduce funding by up to 50% (to £22,500 per year).

Conclusion:

If we were to reduce our maintenance regime, water levels would be expected to increase and bring additional risk to people. During a 1% AEP fluvial event for policy two, the risk to people, property and the economy would increase, but not significantly. This is because there is only one defence scheme that would be overtopped and the Sirhowy and Upper Rhymney are not sensitive to changes in roughness. In a mostly rural area, the expected increases in risk under this policy are low in comparison to the rest of the Eastern Valleys. However, the existing defence scheme in Ynysddu would still need to be maintained as it provides protection to a significant number of people and properties.

Policy unit 4: Mid and Upper Reaches

Generic response: Policy 3 – Continue with existing flood defence actions only

Description: This response to manage risk at the same level assumes that we would not undertake any alternative flood risk management actions, and that we would continue to maintain our defences at their current level. We would also continue our river maintenance, which allows the rivers to flow freely, at the same level. The current level of flood risk management under the chosen future scenario of climate change and increased urbanisation was modelled for Chapter 4.

Base case conditions (1% AEP fluvial flood event)

People at risk: Fluvial - 274	Economic risk: Fluvial – £5.8m	Properties at risk: Fluvial – 87	Environmental sites at risk: Fluvial – No SSSIs at risk
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Results of the broad scale modelling (1% AEP fluvial flood event)

People at risk: Fluvial – 320 (+17%)	Economic risk: Fluvial – £9.3m (+60%)	Properties at risk: Fluvial – 150 (+72%)	Environmental sites at risk: Fluvial – No SSSIs at risk (no change)
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Conclusions

Cost: The Mid and Upper Reaches policy unit covers eight flood risk management systems, for which we currently spend approximately £45,000 per year on maintenance, assets and operations. We would continue investing this much in the future.

Conclusion: In the past our management of flood risk has been mainly through building defences. We could continue investing in flood risk management to the same level in policy unit four, by maintaining our defences at their current level in Ynysddu, and continuing our current river maintenance strategies. To increase them into the future would require additional investment. The results from this model show that if we did not undertake any additional work in managing flood risk into the future across the policy unit, then risks to people, property and the economy would increase, but not significantly. The risks are also not considerably lower than the policy two generic response.

Policy unit 4: Mid and Upper Reaches

Generic response: Policy 3 – Reduced maintenance balanced by flood storage

Description: An alternative, softer approach to flood risk management is that we could relax our channel maintenance regime. This would raise water levels as channel capacity would reduce (as modelled under policy two). To compensate for this we could implement local scale flood storage schemes to reduce water levels. These would attenuate flows by up to 5%, and would operate at a local scale. However, there is no scope to incorporate local FSR schemes in this policy unit. There is no scope for broad scale modelling under this generic response for the Mid and Upper Reaches policy unit, so no further action has been undertaken.

Base case conditions (1% AEP fluvial flood event)

People at risk: Fluvial - 274	Economic risk: Fluvial – £5.8m	Properties at risk: Fluvial – 87	Environmental sites at risk: Fluvial – No SSSIs at risk
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Results of the broad scale modelling (1% AEP fluvial flood event)

People at risk: N/A	Economic risk: N/A	Properties at risk N/A	Environmental sites at risk: Fluvial – N/A
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Conclusions

Cost: N/A

Conclusion: Taking action to implement local FSR to balance the effects of reducing maintenance is not feasible in the Mid and Upper Reaches policy unit. There are no suitable locations along the Sirhowy or Upper Rhymney for FSR schemes. Therefore, no further action or modelling has been undertaken for this policy unit.

Policy unit 4: Mid and Upper Reaches

Generic response: Policy 4 – Take further action to improve and create new flood defences

Description: This response to sustain flood risk into the future at the current level assumes that we would not undertake any alternative activities. All the increase of risk into the future would be managed by increasing and maintaining our defences. We have identified one area within the Mid and Upper Reaches policy unit where there is an increase in flood risk in the future. This is at the Crosskeys Industrial Estate, close to where the River Sirhowy joins the River Ebbw. We trimmed our future flood outline to show that this area would benefit from a new defence.

Base case conditions (1% AEP fluvial flood event)

People at risk: Fluvial - 274	Economic risk: Fluvial – £5.8m	Properties at risk: Fluvial – 87	Environmental sites at risk: Fluvial – No SSSIs at risk
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Results of the broad scale modelling (1% AEP fluvial flood event)

People at risk: Fluvial – 303 (+11%)	Economic risk: Fluvial - £8.3m (+43%)	Properties at risk Fluvial – 107 (+23%)	Environmental sites at risk: Fluvial – No SSSIs at risk (no change)
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Conclusions

Cost: We currently spend approximately £45,000 per year on inspecting and maintaining our defence assets in the Mid and Upper Reaches policy unit. We have based our costs on building new defences

costing £1,500 per metre. To build a new defence at the Crosskeys Industrial Estate along the River Sirhowy would cost approximately £291,000. However, there would also be the cost of undertaking pre-feasibility studies. Therefore, in total, the indicative cost could be up to £500,000.

Conclusion: If we continued to maintain and improve our flood defences to account for the additional risk in the future in the main flood risk areas in policy unit four, there will still be a small amount of fluvial flood risk during a 1% AEP fluvial flood event. Our flood risk management approach is to, where possible, move away from the traditional form of structural responses such as defences, in favour of combinations of softer management options. In this policy unit, we feel that in comparison to the rest of the Eastern Valleys the risk and consequences to people and property is relatively low. We therefore think investment in new defences may not be a cost-effective response as the overall reduction in flood risk and damages to people and property under this policy is low.

Policy unit 4: Mid and Upper Reaches

Generic response: Policy 4 – Localised Flood Storage

Description: We could implement local scale flood storage schemes to reduce water levels. These would attenuate flows by up to 5%, and would operate at a local scale. Due to topographic restrictions and land constraints, flow attenuation schemes which reduce flows above 5% are not feasible. However, for the Mid and Upper Reaches policy unit there is no scope to incorporate local FSR schemes. There is no scope for broad scale modelling under this generic response for the Mid and Upper Reaches policy unit, so no further action has been undertaken.

Base case conditions (1% AEP fluvial flood event)

People at risk: Fluvial - 274	Economic risk: Fluvial – £5.8m	Properties at risk: Fluvial – 87	Environmental sites at risk: Fluvial – No SSSIs at risk
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Results of the broad scale modelling (1% AEP fluvial flood event)

People at risk: N/A	Economic risk: N/A	Properties at risk N/A	Environmental sites at risk: N/A
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Conclusions

Cost: N/A

Conclusion: Taking action to implement local FSR, to reduce flows by 5%, is not feasible in the Mid and Upper Reaches policy unit. There are no suitable locations along the Sirhowy or Upper Rhymney for FSR schemes. Therefore, no further action or modelling has been undertaken for this policy unit.

Policy unit 4: Mid and Upper Reaches

Generic response: Policy 4 – Increased maintenance

Description: We currently undertake some channel maintenance across policy unit four. We have the option to increase this further, to increase channel capacity and allow flow along the River Sirhowy and River Rhymney to be conveyed more freely. This would theoretically reduce flood risk. Our broad scale model was run with channel and flood plain roughness values reduced by 10%, to simulate an increase in our maintenance.

Base case conditions (1% AEP fluvial flood event)

People at risk: Fluvial - 274	Economic risk: Fluvial – £5.8m	Properties at risk: Fluvial – 87	Environmental sites at risk: Fluvial – No SSSIs at risk
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Results of the broad scale modelling (1% AEP fluvial flood event)

People at risk: Fluvial – 296 (+8%)	Economic risk: Fluvial - £7.35m (+27%)	Properties at risk Fluvial – 104 (+20%)	Environmental sites at risk: Fluvial – No SSSIs at risk (no change)
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Conclusions

Cost: We currently spend approximately £45,000 per year on maintenance and operations in the Mid and Upper Reaches policy unit. If we were to increase our maintenance programme costs might be expected to increase by approximately 50% (to £67,500 per year).

Conclusion: In the future, our flood defences would be overtopped if we did not continue to improve them in-line with future increases in water levels. The aim of policy four is to sustain the current level of risk in to the future, although there may be a small amount of risk that we would have to accept. By increasing our channel maintenance throughout the policy unit, we would increase channel capacity. This would allow more water to be contained within the channel, and reduce the flood risk. By undertaking this response alone in the Mid and Upper Reaches policy unit, the consequences in the future to people, property and the economy would not be significantly lower than the P3 generic response, continue with existing flood defence actions only. Therefore, this generic response is considered not to be suitable for policy unit four due to the increased costs and the comparatively small gains in a policy unit where the risks are low currently.

Policy unit 4: Mid and Upper Reaches

Generic response: Policy 5 – Take further action to improve and create new flood defences

Description: Taking further action to improve and create new flood defences to reduce flood risk, both now and into the future, assumes that sustaining the current level of risk would be unacceptable. There is not currently a significant fluvial flood risk in policy unit four in comparison with other areas in the Eastern Valleys. However, we have identified under the policy four generic response take further action to improve and create new defences, one main area where a new defence could be built. Under policy five, we could take further action to reduce flood risk by building new defences in the following areas: Tredegar along the River Sirhowy, in two locations in Pontllanfraith along the River Sirhowy, in two locations in Ynysddu along the River Sirhowy and in Abertysswg along the River Rhymney. However, one of the schemes in Pontllanfraith and one in Ynysddu and the River Sirhowy would not be economically feasible as cost (see below), would not offset the economic benefit. Therefore, we only trimmed our future fluvial flood outlines in the other areas mentioned above. This showed that these areas would benefit from new defences.

Base case conditions (1% AEP fluvial flood event)

People at risk: Fluvial - 274	Economic risk: Fluvial – £5.8m	Properties at risk: Fluvial – 87	Environmental sites at risk: Fluvial – No SSSIs at risk
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Results of the broad scale modelling (1% AEP fluvial flood event)

People at risk: Fluvial – 154 (-44%)	Economic risk: Fluvial - £1.2m (-79%)	Properties at risk Fluvial – 42 (-52%)	Environmental sites at risk: Fluvial – No SSSIs at risk (no change)
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Conclusions

Cost: We currently spend approximately £45,000 per year on inspecting and maintaining our defence assets in the Mid and Upper Reaches policy unit. We have based our costs on a new flood wall costing £1,500 per metre. On top of the costs we estimated in policy four (up to £500,000), we estimated the additional costs under policy five if new defences were built in our selected areas. However, as discussed above and in the conclusion, having weighed up the costs against the benefits, we selected only some fluvial risk areas to be considered under policy five (selected areas highlighted in bold).

- **170m of new defence at Tredegar along the River Sirhowy would cost approximately £255,000.**
- 78m of new defence at Pontllanfraith along the River Sirhowy adjacent to Penmaen Road would cost approximately £117,000.
- **282m of new defence at the Newport Road industrial estate in Pontllanfraith along the River Sirhowy would cost approximately £423,000.**
- 473m of new defence at Dan-Y-Mynydd, Ynysddu along the River Sirhowy would cost approximately £710,000.
- **320m of new defence at Ynysddu along the right bank of River Sirhowy would cost approximately £480,000.**
- **114m of new defence at Abertysswg along the River Rhymney would cost approximately £171,000.**

Therefore, the total indicative cost under policy five would be in excess of £3m (including P4 new defences). This also includes estimated pre-feasibility study costs.

Conclusion: We recognise that into the future we must be aware of the potential consequences from fluvial flood events. By increasing the height of existing and building new defences we are taking more action to manage flood risks into the future. This could be applicable in the following areas:

- A new defence along the right bank of the River Sirhowy at Tredegar at a cost of £255,000 would protect 3 industrial properties and reduce economic damages by up to £478,000.
- A new defence along the right bank of the River Sirhowy at the Newport road industrial estate in Pontllanfraith at a cost of £423,000 would protect 2 large industrial properties and reduce economic damages by approximately £4.7m.
- A new defence along the right bank of the River Sirhowy at Ynysddu at a cost of approximately £480,000 would protect 51 properties and reduce economic damages by up to £1.6m.
- A new defence along the right bank of the River Rhymney at Abertyswg at a cost of £171,000 would protect 9 properties and reduce economic damages by just over £390,000.

However, we recognise that reducing flood risk in the following areas would not be economically feasible as the benefits would not offset the level of investment:

- A new defence along the left bank of the River Sirhowy at Pontllanfraith adjacent to Penmaen Road at a cost of £117,000 would protect 8 properties and reduce economic damages by up to £30,000.
- A new defence along the left bank of the River Sirhowy at Dan-Y-Mynydd, Ynysddu at a cost of £710,000 would protect 24 properties and reduce economic damages by up to £670,000.

However, the total costs in this policy unit may not warrant investment in the suggested risk areas due to the low overall risks to people, property and the economy in comparison to the rest of the Eastern Valleys.

Policy unit 4: Mid and Upper Reaches

Generic response: Policy 6 – Attenuation

Description: The creation of flow attenuation areas in the Mid and Upper Reaches policy unit is not feasible. Responses that deliberately promote large scale flooding are not considered as sustainable methods for reducing risk. Setting back defences in this policy unit is not an option, as much of the floodplain has been developed. There is no scope for broad scale modelling under policy six for the Mid and Upper Reaches policy unit, so no further action has been undertaken.

Base case conditions (1% AEP fluvial flood event)

People at risk: Fluvial - 274	Economic risk: Fluvial – £5.8m	Properties at risk: Fluvial – 87	Environmental sites at risk: Fluvial – No SSSIs at risk
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Results of the broad scale modelling (1% AEP fluvial flood event)

People at risk: N/A	Economic risk: N/A	Properties at risk: N/A	Environmental sites at risk: N/A
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Conclusions

Cost: N/A

Conclusion: Taking action to increase the frequency of flooding is not feasible in the Mid and Upper Reaches policy unit, as such, there is not scope for carrying out policy six in this policy unit. Increased frequency of flooding to make space for water would result in high number of people at risk and high economic damages. Deliberately promoting flooding through schemes, which make space for water, would cause large scale community disruption.

The following table summarises the findings of the generic response modelling for policy unit four (Mid and Upper Reaches). The responses or combination of responses chosen for each policy will be taken forward and compared against the objectives and indicators in table 12.6.

Policy	Generic response
1	Withdraw / retreat defences and stop maintenance
2	Reduced maintenance
3	Risk cannot be managed at the same level of risk by any combination of softer options, such as reducing maintenance and balancing with local flood storage schemes.
4	We have demonstrated that increased maintenance has the greatest effect for reducing risk into the future in policy unit four.
5	A combination of defences and alternative flood risk management options would not be suitable. Therefore a defences alone option has been chosen, although measures such as flood warning and evacuation procedures will be considered as well.
6	Not technically feasible in this policy unit.

Form 12.6: Screening of policy options against appraisal objectives

Policy unit name/number:		Policy unit 4: Mid and Upper Reaches								
N o.	Specific (appraisal) objectives	Indicators	Current baseline	Future baseline	Policy Options					
					P1 No active intervention	P2 Reduce existing actions	P3 Continue with existing actions to maintain current risk	P4 Take further action to sustain current risk	P5 Take further action to reduce current risk	P6 Take further action to increase frequency of flooding
Generic Response					Decreased conveyance Monitoring, advise & survey	Decreased conveyance Influencing and Informing Monitoring, advise & survey Studies	Increased or decreased conveyance Attenuation/retention Influencing and Informing Monitoring, advise & survey Studies	Increased or decreased conveyance Attenuation/retention Influencing and Informing Monitoring, advise & survey Studies	Increased or decreased conveyance Attenuation/retention Influencing and Informing Monitoring, advise & survey Studies	Increased or decreased conveyance Attenuation/retention Influencing and Informing Monitoring, advise & survey Studies
PEOPLE										
1.	Reduce community disruption caused by flooding in Ynysddu and the upper areas of the Rhydney catchment and the Sirhowy catchment	The number of community assets at risk during the 1% AEP fluvial flood event The number of residential properties at flood risk during the 1% AEP fluvial flood event	There are 2 community centres (Ynysddu) and 1 retail building at flood risk during the 1% AEP fluvial flood event There are 82 residential properties at flood risk during the 1% AEP fluvial flood event	There will be 2 community centres (Ynysddu) and 1 retail building at flood risk during the 1% AEP fluvial flood event There will be 140 residential properties at flood risk during the 1% AEP fluvial flood event	There would be 2 community centres (Ynysddu) and 1 retail building at flood risk during the 1% AEP fluvial flood event There would be 149 residential properties at flood risk during the 1% AEP fluvial flood event	There would be 2 community centres (Ynysddu) and 1 retail building at flood risk during the 1% AEP fluvial flood event There would be 140 residential properties at flood risk during the 1% AEP fluvial flood event	There would be 2 community centres (Ynysddu) and 1 retail building at flood risk during the 1% AEP fluvial flood event There would be 140 residential properties at flood risk during the 1% AEP fluvial flood event	There would be 1 community centre (Ynysddu) and 1 retail building at flood risk during the 1% AEP fluvial flood event There would be 95 residential properties at flood risk during the 1% AEP fluvial flood event	There would be no community assets at flood risk during the 1% AEP fluvial flood event There would be 38 residential properties at flood risk during the 1% AEP fluvial flood event	There is no scope for carrying out policy six in this policy unit. Increased frequency of flooding to make space for water could result in a significant increase in community disruption. Deliberately flooding specific areas to make space for water would cause large-

Policy unit name/number:		Policy unit 4: Mid and Upper Reaches								
N o.	Specific (appraisal) objectives	Indicators	Current baseline	Future baseline	Policy Options					
					P1 No active intervention	P2 Reduce existing actions	P3 Continue with existing actions to maintain current risk	P4 Take further action to sustain current risk	P5 Take further action to reduce current risk	P6 Take further action to increase frequency of flooding
		The duration of flooding (<1 day, 1 day to 5 days, > 5 days)	The duration of flooding is less than one day for the 1% AEP fluvial flood event	The duration of flooding will be less than one day for the 1% AEP fluvial flood event	The duration of flooding would be less than one day for the 1% AEP fluvial flood event	The duration of flooding would be less than one day for the 1% AEP fluvial flood event	The duration of flooding would be less than one day for the 1% AEP fluvial flood event	The duration of flooding would be less than one day for the 1% AEP fluvial flood event	The duration of flooding would be less than one day for the 1% AEP fluvial flood event	scale community disruption in those areas. We have not identified any areas in the policy unit where we could do this without increasing community disruption.
		The area of flooding during the 1% AEP fluvial flood event where depth of flooding exceeds 0.5 metres.	The flooded area where depths exceed 0.5 metres is 0.75km ² during a 1% AEP fluvial flood event	The flooded area where depths exceed 0.5 metres will be 1.34km ² during a 1% AEP fluvial flood event	The flooded area where depths exceed 0.5 metres would be 1.71km ² during a 1% AEP fluvial flood event	The flooded area where depths exceed 0.5 metres would be 1.51km ² during a 1% AEP fluvial flood event	The flooded area where depths exceed 0.5 metres would be 1.34km ² during a 1% AEP fluvial flood event	The flooded area where depths exceed 0.5 metres would be 1.3km ² during a 1% AEP fluvial flood event	The flooded area where depths exceed 0.5 metres would be 1.29km ² during a 1% AEP fluvial flood event	
ECONOMICS										
2.	Reduce economic damages caused by flooding in Ynysddu and in upper areas of	The total cost of property economic damages during the 1% AEP fluvial flood event	The 1% AEP fluvial flood economic property damages are £5.8m	The 1% AEP fluvial flood economic property damages will be £9.3m	The 1% AEP fluvial flood economic property damages would be £11.3m	The 1% AEP fluvial flood economic property damages would be £10.3m	The 1% AEP fluvial flood economic property damages will be £9.3m	The 1% AEP fluvial flood economic property damages would be £7.3m	The 1% AEP fluvial flood economic property damages would be £1.2m	There is no scope for carrying out policy six in this policy unit. Increased frequency of flooding to make

Policy unit name/number:		Policy unit 4: Mid and Upper Reaches								
N o.	Specific (appraisal) objectives	Indicators	Current baseline	Future baseline	Policy Options					
					P1 No active intervention	P2 Reduce existing actions	P3 Continue with existing actions to maintain current risk	P4 Take further action to sustain current risk	P5 Take further action to reduce current risk	P6 Take further action to increase frequency of flooding
	the Rhymney catchment and the Sirhowy catchment	The total cost of agricultural damages during the 1% AEP fluvial flood event	The 1% AEP fluvial flood agricultural damages are £131,000	The 1% AEP fluvial flood agricultural damages will be £200,000	The 1% AEP fluvial flood agricultural damages would be £243,000	The 1% AEP fluvial flood agricultural damages would be £222,000	The 1% AEP fluvial flood agricultural damages would be £200,000	The 1% AEP fluvial flood agricultural damages would be £194,000	The 1% AEP fluvial flood agricultural damages would be £192,000	space for water could result in a significant increase in economic damages. Deliberately flooding specific areas to make space for water would cause large-scale damage to property. We have not identified any areas in the policy unit where we could do this without increasing the economic damages significantly
3.	Optimise the level of Flood Risk Management expenditure. Ensure investment is proportional to the risks	The indicative costs of our flood risk management actions	We currently spend approximately £45,000 per year on maintenance and operations	We will spend more than we currently spend on maintenance and operations as risk is going to increase in the future in the Eastern Valleys, placing more demand on our resources and expenditure.	No construction or maintenance costs associated with undertaking this policy but it would be necessary to devise a strategy, and withdraw over a number of years, monitoring the situation once this had been done.	We would expect costs to reduce by half to £22,500 per year, which may match the low risk in the policy unit	We would continue to spend £45,000 per year on maintenance and operations. However, the risks would not be reduced enough to warrant this continual expenditure	We would expect to double our expenditure to £90,000 per year on maintenance and operations. However, the risks would not be reduced significantly to warrant this increase in expenditure. Maintenance costs will increase as a result.	Indicative costs to improve and build new defences would cost approximately £3.0million. Although risk would be significantly reduced, the relatively low risk currently does not warrant this cost in comparison to the rest of the Eastern Valleys.	There is no scope for carrying out policy six in this policy unit. Constructing formal flood storage areas would cost many millions of pounds. Deliberately promoting flooding through schemes that make space for water would cause large scale community disruption to the Eastern Valleys as a whole

Policy unit name/number:		Policy unit 4: Mid and Upper Reaches									
N o.	Specific (appraisal) objectives	Indicators	Current baseline	Future baseline	Policy Options						
					P1 No active intervention	P2 Reduce existing actions	P3 Continue with existing actions to maintain current risk	P4 Take further action to sustain current risk	P5 Take further action to reduce current risk	P6 Take further action to increase frequency of flooding	
										Maintenance costs will increase as a result.	
ENVIRONMENT											
4.	Ensure no deterioration of designated international and national nature conservation sites	The percentage area of each SSSI affected during the 1% AEP fluvial flood event	There are no SSSIs at flood risk during the 1% AEP fluvial flood event	There will be no SSSIs at flood risk during the 1% AEP fluvial flood event	There would be no SSSIs at flood risk during the 1% AEP fluvial flood event	There would be no SSSIs at flood risk during the 1% AEP fluvial flood event	There would be no SSSIs at flood risk during the 1% AEP fluvial flood event	There would be no SSSIs at flood risk during the 1% AEP fluvial flood event	There would be no SSSIs at flood risk during the 1% AEP fluvial flood event	There would be no SSSIs at flood risk during the 1% AEP fluvial flood event	There is no scope for carrying out policy six in this policy unit. Increased frequency of flooding to make space for water would result in a higher percentage area of risk to designated sites. Deliberately promoting flooding through schemes that make space for water would cause large scale disruption to this policy unit and the Eastern Valleys as a whole
5.	Protect and improve habitats and species diversity, particularly BAP habitats and those relying on freshwater	BAP habitats and species at flood risk during the 1% AEP fluvial flood event	The following BAP habitats are at flood risk during a 1% AEP fluvial flood event: <ul style="list-style-type: none"> • Blanket bog • Lakes and reservoirs • Ponds • Reedbeds 	The following BAP habitats are likely to experience more frequent and longer duration of flooding in the future: <ul style="list-style-type: none"> • Blanket bog • Lakes and reservoirs • Ponds 	The following BAP habitats are likely to experience more frequent and longer duration flooding as a result of Policy 1: <ul style="list-style-type: none"> • Blanket bog • Lakes and reservoirs • Ponds 	The following BAP habitats are likely to experience more frequent and longer duration flooding as a result of Policy 2: <ul style="list-style-type: none"> • Blanket bog • Lakes and reservoirs • Ponds 	The following BAP habitats are likely to experience more frequent and longer duration flooding as a result of Policy 3: <ul style="list-style-type: none"> • Blanket bog • Lakes and reservoirs • Ponds 	The following BAP habitats are likely to be at risk to the same extent as under current baseline conditions, as a result of Policy 4: <ul style="list-style-type: none"> • Blanket bog • Lakes and 	The following BAP habitats are likely to experience less frequent and shorter duration flooding as a result of Policy 5: <ul style="list-style-type: none"> • Blanket bog • Lakes and 	There is no scope for carrying out policy six in this policy unit. Increased frequency of flooding to make space for water would result in a higher percentage	

Policy unit name/number:		Policy unit 4: Mid and Upper Reaches								
N o.	Specific (appraisal) objectives	Indicators	Current baseline	Future baseline	Policy Options					
					P1 No active intervention	P2 Reduce existing actions	P3 Continue with existing actions to maintain current risk	P4 Take further action to sustain current risk	P5 Take further action to reduce current risk	P6 Take further action to increase frequency of flooding
			<ul style="list-style-type: none"> Rhos pastures Rivers, streams and floodplains <p>The following BAP species are at flood risk during a 1% AEP fluvial flood event:</p> <ul style="list-style-type: none"> Brown Trout Double Line Moth Lapwing Reed Bunting 	<ul style="list-style-type: none"> Reedbeds Rhos pastures Rivers, streams and floodplains <p>The following BAP species are likely to experience more frequent and longer duration of flooding in the future:</p> <ul style="list-style-type: none"> Brown Trout Double Line Moth Lapwing Reed Bunting 	<ul style="list-style-type: none"> Reedbeds Rhos pastures Rivers, streams and floodplains <p>The following BAP species are likely to experience more frequent and longer duration flooding as a result of Policy 1:</p> <ul style="list-style-type: none"> Brown Trout Double Line Moth Lapwing Reed Bunting 	<ul style="list-style-type: none"> Reedbeds Rhos pastures Rivers, streams and floodplains <p>The following BAP species are likely to experience more frequent and longer duration flooding as a result of Policy 2:</p> <ul style="list-style-type: none"> Brown Trout Double Line Moth Lapwing Reed Bunting 	<ul style="list-style-type: none"> Reedbeds Rhos pastures Rivers, streams and floodplains <p>The following BAP species are likely to experience more frequent and longer duration flooding as a result of Policy 3:</p> <ul style="list-style-type: none"> Brown Trout Double Line Moth Lapwing Reed Bunting 	<ul style="list-style-type: none"> reservoirs Ponds Reedbeds Rhos pastures Rivers, streams and floodplains <p>The following BAP species are likely to be at risk to the same extent as under current baseline conditions, as a result of Policy 4:</p> <ul style="list-style-type: none"> Brown Trout Double Line Moth Lapwing Reed Bunting 	<ul style="list-style-type: none"> reservoirs Ponds Reedbeds Rhos pastures Rivers, streams and floodplains <p>The following BAP species are likely to experience less frequent and shorter duration flooding as a result of Policy 5:</p> <ul style="list-style-type: none"> Brown Trout Double Line Moth Lapwing Reed Bunting 	<p>area of risk to designated habitats and species. Deliberately promoting flooding through schemes that make space for water would cause large scale disruption to this policy unit and the Eastern Valleys as a whole</p>
6.	Manage flood risk to Listed Buildings in Rhymney, Tredegar and Blackwood and ensure sites which are currently 'safe' do not become at risk of flooding.	The number of Listed Buildings within the 1% AEP fluvial flood extent	There are 7 Listed Buildings at flood risk during the 1% AEP fluvial flood event	There will be 7 Listed Buildings at flood risk during the 1% AEP fluvial flood event	There would be 7 Listed Buildings at flood risk during the 1% AEP fluvial flood event	There would be 7 Listed Buildings at flood risk during the 1% AEP fluvial flood event	There would be 7 Listed Buildings at flood risk during the 1% AEP fluvial flood event	There would be 7 Listed Buildings at flood risk during the 1% AEP fluvial flood event	There would be 7 Listed Buildings at flood risk during the 1% AEP fluvial flood event	There is no scope for carrying out policy six in this policy unit. Deliberately promoting flooding through schemes that make space for water would cause large scale disruption to the policy unit and the Eastern Valleys as a whole

Form 12.7: Summary of the relative overall losses (including flood risk management costs) and gains (including flood alleviation benefits), thus demonstrating the rationale behind selecting the preferred option

Policy unit name/number:	Policy unit 4: Mid and Upper Reaches		
Policy options	Losses	Gains	Preferred policy option
Policy option P1			
Environmental	<p>LOW- More frequent and longer duration flooding may adversely affect habitats intolerant of waterlogging. Impacts will be particularly severe if inundation is from low quality water or non-fluvial sources.</p> <p>LOW- Increase in BAP species at risk of flooding from a 1% AEP fluvial flood event</p> <p>NEUTRAL = No increase in the number of listed buildings at risk from a 1% AEP fluvial flood event. The number at risk remains at seven.</p>	<p>LOW+ More frequent and longer duration flooding may enhance water-dependent habitats.</p> <p>LOW+ Stopping river maintenance and not maintaining defences may benefit BAP species through reduced disturbance. In particular, Brown Trout and Reed Bunting are likely to benefit</p> <p>NEUTRAL = No increase in the number of listed buildings at risk from a 1% AEP fluvial flood event. The number at risk remains at seven.</p>	<p>Not preferred option – although risk to people, property and the economy would be comparatively low, we feel some flood risk management is still necessary, particularly for Ynysddu where there is an existing defence scheme.</p>
Social	<p>LOW- 67 additional residential properties at risk from flooding</p> <p>NEUTRAL= There would be no additional community assets at risk from flooding</p> <p>MEDIUM- An additional 0.96km² of land where depths exceed 0.5 metres at risk from flooding</p>		
Economic	<p>LOW- £5.5m increase in economic damages to properties</p> <p>LOW- £112,000 increase in agricultural damages</p>		
Policy option P2			
Environmental	<p>LOW- More frequent and longer duration flooding may adversely affect habitats intolerant of waterlogging. Impacts will be particularly severe if inundation is from low quality water or non-fluvial sources.</p> <p>LOW- Increase in BAP species at risk of flooding from a 1% AEP fluvial flood event</p> <p>NEUTRAL = No increase in the number of listed buildings at risk from a 1% AEP fluvial flood event. The number at risk remains at seven.</p>	<p>LOW+ More frequent and longer duration flooding may enhance water-dependent habitats.</p> <p>LOW+ Reduced maintaining defences may benefit BAP species through reduced disturbance. In particular, Brown Trout and Reed Bunting are likely to benefit</p> <p>NEUTRAL = No increase in the number of listed buildings at risk from a 1% AEP fluvial flood event. The number at risk remains at seven.</p>	<p>✓ Reduce existing actions – reducing flood risk management is a feasible option in this policy unit as the increases in flood risk would be low.</p>
Social	<p>LOW- 58 additional residential properties at risk from flooding</p> <p>NEUTRAL= There would be no additional community assets at risk from flooding</p> <p>LOW- An additional 0.76km² of land where depths exceed 0.5 metres at risk from flooding</p>		
Economic	<p>LOW- £4.5m increase in economic damages to properties</p> <p>LOW- £91,000 increase in agricultural damages</p>		

Policy unit name/number:	Policy unit 4: Mid and Upper Reaches		
Policy options	Losses	Gains	Preferred policy option
Policy option P3			
Environmental	<p>LOW- More frequent and longer duration flooding may adversely affect habitats intolerant of waterlogging. Impacts will be particularly severe if inundation is from low quality water or non-fluvial sources.</p> <p>LOW- Increase in BAP species at risk of flooding from a 1% AEP fluvial flood event</p> <p>NEUTRAL = No increase in the number of listed buildings at risk from a 1% AEP fluvial flood event. The number at risk remains at seven</p>	<p>LOW+ More frequent and longer duration flooding may enhance water-dependent habitats.</p> <p>NEUTRAL = No increase in the number of listed buildings at risk from a 1% AEP fluvial flood event. The number at risk remains at seven</p>	Not preferred option – maintaining our current level of management is not a sustainable option in this policy unit, as flood risk is not significantly lower than the policy two selected.
Social	<p>LOW- 58 additional residential properties at risk from flooding</p> <p>NEUTRAL= There would be no additional community assets at risk from flooding</p> <p>LOW- An additional 0.59km² of land where depths exceed 0.5 metres at risk from flooding</p>		
Economic	<p>LOW- £3.5m increase in economic damages to properties</p> <p>LOW- £69,000 increase in agricultural damages</p>		
Policy option P4			

Policy unit name/number:	Policy unit 4: Mid and Upper Reaches		
Policy options	Losses	Gains	Preferred policy option
Environmental	<p>NEUTRAL = No change in the frequency or duration of flooding to BAP habitats or species.</p> <p>MEDIUM- Delivery of CFMP policy to sustain current flood risk may reduce the quality and quantity of BAP habitat and species within the policy unit. Rivers, streams and floodplains and Brown Trout are likely to be particularly affected</p> <p>NEUTRAL = No increase in the number of listed buildings at risk from a 1% AEP fluvial flood event. The number at risk remains at seven</p>	<p>NEUTRAL = No change in the frequency or duration of flooding to BAP habitats or species.</p> <p>NEUTRAL = No increase in the number of listed buildings at risk from a 1% AEP fluvial flood event. The number at risk remains at seven</p>	Not preferred option – in comparison to risk and consequences as a result of flooding across other areas of the Eastern Valleys, flood risk is comparatively low, and further investment towards increasing maintenance is considered not to be justified.
Social	<p>LOW- 13 additional residential properties at risk from flooding</p> <p>LOW- An additional 0.55km² of land where depths exceed 0.5 metres at risk from flooding</p>	<p>LOW+ There would be a decrease in community disruption as 1 community centre (-1) and 1 retail building (-0) would be at flood risk</p>	
Economic	<p>LOW- £1.5m increase in economic damages to properties</p> <p>LOW- £63,000 increase in agricultural damages</p>		
Policy option P5			
Environmental	<p>NEUTRAL = No change in the frequency or duration of flooding to BAP habitats or species.</p> <p>MEDIUM- Delivery of CFMP policy to reduce current flood risk may reduce the quality and quantity of the BAP habitat and species within the policy unit. Rivers, streams and floodplains and Brown Trout are likely to be particularly affected</p> <p>LOW- Less frequent and shorter duration flooding of BAP habitats may adversely affect habitats dependent on waterlogging.</p> <p>NEUTRAL = No increase in the number of listed buildings at risk from a 1% AEP fluvial flood event. The number at risk remains at seven</p>	<p>NEUTRAL = No change in the frequency or duration of flooding to BAP habitats or species.</p> <p>LOW+ Less frequent and shorter duration flooding of BAP habitats will benefit BAP habitats intolerant of waterlogging.</p> <p>LOW+ A decrease in the number of BAP species at flood risk from a 1% AEP fluvial flood event.</p> <p>NEUTRAL = No increase in the number of listed buildings at risk from a 1% AEP fluvial flood event. The number at risk remains at seven</p>	Not preferred option – in comparison to risk and consequences as a result of flooding across other areas of the Eastern Valleys, flood risk is comparatively low, and further investment towards a structural response is considered not to be justified.
Social	<p>LOW- An additional 0.54km² of land where depths exceed 0.5 metres at risk from flooding</p>	<p>MEDIUM+ There would be a decrease in community disruption as 38 (-44) residential properties would be at flood risk</p> <p>HIGH+ There would be a decrease in community disruption as no community assets would be at flood risk</p>	
Economic	<p>LOW- £61,000 increase in agricultural damages</p>	<p>HIGH+ £1.2m economic damages to properties (-£4.6m)</p>	
Policy option P6			

Policy unit name/number:	Policy unit 4: Mid and Upper Reaches		
Policy options	Losses	Gains	Preferred policy option
Environmental	There is no scope for carrying out policy six in this policy unit. Increased frequency of flooding to make space for water would result in a very high number of people at risk and very high economic damages. Deliberately promoting flooding through schemes that make space for water would cause large-scale community disruption to the Eastern Valleys as a whole.	There is no scope for carrying out policy six in this policy unit. Increased frequency of flooding to make space for water would result in a very high number of people at risk and very high economic damages. Deliberately promoting flooding through schemes that make space for water would cause large-scale community disruption to the Eastern Valleys as a whole.	Not preferred option – there is no scope for carrying out policy six in this policy unit. There is very limited opportunity for increasing the frequency of flooding as a flood risk management option within this policy unit.
Social			
Economic			

Key

HIGH:	<p>High negative</p> <p>A policy has a 'high negative' effect where it could contribute to a social, economic or environmental objective in a significantly negative way.</p> <p>A 'high negative' effect could be:</p> <ul style="list-style-type: none"> (i) a very large increase in current flood risk; (ii) very large projected increases in flood risk under future conditions, and/or; (iii) significant additional social, economic and/or environmental losses.
MEDIUM:	<p>Medium negative</p> <p>A policy has a 'medium negative' effect where it could contribute to a social, economic or environmental objective in a negative way.</p> <p>A 'medium negative' effect could be:</p> <ul style="list-style-type: none"> (i) an increase in current flood risk; (ii) a projected increase in flood risk under future conditions, and/or; (iii) social, economic and/or environmental losses.
LOW:	<p>Low negative</p> <p>A policy has a 'low negative' effect where it could make a limited contribution to a social, economic or environment objective, but where the overall contribution would be negative.</p> <p>A 'low negative' effect could be:</p> <ul style="list-style-type: none"> (i) an overall increase in current flood risk; (ii) an overall increase in flood risk under future conditions, and/or; (iii) overall social, economic and/or environmental losses.
NEUTRAL:	<p>Neutral</p> <p>A policy has a 'neutral' effect where it makes neither a positive or negative contribution to a social, economic or environmental objective.</p> <p>A 'neutral' effect could be:</p> <ul style="list-style-type: none"> (i) no change in current level of risk. In this instance the current level of risk would have to be low, so that the residual risk after a neutral policy was implemented remained acceptable; (ii) no change in flood risk under future conditions. In this instance projected future risk would need to be low so that the residual risk after a neutral policy was implemented remained acceptable, and/or; (iii) no additional social, economic and/or environmental gains or losses. <p>Policy options may also be 'neutral' where they are not relevant in a particular policy unit, or where it is not feasible for a policy option to contribute to an objective.</p>
HIGH:	<p>High positive</p> <p>A policy has a 'high positive' effect where it could contribute to a social, economic or environmental objective in a significantly positive way.</p> <p>A 'high positive' effect could be:</p> <ul style="list-style-type: none"> (i) a very large reduction in current flood risk; (ii) avoiding/reducing very large projected increases in flood risk under future conditions, and/or; (iii) significant additional social, economic and/or environmental gains.
MEDIUM:	<p>Medium positive</p> <p>A policy has a 'medium positive' effect where it could contribute to a social, economic or environmental objective in a positive way.</p> <p>A 'medium positive' effect could be:</p> <ul style="list-style-type: none"> (i) a reduction in current flood risk; (ii) avoiding/reducing projected increases in flood risk under future conditions, and/or; (iii) additional social, economic and/or environmental gains.
LOW:	<p>Low positive</p> <p>A policy has a 'low positive' effect where it could make a limited contribution to a social, economic or environment objective, but where the overall contribution would be positive.</p> <p>A 'low positive' effect could be:</p> <ul style="list-style-type: none"> (i) an overall reduction in current flood risk; (ii) an overall avoidance/reduction in flood risk under future conditions,

Form 12.8: Summary of the preferred policy

Policy Unit name/number:	<p>Policy Unit 4: Mid and Upper Reaches</p> <p>The policy unit is located within the mid and upper reaches of the Eastern Valleys CFMP area. The policy unit covers the main area of Ynysddu, and also covers the urban areas of Rhymney, Tredegar and Blackwood.</p>
Problem / risk:	<p>The main rivers within this policy unit are the River Sirhowy and the River Rhymney (the main tributary of the Lower River Rhymney). There is one main source of flooding within this policy unit; fluvial. Other secondary sources of flooding within this policy unit include surface and sewer flooding. We currently spend approximately £45,000 per year on maintenance and operations in this policy unit.</p> <p>Current and future fluvial risk within the policy unit is low in comparison to the rest of the Eastern Valleys.</p> <p>Flood risk does not increase significantly for higher return period flood events both now and into the future.</p>
Policy selected	<p>Policy 2 – reduce existing actions</p> <p>We have selected this policy based on the risk posed by inland flooding sources and tidal flooding sources. By selecting this policy we are accepting that flood risk will increase now and into the future. This will need to be a managed process and does not mean that where flood defences are protecting a large number of properties (Ynysddu) these should be removed. Most of the additional flood risk will be in areas where there is little flood risk to people, property and the environment.</p> <p>If the risks posed by tidal flooding were removed from the policy appraisal process, preliminary estimates suggest that this policy would remain a P2. This is because there is no tidal flood risk in this policy unit.</p> <p>The flood risk in Mid and Upper Reaches policy unit is considered to be low and we should be looking to reduce our existing flood risk management in areas not at flood risk.</p>
Justification and alternative policies considered	<p>Policy 2 sets a framework that reduces our current flood risk management and actions within the policy unit. This policy is appropriate for this policy unit for the following reasons:</p> <ul style="list-style-type: none"> - The current level of flood risk is low in comparison to other areas of the Eastern Valleys. - The future level of flood risk is low in comparison to other areas of the Eastern Valleys. - Some areas within the policy unit may warrant a reduction in current flood risk management activities and maintenance, particularly in rural areas. - There is little harm to life, community disruption and economic damages both now and into the future. - Increasing the current flood risk management actions brings little reduction in flood risk in this policy unit. - We still need to maintain the defences in Ynysddu, which would not be possible under a P1. <p>The main area of Ynysddu is located in the middle catchment area of the Sirhowy River. There are existing flood defences in Ynysddu along the River Sirhowy. There is a residual risk of these defences breaching, so properties located behind these flood defences are vulnerable.</p> <p>The current scale of fluvial flood risk during a 1% AEP flood event in the policy unit is low in comparison to other areas in the Eastern Valleys. The estimated total property damage for Ynysddu in the 1% AEP fluvial flood event is £1.8 million. The estimated total property damage for the policy unit is £2.4million for the 10% AEP fluvial flood event and £5.8million for the 1% AEP fluvial flood event. The property damages increase for the 0.1% AEP fluvial flood event to £11.1 million. The damages do not increase significantly for Ynysddu. The flood risk to people,</p>

property and the economy does not increase significantly, in comparison to the rest of the Eastern Valleys. Across the policy unit the 1% AEP fluvial flood event would affect approximately 87 properties, with no critical transport routes or critical assets at flood risk.

In the future, the 1% AEP fluvial flood event damages for the policy unit do not increase significantly in comparison to the rest of the Eastern Valleys. The future damages to properties in the 1% AEP fluvial flood event are £2.2 million. The increase in flood risk into the future is low, but it will be necessary for us to target our reduced investment, under the policy two selected, in higher risk areas where consequences to people and property are more significant, such as Ynysddu where there is an existing flood defence scheme. Property damages in this policy unit will increase to £9.3million for the 1% AEP fluvial flood event. This would only increase by £1million under the selected policy two. Across the policy unit only 150 properties will be at risk from flooding with no critical transport routes or critical assets at flood risk. The number of properties at flood risk would only increase by five under the selected policy two.

The expected current annual damages in the entire policy unit are £580,000/yr. The expected annual damages would only increase by 30% in the future as a result of the impacts of climate change and further development planned within the policy unit.

Justification and alternative policies considered

Gains and losses under preferred policy (policy two)

Social

Policy two gives one neutral and two low losses against our social CFMP objectives and indicators. We would be accepting some additional flood risk by selecting policy two as our preferred policy but the social consequences are low in comparison to other areas of the Eastern Valleys. The risks do not increase significantly under higher return period flood events in comparison to the rest of the Eastern Valleys.

Economic

Policy two gives two low losses against our economic CFMP objectives and indicators. The risk to critical assets and transport routes are low in policy unit four, and the economic damages we are accepting are minimal in comparison to the rest of the Eastern Valleys.

Environmental

Policy two gives one neutral, two low losses and two low gains against our environmental CFMP objectives and indicators. There are few designated sites within the policy unit and any increases in flooding from the selected policy will not affect any environmental sites.

Alternative policies considered

Policy one – *No active intervention*. Although the increased risk to people (+141), properties (+82) and the economy (+£5.5m) would be relatively low, we feel it is necessary to maintain some of our existing flood risk management actions.

Policy three – *Maintain current levels of flood risk management*. The increased risk to people (+46), properties (+63) and the economy (+£3.5m) would be low. However, this is not significantly lower than the selected policy two risks and does not warrant the current flood risk management expenditure in some areas.

Policy four – *Take further action to sustain the current level of flood risk into the future*. In comparison to risk and consequences as a result of flooding across other areas of the Eastern Valleys, flood risk is low, and further investment towards increasing maintenance further is considered not to be justified.

Policy five – *Take further action to reduce flood risk (now and/or into the future)*. In

	<p>comparison to risk and consequences as a result of flooding across other areas of the Eastern Valleys, flood risk is low, and further investment towards a structural response is considered not to be justified.</p> <p>Policy six – <i>Take action with others to store water or manage run-off in locations that provide overall flood risk reduction or environmental benefits, locally or elsewhere in the catchment.</i> There is no scope for carrying out policy six in this policy unit. There is very limited opportunity for increasing the frequency of flooding as a flood risk management option within this policy unit.</p>
Catchment-wide opportunities & constraints	<p>The greatest opportunity in policy unit four is to reduce our current flood risk management expenditure and focus the reduced investment on existing flood defence schemes.</p> <p>There may be opportunities to use alternative maintenance activities throughout the policy unit to enable gradual enhancement of channel habitats.</p>
Actions	<ul style="list-style-type: none"> • Initiate urban drainage studies for the urban areas in the policy unit to identify surface water drainage issues and potential for remediation. • Review asset management systems. • In partnership with Blaenau Gwent and Caerphilly Local Authorities we should enforce stringent building controls on new development within flood risk areas. Suitable land allocations for new development should first be sought outside of flood risk areas. • SUDs and building regulations (resilience) should be incorporated, where appropriate, into all new developments.
Risks, uncertainties & dependencies	<p>The damages across the Mid and Upper Reaches policy unit from flooding are estimates that are considered sufficiently accurate to justify selecting policy two. However, there are uncertainties surrounding the choice of future scenarios and this policy has been selected based on our future scenario that used a combination of high climate change and low urbanisation projections.</p> <p>There were no existing models for the rivers within this policy unit, therefore flooding has been estimated from a broad-scale modeling approach. There is more uncertainty with the broadscale modeling than areas with existing models.</p>

Form 12.9: Requirements for further policy development and appraisal

Is there a need for further policy development?	No
If yes, then mark Policy Options for more detailed development. Some complex policies may require more detailed development, probably at Strategy Plan level.	
Is there a need for further more detailed appraisal?	No
If yes, take forward to Strategy study.	

Form 12.10: Indicators for monitoring, review and evaluation

Set out the indicators that need to be included in the policy implementation plan, for policy monitoring, drawing on the residual risks and likely impacts identified above. This will allow better review and evaluation of the policy when implemented.	
Monitoring	Significance/impact
Hydrometric monitoring of river flows and levels, rainfall and groundwater levels throughout the catchment in order to monitor changes in climate	<ul style="list-style-type: none"> • Additional data may change our assessment of current or future conditions
Scientific advancements in flood risk management	<ul style="list-style-type: none"> • Improved predictions in changes to river flows

Land use change monitored using satellite imagery	<ul style="list-style-type: none"> • Further information on land use change may change future predictions of flood risk
Actual development rates	<ul style="list-style-type: none"> • Need to check if urbanisation predictions made are realistic in light of current and future development undertaken
Designation and condition of environmental sites	<ul style="list-style-type: none"> • May change the chosen policy if additional sites are designated. Monitoring of site condition will confirm that chosen CFMP policies have not adversely affect designated sites
Designation and condition of historic environmental assets	<ul style="list-style-type: none"> • May change the chosen policy if additional sites are designated. Monitoring of site condition will confirm that chosen CFMP policies have not adversely affect designated sites
Detrimental impacts of flood risk management projects on BAP habitats and species	<ul style="list-style-type: none"> • To ensure that specific flood risk management projects do not adversely affect BAP habitats and species
Level of uptake of flood warning services	<ul style="list-style-type: none"> • Monitor whether the community are aware of the flood risks
Condition of flood defences	<ul style="list-style-type: none"> • Need to maintain defences in line with the policy chosen
Actual expenditure on maintenance activities by policy unit, subdivided into activities.	<ul style="list-style-type: none"> • Ensure that money is being targeted according to policy chosen
Actual expenditure on capital works to reduce flood risk	<ul style="list-style-type: none"> • Need to ensure that these actions are in keeping with the policy chosen
Improved documentation of actual flood events: <ul style="list-style-type: none"> • Number of properties/assets/ environmental sites/historic environment assets flooded • Source of flooding • Cause of flooding • Whether due to defence failure 	<ul style="list-style-type: none"> • Information on actual flood events needs to be better recorded in order to understand the relative importance of the various sources of flooding
Construction of critical infrastructure	<ul style="list-style-type: none"> • May change the chosen policy if additional critical infrastructure is constructed within the floodplain

Spatial location of policy unit 5: Upper Ebbw



Form 12.5: Summary of current and future levels of and responses to flood risk

<p>Policy unit name/number:</p>	<p>Policy Unit 5: Upper Ebbw</p>
<p>Current responses to flood risk within the policy unit?</p>	<p>Defences We defend the main urban areas in policy unit five, namely Abertillery, Llanhilleth and Cwm, using raised earth, concrete and stone-wall embankments, with gabion and blockstone revetments and concrete haunching.</p> <p>In Abertillery, the defences extend along the left bank of the River Ebbw from the Roseheyworth Business Park, through Six Bells down to Aberbeeg for a distance of approximately 4.4km.</p> <p>In Cwm, the defences extend along the left bank of the River Ebbw from Elm Street down to Tallistown for a distance of approximately 1.4km.</p> <p>In Llanhilleth/Crumlin, the defences extend along the left bank of the River Ebbw, protecting Cae Felin Street and Meadow Street, for a distance of approximately 0.5km.</p> <p>Flood Warning We provide a flood warning service via Floodline Warnings Direct. Flood Warning Area 103FWFg11 covers fluvial flood risk from the River Ebbw in Cwm, Abertillery, Six Bells, Aberbeeg and Llanhilleth. The lead times for flood warning in policy unit five are unknown. We aim to issue flood warnings at least 2 hours before a flood event occurs. There are currently 295 properties at flood risk during a 1% AEP fluvial flood event, 64 of which lie within the existing flood warning area. Uptake to the flood warning service is unknown.</p> <p>Maintenance of existing structures We carry out routine maintenance works on all main rivers in policy unit five. In Aberbeeg, Cwm and Six Bells we undertake: routine mowing and spraying to maintain the River Ebbw channel capacity; tree management to maintain channel conveyance and trashing and obstruction removal to maintain channel conveyance.</p> <p>The Upper Ebbw policy unit is covered by eight asset systems. FR19S104, FR19S0101, FR19S0100 and FR19S112 are low risk asset systems and are inspected every 36 to 60 months. FR19S068 is a medium risk asset system and is inspected every 18-24 months. FR19S063, FR19S097 and FR19S076 are high risk asset systems and are inspected every 6 to 12 months. We currently spend approximately £48,000 per year on maintenance and operations in policy unit five.</p>
<p>Standards of service that apply to flood defences within the policy unit?</p>	<p>Standard of Protection The flood defences in Cwm, Abertillery, Six Bells and Llanhilleth/Crumlin all have a 1% AEP Standard of Protection (SoP) in most places.</p> <p>All of these defences are likely to be overtopped when allowances are made for climate change into the future.</p> <p>Condition and maintenance of defences This information is unknown.</p>
<p>What is currently exposed to flooding?</p>	<p>People We estimate that there are currently 687 people at risk of flooding in policy unit five from a 1% AEP fluvial flood event. The fluvial flood risk comes from the River Ebbw and the main risk to people during the 1% AEP fluvial flood event is in Risca.</p> <p>Flood risk does increase during the 0.1% AEP fluvial flood event because all flood defences are overtopped.</p> <p>Community Disruption We estimate that there are currently 295 properties at risk of flooding in policy unit</p>

	<p>five from a 1% AEP fluvial flood event, 272 of which are residential. Community assets at flood risk are three health services in Llanhilleth, two schools in Ebbw Vale and Blaina, one community centre in Glyncoed and eight retail buildings.</p> <p>Critical Infrastructure We estimate that there are no critical transport routes at flood risk during a 1% AEP fluvial flood event. The only critical assets at risk are two electricity stations in Beaufort and Abertillery.</p> <p>Economic Damages We estimate the total economic property damages resulting from the 1% AEP fluvial flood event to be £7.6 million. We estimate the total economic agricultural damages resulting from the 1% AEP fluvial flood event to be £173,000.</p> <p>Historic Environment We estimate that five listed buildings are at flood risk from a 1% AEP fluvial flood event.</p> <p>Landscape The Brecon Beacons National Park is located in the north of the policy unit. A very small proportion of the national park (<0.1%) is at flood risk from a 1% AEP fluvial flood event.</p> <p>Recreation We estimate that there are currently three recreational areas at flood risk in policy unit five from the 1% AEP fluvial flood event.</p> <p>Nature conservation sites We estimate that there are currently no designated nature conservation sites at flood risk from a 1% AEP fluvial flood event in policy unit five.</p> <p>BAP Habitats The exact location of BAP habitats in the catchment is unknown, but we estimate that several locally important habitats, identified in the Blaenau Gwent Local BAP, will be at risk from fluvial flooding. These habitats include; blanket bog; fens; lakes and reservoirs; mesotrophic lakes; reedbeds; rhos pastures; rivers, streams and floodplains; and wet woodlands.</p> <p>Species The exact location of BAP species in the catchment is unknown, but we estimate that a several locally important species, identified in the Blaenau Gwent Local BAP, will be at risk of fluvial flooding. These species include Great Crested Newt; Greater Horseshoe Bat; Lesser Horseshoe Bat; Otter and Pipistrelle Bat.</p>
<p>Who and what are currently most vulnerable to flood damage and losses?</p>	<p>Social and economic receptors People living in areas behind flood defences are the most vulnerable to flooding due to the high depths and velocities of flood water that would be expected if a breach occurred in the defence scheme or the defences were overtopped. The area of Ebbw Vale has the highest economic damages during a 1% AEP fluvial flood event, most of which are as a result of flooding to residential properties.</p> <p>Environmental receptors Only a small proportion of the Brecon Beacons National Park (<0.1%) is at flood risk from a 1% AEP fluvial flood event. As such a small area of national park at risk, and this area is the Ebbw river corridor, flooding is unlikely to have a negative affect on the landscape value of the park.</p>

	<p>BAP habitats and species in the unit are at greatest risk from prolonged or frequent floodwater inundation, especially by low quality water, which can indirectly degrade habitats. However, some wetland BAP habitats, and the species they support, may benefit from increased flooding.</p> <p>The five listed buildings at current flood risk from a 1% AEP fluvial event are likely to be negatively affected. Frequent inundation, with high depths and velocities of flood water, is likely to have a negative impact.</p>
<p>What are the key factors that could drive future flood risk?</p>	<p>Climate change</p> <p>Climate change is the main driver of future flood risk in the Eastern Valleys. Climate change will result in higher flows and higher tide levels, which will increase water levels in our rivers. This will put pressure on existing flood defences and will result in the current Standard of Protection of our channels and flood defences being reduced. Flooding under our modelled future scenarios of climate change would cause significantly more damage and pose a significantly higher risk to people and property than existing conditions.</p> <p>Land use management changes</p> <p>We have decided not to consider the impact of land use change outside of urban areas on future flood risk in this CFMP. Agricultural intensification and changes in drainage practices are unrealistic scenarios because the Eastern Valleys has poor quality soils that are unsuitable for agricultural intensification. It is also constrained by the steep gradients of the land, meaning arable farming is impossible in certain areas. It is very difficult for us to predict the future of agriculture in the Eastern Valleys beyond the immediate future. It may be that extensification is a more realistic long-term scenario, where land is farmed less intensively and for environmental benefits. However, it is unlikely that extensification would have little impact on flood risk as the area is not intensively farmed at present.</p> <p>Development in the flood plain</p> <p>Increased urbanisation will result in increased flood volumes and higher peak water levels, and flooding would occur more quickly. Unless runoff from new urban development within and outside of floodplains is balanced flood risk will increase locally and downstream. Development in the floodplain should only be allowed when no other suitable land allocations are available and any buildings within floodplains should have flood resilience measures incorporated into their design, and floodplain compensation would be necessary.</p> <p>Flood defence failure</p> <p>In the event of flood defence infrastructure failing during a flood event, the resulting flood water depths and velocities would be very high. There would also be very little flood warning time for people located close to existing flood defences. Therefore, the risk of harm to life would be very high and the resulting economic damages would be very high. The areas most vulnerable to flood defence failure in policy unit five are the Abertillery, Cwm and Llanhilleth residential areas as properties are built right behind defences of the River Ebbw.</p>
<p>What are the possible future levels of flood risk under the main scenarios?</p>	<p>Our final future scenario that we used to assess possible future levels of flood risk considered a combination of the two main drivers, climate change and urbanisation. We have identified the following. We show the total numbers at risk, with the increase from current conditions in brackets:</p> <p>People</p> <p>In the future, we estimate that there will be 1768 (+1081) people at risk of flooding from a 1% AEP fluvial flood event. The increase in people at risk during these events is mainly due to our 1% SoP flood defences overtopping.</p> <p>Community Disruption</p> <p>In the future, we estimate that there will be 855 (+560) properties at risk of flooding from a 1% AEP fluvial flood event, 803 (+531) of which are residential. Community assets will also be at flood risk in the future 1% AEP fluvial flood event: three health</p>

services (+0) in Llanhilleth, three schools (+1) in Ebbw Vale and Blaina, four community centres (+3) in Glyncoed, Beaufort and Llanhilleth, and 12 retail buildings (+4).

Critical Infrastructure

In the future, we estimate that there will be 0.6km (+0.6km) of the A467 through Nantyglo at flood risk during a 1% AEP fluvial flood event. Critical assets at risk will be three electricity stations in Beaufort and Abertillery (+1).

Economic Damages

In the future, we estimate the total economic property damages resulting from the 1% AEP fluvial flood event will be £24.5 million (+£16.9m).

In the future, we estimate the total economic agricultural damages resulting from the 1% AEP fluvial flood event will be £183,000 (+£10,000).

Historic Environment

In the future, we estimate that one additional listed building will be at flood risk from a 1% AEP fluvial flood event. Therefore, in total six listed buildings will be at flood risk in the future.

Landscape

In the future, a slightly increased proportion of the Brecon Beacons National Park will be at flood risk from a 1% AEP fluvial flood event. However, the area affected is still very small (0.1%), and limited to the Ebbw river corridor area.

Recreation

In the future, we estimate that there will be three recreational areas (+0) at flood risk in a 1% AEP fluvial flood event.

Nature conservation sites

In the future, we estimate that there will be no designated nature conservation sites at flood risk from a 1% AEP fluvial flood event in policy unit five.

BAP Habitats

The exact location of BAP habitats in the catchment is unknown. However, we estimate that in the future an increasing area of the locally important BAP habitats identified above will be at risk of flooding.

Species

The exact location of BAP species in the catchment is unknown. However, we estimate that in the future an increasing number of the locally important BAP species identified above will be at risk of flooding.

What potential responses (or groups of responses) are being considered to manage flood risk?	Generic Response/Strategic		Response
	Attenuation/retention	<ul style="list-style-type: none"> ▪ SUDS - new/retrospective 	A potential method for reducing surface water runoff and should be included in all new developments.
	Increased or decreased conveyance	<ul style="list-style-type: none"> ▪ River maintenance <hr style="border-top: 1px dashed black;"/> <ul style="list-style-type: none"> ▪ Fluvial defences 	<p>Ongoing maintenance activities include mowing and spraying, tree management, and trashing and obstruction removal. Reduced/increased maintenance activities within this policy unit should be considered further.</p> <p>We defend some of the main areas in this policy unit, namely Abertillery, Cwm and Llanhilleth (not a main area), using raised earth, concrete and stone-wall revetments with gabion and blockstone revetments and concrete haunching along both sides of the River Ebbw.</p>

	Influencing and informing	<ul style="list-style-type: none"> Flood awareness 	National campaign. Should be continued and awareness increased within this policy unit where the flood risk from fluvial flooding is high.
		<ul style="list-style-type: none"> Flood warning and evacuation 	Existing flood warning areas cover fluvial flood risk from the River Ebbw in Abertillery (down through Six Bells), Cwm and Llanhilleth - uptake to FWD unknown but likely to be opportunity to increase. In light of future flood risk, it is likely that the flood warning area may need extending.
		<ul style="list-style-type: none"> Emergency & disaster planning/response 	Policy unit covered by Blaenau Gwent Local Authority. Existing emergency plans in place, which should be reviewed and updated as new information becomes available.
		<ul style="list-style-type: none"> Planning policy, Development control 	Continue to follow Welsh Assembly Government policies. Blaenau Gwent Local Authority should ensure that suitable land allocations outside flood risk areas are sought first.
		<ul style="list-style-type: none"> Building regulations (resilience) 	To be incorporated into all new developments located within flood risk areas.
	Monitoring, advise and survey	<ul style="list-style-type: none"> Data and information 	Should continue despite policy selected.
		<ul style="list-style-type: none"> Asset inspection 	Policy unit is covered by low, medium and high asset systems, and therefore inspections will vary from 6 to 60 months. Asset classifications should be reviewed and it may be necessary to upgrade some of the asset systems.
		<ul style="list-style-type: none"> Hydrometric network 	Well gauged, at Aberbeeg, Cwm and Abertillery. Latter two relatively new gauges (installed in 2005) and essential that trigger levels if not already set are reviewed to ensure they are adequate.
	Studies	<ul style="list-style-type: none"> Flood risk mapping 	Existing flood risk management studies do not cover all of this policy unit, namely the upper reaches. Could be beneficial to improve the demarcation of the flood maps, particularly through Ebbw Vale, which has been highlighted as at moderately high risk from fluvial flooding.
		<ul style="list-style-type: none"> Flood forecasting 	No existing studies. A flood forecasting study may be beneficial.
		<ul style="list-style-type: none"> Pre-feasibility 	Existing pre-feasibility studies in Abertillery, Six Bells and Cwm. May be necessary following strategy plan for further studies in other areas such as Ebbw Vale.
		<ul style="list-style-type: none"> Strategy plans 	Recommended that a strategy plan should be undertaken to target areas where pre-feasibility studies are needed.

	<ul style="list-style-type: none"> SAMPs 	Policy unit covered by SAMPs. Likely that they will need reviewing to take into account future flood risk.
	<ul style="list-style-type: none"> Urban drainage plans 	Further significant urban expansion will need plans to ensure that flood risk will not increase within the towns or further downstream.
What gaps and uncertainties are there in knowledge, and what assumptions have been made?	<p>Broadscale modelling</p> <ul style="list-style-type: none"> Broadscale hydrology and hydraulic modelling techniques used; Where no existing models are available, these have been supplemented by other modelling techniques. Existing models were available for Abertillery, Cwm and through Llanhilleth for the River Ebbw. <p>Future scenarios</p> <ul style="list-style-type: none"> Although climate change projections are based on current guidance, these are still estimations; Urbanisation projections up until the year 2100 are based on current rates of urbanisation. <p>Data limitations</p> <ul style="list-style-type: none"> No data on the percentage uptake of properties located in Flood Warning Areas; No data on the condition of flood defences/maintenance regime. The exact locations of BAP habitats and species within the policy unit are unknown. 	

Broad scale Modelling Tables

Generic Response Modelling

The following tables provide a summary of how flooding will change in response to flood management options which may be adopted within policy unit two and what the implications of these changes might be. We have not applied any specific measures or schemes to the policy unit, but rather have applied what has been termed a 'generic response'. This represents the most likely outcome of a given policy, but is not specific and does not reflect any proposed scheme or project. It simply allows a broad assessment of what the impact of that policy might be.

Our broad scale models have been used to investigate the impact of these changes and have allowed us to quantify the effect on flood damages. We compare the risks for each generic response against the current base case conditions (the risk which currently exists in the catchment today). The results given below for each of the generic responses (i.e. the appropriate scenario for that part of the catchment) are for the 1% AEP fluvial flood event.

We have unit costs available for defences, however the costs of flow attenuation schemes are not available. The cost of large scale flow attenuations scheme would be extremely high, as they form heavy structural response to flood risk. More local schemes for attenuating flow would cost less, but the costs would still be high compared to defences.

Policy unit 5: Upper Ebbw

Generic response: Policy 1 - Withdraw/retreat defences and decreased conveyance

Description: We used our broad scale River Ebbw models to assess the combined effects of not maintaining defences and stopping river maintenance. Channel and floodplain roughness values in our broad scale models were increased from 0.04 and 0.06 to 0.075 and 0.095 respectively, to reflect the increase of roughness expected if maintenance were stopped. Defences were not removed from the model as their impact was considered negligible, due to them being overtopped.

Base case conditions (1% AEP fluvial flood event)

People at risk: Fluvial - 687	Economic risk: Fluvial – £7.6m	Properties at risk: Fluvial – 295	Environmental sites at risk: N/A
Results of the broad scale modelling			
People at risk: Fluvial – 2,861 (+316%)	Economic risk: Fluvial – £44.3m (+483%)	Properties at risk: Fluvial – 1,378 (+367%)	Environmental sites at risk: N/A
Conclusions			
Cost: Nothing - no active intervention			
Conclusion: The results of this modelling have indicated that if we stopped our maintenance of the defences and channels in policy five the risk to people, properties and the economy would increase greatly. The impact of 'no active intervention' in this policy unit is significant, because we would be encouraging more flooding to occur. Our defences and the maintenance we undertake on the River Ebbw throughout the Upper Ebbw policy unit are very important in reducing the risk of flooding and this is why the existing level of risk is relatively low.			
We would withdraw our current flood warning service that we provide under this generic response.			

Policy unit 5: Upper Ebbw

Generic response: Policy 2 – Reduced maintenance

Description: The active removal of the defences we maintain in and around the Upper Ebbw policy unit would not be a sustainable flood risk management strategy. The defences in this policy unit currently have a 1% AEP Standard of Protection in most places, so provide considerable protection. We could reduce our flood risk management around the Upper Ebbw policy unit by relaxing our maintenance activities, such as weed-cutting and clearing. We increased channel and floodplain roughness in the River Ebbw broad scale models from 0.04 and 0.06 to 0.055 and 0.075 respectively, to reflect the increase of roughness expected if maintenance were reduced.

Base case conditions (1% AEP fluvial flood event)

People at risk: Fluvial - 687	Economic risk: Fluvial – £7.6m	Properties at risk: Fluvial – 295	Environmental sites at risk: N/A
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Results of the broad scale modelling (1% AEP fluvial flood event)

People at risk: Fluvial – 2,343 (+241%)	Economic risk: Fluvial - £33.3m (+338%)	Properties at risk: Fluvial – 1,137 (+285%)	Environmental sites at risk: N/A
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Conclusions

Cost: We currently spend approximately £48,000 per year on maintenance and operations in policy unit five. Under policy two we would not stop this regime, but we would scale down our programme, for example we may downgrade a high risk flood risk management system (FRMS) to a medium FRMS, or lower the funding available to a low FRMS, which may reduce funding by up to 50% (to £24,000 per year).

Conclusion:

If we were to reduce our maintenance regime, water levels would be expected to increase and bring additional risk to people. During a 1% AEP fluvial event in the future, the defences we maintain in this policy unit would be overtopped if we did not increase them in line with future increases in water levels. By reducing our maintenance the risk to people, property, the economy and the environment would be increased further. This is because channel capacity would reduce and more flooding would occur.

Policy unit 5: Upper Ebbw

Generic response: Policy 3 – Continue with existing flood defence actions only

Description: This response to manage risk at the same level assumes that we would not undertake any alternative flood risk management actions, and that we would continue to maintain our defences at their current level. We would also continue our river maintenance, which allows the rivers to flow freely, at the same level. The current level of flood risk management under the chosen future scenario of climate

change and increased urbanisation was modelled for Chapter 4.			
Base case conditions (1% AEP fluvial flood event)			
People at risk: Fluvial - 687	Economic risk: Fluvial - £7.6m	Properties at risk: Fluvial - 295	Environmental sites at risk: N/A
Results of the broad scale modelling (1% AEP fluvial flood event)			
People at risk: Fluvial - 1,768 (+157%)	Economic risk: Fluvial - £24.5m (+222%)	Properties at risk: Fluvial - 855 (+190%)	Environmental sites at risk: N/A
Conclusions			
Cost: The Upper Ebbw policy unit falls within four low risk, one medium risk and three high risk flood risk management systems, for which we currently spend approximately £48,000 per year on maintenance, assets and operations. We would continue investing this much in the future.			
Conclusion: In the past our management of flood risk has been mainly through building defences. We could continue investing in flood risk management to the same level in the Upper Ebbw policy unit, by maintaining our defences at their current level. To increase them into the future would require additional investment. The results from this model show that if we did not undertake any additional work in managing flood risk into the future across the Upper Ebbw policy unit, then risks to people, property and the economy would increase, because our existing flood defences would overtop. This increase is not as high as other areas in the Eastern Valleys. However, it is important that we consider alternative responses other than focusing on defences alone.			

Policy unit 5: Upper Ebbw			
Generic response: Policy 4 – Take further action to improve and create new flood defences			
Description: This response to sustain flood risk into the future at the current level assumes that we would not undertake any alternative activities. We have identified seven areas within the Upper Ebbw policy unit where there is a big increase in flood risk in the future. These areas include: Cwm, Abertillery, Six Bells, three areas in Aberbeeg, and Llanhilleth. These areas are at risk in the future due to either existing flood defences overtopping or the channel capacity being exceeded. We trimmed our future flood outlines to show that these areas would benefit from either new defences or increasing existing defences.			
Base case conditions (1% AEP fluvial flood event)			
People at risk: Fluvial - 687	Economic risk: Fluvial - £7.6m	Properties at risk: Fluvial - 295	Environmental sites at risk: N/A
Results of the broad scale modelling (1% AEP fluvial flood event)			
People at risk: Fluvial - 715 (+4%)	Economic risk: Fluvial - £9.7m (+28%)	Properties at risk: Fluvial - 331 (+12%)	Environmental sites at risk: N/A
Conclusions			
Cost: We currently spend approximately £48,000 per year on inspecting and maintaining our defence assets in the Upper Ebbw policy unit. We have based our costs on a new flood wall costing £1,500 per metre and increasing existing defences costing £406 per metre. To construct new and increase the height of existing defences along the River Ebbw in the locations listed above would cost approximately £1.35m. However, there would also be the cost of undertaking pre-feasibility studies and further maintenance costs, particularly with the new defences. Therefore, in total, the indicative cost would be in excess of £1.5m.			
Conclusion: If we continued to maintain, improve and build new defences to account for the additional risk in the future in the main flood risk areas in the Upper Ebbw policy unit, there will still be a small amount of fluvial flood risk during a 1% AEP fluvial flood event. Our flood risk management approach is to, where possible, move away from the traditional form of structural responses such as defences, in favour of combinations of softer management options. Improving existing and building new fluvial defences along the River Ebbw in the Upper Ebbw policy unit will provide protection to approximately 590 properties, reducing economic damages by approximately £16.4m.			

Policy unit 5: Upper Ebbw			
Generic response: Policy 4 – Increased maintenance			
Description: We currently undertake widespread channel maintenance across the Upper Ebbw policy unit. We have the option to increase this further, to increase channel capacity and allow flow to be conveyed more freely. This would theoretically reduce flood risk. Our broad scale model for the River Ebbw was run with channel and flood plain roughness values reduced by 10%, to simulate an increase in our maintenance.			
Base case conditions (1% AEP fluvial flood event)			
People at risk: Fluvial - 687	Economic risk: Fluvial – £7.6m	Properties at risk: Fluvial – 295	Environmental sites at risk: N/A
Results of the broad scale modelling (1% AEP fluvial flood event)			
People at risk: Fluvial – 1,563 (+128%)	Economic risk: Fluvial - £23.4m (+208%)	Properties at risk Fluvial – 793 (+169%)	Environmental sites at risk: N/A
Conclusions			
Cost: We currently spend approximately £48,000 per year on maintenance and operations in the Upper Ebbw policy unit. If we were to increase our maintenance programme costs might be expected to increase by approximately 50% (to £72,000 per year).			
Conclusion: In the future, our flood defences would be overtopped if we did not continue to improve them in-line with future increases in water levels. The aim of policy four is to sustain the current level of risk in to the future, although there may be a small amount of risk that we would have to accept. By increasing our channel maintenance throughout the policy unit, we would increase channel capacity. This would allow more water to be contained within the channel, and reduce the flood risk. By undertaking this response alone in the Upper Ebbw policy unit, the consequences in the future to people, property and the economy would still be significantly high and only slightly lower than the additional consequences shown for the policy three generic response, continue with existing flood defence actions only. Therefore, this generic response is considered not to be suitable for the Upper Ebbw policy unit. We already carry out significant maintenance within this policy unit, and it is unlikely that we would be able to increase our current maintenance activities significantly. In addition, the benefits gained from further activities would not out way the additional costs involved. In light of these considerations, we will not be considering this as a generic response to take forward to policy appraisal.			

Policy unit 5: Upper Ebbw			
Generic response: Policy 5 – Take further action to improve and create new flood defences			
Description: Taking further action to improve and create new flood defences to reduce flood risk, both now and into the future, assumes that sustaining the current level of risk would be unacceptable. There is not currently a significant fluvial flood risk in the Upper Ebbw policy unit. However, we have identified under the policy four generic response - take further action to improve and create new defences, seven main areas where defences could be improved or new ones built. Under policy five, we could take further action to reduce flood risk by building new defences in the following areas: Beaufort, Carmeltown, Glyncoed, Ebbw Vale, Cwm, Victoria, Blaina and Abertillery. We trimmed our future fluvial flood outlines (further than the defences P4 generic response) in the above locations, apart from Victoria as this was not economically justifiable, as discussed below. This showed that these areas would benefit from new defences.			
Base case conditions (1% AEP fluvial flood event)			
People at risk: Fluvial - 687	Economic risk: Fluvial – £7.6m	Properties at risk: Fluvial – 295	Environmental sites at risk: N/A
Results of the broad scale modelling (1% AEP fluvial flood event)			
People at risk: Fluvial – 166 (-76%)	Economic risk: Fluvial - £2.4m (-68%)	Properties at risk Fluvial – 87 (-71%)	Environmental sites at risk: N/A
Conclusions			

Cost: We currently spend approximately £48,000 per year on inspecting and maintaining our defence assets in the Upper Ebbw policy unit. We have based our costs on a new flood wall costing £1,500 per metre and increasing existing defences costing £406 per metre. On top of the costs we estimated in policy four (in excess of £1.5m), we estimated the additional costs under policy five if new defences were built, or existing ones increased, in our selected areas. However, as discussed above and in the conclusion, having weighed up the costs against the benefits, one area has been rejected under policy five.

Selected areas

- 300m of new defence at Garn-Lydan (Beaufort) on the right bank of the Cwm Carno (River Ebbw) would cost approximately £450,000.
- 200m of new defence at Carmeltown on the right bank of the River Ebbw would cost approximately £300,000.
- 500m of new defence at Glyncoed on the right bank of the River Ebbw would cost approximately £750,000.
- 200m of new defence at the Cwm Draw industrial estate, Ebbw Vale, on the right bank of the River Ebbw would cost approximately £300,000.
- Increasing the height of 1360m of existing defence in Cwm on the left bank of the River Ebbw would cost approximately £550,000.
- Increasing the height of 450m of existing defence in Abertillery on the left bank of the River Ebbw would cost approximately £183,000.
- 700m of new defence at Blaina on the right and left banks of the River Ebbw would cost approximately £1million.

Discounted areas

- 140m of new defence at Victoria on the right bank of the River Ebbw would cost approximately £210,000.

Therefore, the total indicative cost under policy five (including costs under the policy four defences option) would be in excess of £5m, including pre-feasibility costs.

Conclusion: We recognise that into the future we must be aware of the potential consequences from fluvial flood events. By increasing the height of existing and building new defences we are taking more action to manage flood risks into the future. We suggest that the current and future risk in the following areas is high and the benefits that would be gained from building defences may warrant new investment and should be explored further. These areas will be taken forward in our consideration of policy five in the policy appraisal forms:

- Building a new defence at Garn-Lydan (Beaufort) on the right bank of the Cwm Carno (River Ebbw) at a cost of £450,000 would protect 15 properties and reduce economic damages by up to £440,000.
- Building a new defence at Carmeltown on the right bank of the River Ebbw at a cost of £300,000 would protect 20 properties and reduce economic damages by up to £570,000
- Building a new defence at Glyncoed on the right bank of the River Ebbw at a cost of £750,000 would protect 107 properties and reduce economic damages by up to £2.9 million.
- Building a new defence at the Cwm Draw industrial estate, Ebbw Vale, on the right bank of the River Ebbw at a cost of £300,000 would protect 12 industrial properties and reduce economic damages by up to £805,000.
- Increasing the height of 1360m of existing defence in Cwm on the left bank of the River Ebbw at a cost of £550,000 would protect 84 properties and reduce economic damages by up to £1.3 million.
- Increasing the height of 450m of existing defence in Abertillery on the left bank of the River Ebbw at a cost of £183,000 would protect 89 properties and reduce economic damages by up to £2.3 million.
- Building a new defence at Blaina on the right and left banks of the River Ebbw at a cost of £1million would protect 32 properties and reduce economic damages by up to £964,000.

However, we recognise that reducing flood risk in the following areas would not be economically feasible as the benefits would not offset the level of investment:

- Building a new defence at Victoria on the right bank of the River Ebbw at a cost of £210,000

would only protect 5 properties and reduce economic damages by up to £84,000.

Larger areas behind defences may need to be covered by the flood warning service, as it is these communities that are at greatest risk if defences were to breach and/or overtop.

Policy unit 5: Upper Ebbw			
Generic response: Policy 6 – Attenuation			
Description: The creation of flow attenuation areas in the Upper Ebbw policy unit is not feasible. Responses that deliberately promote large scale flooding are not considered as sustainable methods for reducing risk. Setting back defences within the main areas in this policy unit is not an option, as much of the floodplain has been developed. There is no scope for broad scale modelling under policy six for the Upper Ebbw policy unit, so no further action has been undertaken.			
Base case conditions (1% AEP fluvial flood event)			
People at risk: Fluvial - 687	Economic risk: Fluvial – £7.6m	Properties at risk: Fluvial – 295	Environmental sites at risk: N/A
Results of the broad scale modelling (1% AEP fluvial flood event)			
People at risk: N/A	Economic risk: N/A	Properties at risk: N/A	Environmental sites at risk: N/A
Conclusions			
Cost: N/A			
Conclusion: Taking action to increase the frequency of flooding is not feasible in the Upper Ebbw policy unit, as such, there is not scope for carrying out policy six in this policy unit. Increased frequency of flooding to make space for water would result in a very high number of people at risk and very high economic damages. Deliberately promoting flooding through schemes, which make space for water, would cause large scale community disruption.			

The following table summarises the findings of the generic response modelling for policy unit one (Cardiff). The responses or combination of responses chosen for each policy will be taken forward and compared against the objectives and indicators in table 12.6.

Policy	Generic response
1	Withdraw / retreat defences and stop maintenance
2	Reduced maintenance
3	Risk cannot be managed at the same level of risk by any combination of softer options, such as reducing maintenance and balancing with local flood storage schemes.
4	We have demonstrated that local flood storage schemes and increased maintenance have very little effect for reducing risk in to the future in the Upper Ebbw policy unit. Using these schemes in combination would not be cost effective given that the costs are not proportional to the benefits they bring. Therefore a response of defences alone has been chosen.
5	A combination of defences and alternative flood risk management options would not be suitable. Therefore a defences alone option has been chosen, although measures such as flood warning and evacuation procedures will be considered as well.
6	Not technically feasible in this policy unit.

Form 12.6: Screening of policy options against appraisal objectives

Policy unit name/number:		Policy unit 5: Upper Ebbw								
N o.	Specific (appraisal) objectives	Indicators	Current baseline	Future baseline	Policy Options					
					P1 No active intervention	P2 Reduce existing actions	P3 Continue with existing actions to maintain current risk	P4 Take further action to sustain current risk	P5 Take further action to reduce current risk	P6 Take further action to increase frequency of flooding
Generic Response					Decreased conveyance Monitoring, advise & survey	Decreased conveyance Influencing and Informing Monitoring, advise & survey Studies	Increased or decreased conveyance Attenuation/retention Influencing and Informing Monitoring, advise & survey Studies	Increased or decreased conveyance Attenuation/retention Influencing and Informing Monitoring, advise & survey Studies	Increased or decreased conveyance Attenuation/retention Influencing and Informing Monitoring, advise & survey Studies	Increased or decreased conveyance Attenuation/retention Influencing and Informing Monitoring, advise & survey Studies
PEOPLE										
1.	Reduce the risk of harm to life in Abertillery, Llanhilleth, Cwm and Ebbw Vale	The number of people within the 1% AEP fluvial flood extent where depths of water exceed 0.5m	There are 186 people at risk where depths exceed 0.5m during a 1% AEP fluvial flood event	There will be 924 people at risk where depths exceed 0.5m during a 1% AEP fluvial flood event	There would be 1595 people at risk where depths exceed 0.5m during a 1% AEP fluvial flood event	There would be 978 people at risk where depths exceed 0.5m during a 1% AEP fluvial flood event	There would be 924 people at risk where depths exceed 0.5m during a 1% AEP fluvial flood event	There would be 204 people at risk where depths exceed 0.5m during a 1% AEP fluvial flood event	There would be 50 people at risk where depths exceed 0.5m during a 1% AEP fluvial flood event	There is no scope for carrying out policy six in this policy unit. Increased frequency of flooding to make space for water could result in a

Policy unit name/number:		Policy unit 5: Upper Ebbw								
N o.	Specific (appraisal) objectives	Indicators	Current baseline	Future baseline	Policy Options					
					P1 No active intervention	P2 Reduce existing actions	P3 Continue with existing actions to maintain current risk	P4 Take further action to sustain current risk	P5 Take further action to reduce current risk	P6 Take further action to increase frequency of flooding
		The number of properties that are at risk during the 1% AEP fluvial flood event but not within an existing flood warning area	231 properties that are at flood risk during a 1% AEP fluvial flood event are not within an existing flood warning area	343 properties that will be at flood risk during a 1% AEP fluvial flood event would not be within an existing flood warning area	Flood warning areas would be removed under this policy and therefore all properties would not be within a flood warning area 1378 properties that would be at flood risk during a 1% AEP fluvial flood event would not be within an existing flood warning area	430 properties that would be at flood risk during a 1% AEP fluvial flood event would not be within an existing flood warning area	343 properties that would be at flood risk during a 1% AEP fluvial flood event would not be within an existing flood warning area	256 properties that would be at flood risk during a 1% AEP fluvial flood event would not be within an existing flood warning area	76 properties that would be at flood risk during a 1% AEP fluvial flood event would not be within an existing flood warning area	significant increase in harm to life. Deliberately flooding specific areas to make space for water would cause increase the harm to life in those areas. We have not identified any areas in the policy unit where we could do this without increasing harm to life.
2.	Reduce community disruption caused by flooding in Abertillery, Llanhilleth, Cwm and Ebbw Vale	The number of community assets at risk during the 1% AEP fluvial flood event	There is 3 health services (Llanhilleth), 2 schools (Ebbw Vale, Blaina), 1 community centre (Glyncoed) and 8 retail buildings at flood risk during the 1% AEP fluvial flood event	There will be 3 health services (Llanhilleth), 3 schools (Ebbw Vale, Blaina), 4 community centres (Glyncoed, Beaufort, Llanhilleth) and 12 retail buildings at flood risk during the 1% AEP fluvial flood event	There would be 5 health services (Aberbeeg, Beaufort, Llanhilleth), 3 schools (Ebbw Vale, Blaina), 5 community centres (Glyncoed, Beaufort, Llanhilleth) and 23 retail buildings at flood risk during the 1% AEP fluvial flood event	There would be 4 health services (Llanhilleth, Aberbeeg), 3 schools (Ebbw Vale, Blaina) 5 community centres (Glyncoed, Beaufort, Llanhilleth) and 21 retail buildings at flood risk during the 1% AEP fluvial flood event	There would be 3 health services (Llanhilleth), 3 schools (Ebbw Vale, Blaina), 4 community centres (Glyncoed, Beaufort, Llanhilleth) and 12 retail buildings at flood risk during the 1% AEP fluvial flood event	There would be 3 health services (Llanhilleth), 3 schools (Ebbw Vale, Blaina), 1 community centre (Glyncoed) and 9 retail buildings at flood risk during the 1% AEP fluvial flood event	There would be 3 health services (Llanhilleth), 1 school (Ebbw Vale) and 3 retail buildings at flood risk during the 1% AEP fluvial flood event	There is no scope for carrying out policy six in this policy unit. Increased frequency of flooding to make space for water could result in a significant increase in community disruption. Deliberately flooding specific areas to make

Policy unit name/number:		Policy unit 5: Upper Ebbw								
N o.	Specific (appraisal) objectives	Indicators	Current baseline	Future baseline	Policy Options					
					P1 No active intervention	P2 Reduce existing actions	P3 Continue with existing actions to maintain current risk	P4 Take further action to sustain current risk	P5 Take further action to reduce current risk	P6 Take further action to increase frequency of flooding
		The number of residential properties at flood risk during the 1% AEP fluvial flood event	There are 272 residential properties at flood risk during the 1% AEP fluvial flood event	There will be 803 residential properties at flood risk during the 1% AEP fluvial flood event	There would be 1,293 residential properties at flood risk during the 1% AEP fluvial flood event	There would be 1,068 residential properties at flood risk during the 1% AEP fluvial flood event	There would be 803 residential properties at flood risk during the 1% AEP fluvial flood event	There would be 289 residential properties at flood risk during the 1% AEP fluvial flood event	There would be 70 residential properties at flood risk during the 1% AEP fluvial flood event	space for water would cause large-scale community disruption in those areas. We have not identified any areas in the policy unit where we could do this without increasing community disruption.
		The duration of flooding (<1 day, 1 day to 5 days, > 5 days)	The duration of flooding is less than 1 day for the 1% AEP fluvial flood event	The duration of flooding will be less than 1 day for the 1% AEP fluvial flood event	The duration of flooding would be less than 1 day for the 1% AEP fluvial flood event	The duration of flooding would be less than 1 day for the 1% AEP fluvial flood event	The duration of flooding would be less than 1 day for the 1% AEP fluvial flood event	The duration of flooding would be less than 1 day for the 1% AEP fluvial flood event	The duration of flooding would be less than 1 day for the 1% AEP fluvial flood event	
		The area of flooding during the 1% AEP fluvial flood event where depth of flooding exceeds 0.5 metres	The flooded area where depths exceed 0.5 metres is 0.86km ² (Ebbw Vale) during a 1% AEP fluvial flood event	The flooded area where depths exceed 0.5 metres will be 0.95km ² (Ebbw Vale) during a 1% AEP fluvial flood event	The flooded area where depths exceed 0.5 metres would be 1.18km ² (Ebbw Vale, Abertillery) during a 1% AEP fluvial flood event	The flooded area where depths exceed 0.5 metres would be 1.11km ² (Ebbw Vale) during a 1% AEP fluvial flood event	The flooded area where depths exceed 0.5 metres would be 0.96km ² (Ebbw Vale) during a 1% AEP fluvial flood event	The flooded area where depths exceed 0.5 metres would be 0.96km ² (Ebbw Vale) during a 1% AEP fluvial flood event	The flooded area where depths exceed 0.5 metres would be 0.87km ² (Ebbw Vale) during a 1% AEP fluvial flood event	
ECONOMICS										
3.	Reduce flood risk to critical transport routes and critical assets in Abertillery, Llanhilleth and Ebbw Vale	The number, length and type of critical asset (police, ambulance, fire station), infrastructure (STW, WTW, gas, electricity, rail or major roads) at risk during the 1%	There is 2 electricity stations (Beaufort, Abertillery) and no critical transport routes at flood risk during the 1% AEP fluvial flood event	There will be 3 electricity stations (Beaufort, Abertillery) and 0.6km of the A467 through Nantyglo at flood risk during the 1% AEP fluvial flood event	There would be 3 electricity stations (Beaufort, Abertillery), 0.6km of the A467 through Nantyglo and 0.7km of the A467 through Llanhilleth at flood risk during the 1% AEP fluvial flood event	There would be 3 electricity stations (Beaufort, Abertillery), 0.6km of the A467 through Nantyglo and 0.6km of the A467 through Llanhilleth at flood risk during the 1% AEP fluvial flood event	There would be 3 electricity stations (Beaufort, Abertillery) and 0.6km of the A467 through Nantyglo at flood risk during the 1% AEP fluvial flood event	There would be 2 electricity stations (Beaufort, Abertillery) and no critical transport routes at flood risk during the 1% AEP fluvial flood event	There would be 1 electricity station (Abertillery) and no critical transport routes at flood risk during the 1% AEP fluvial flood event	There is no scope for carrying out policy six in this policy unit. Increased frequency of flooding to make space for water could result in a significant increase in risk to critical assets and critical transport routes.

Policy unit name/number:		Policy unit 5: Upper Ebbw								
N o.	Specific (appraisal) objectives	Indicators	Current baseline	Future baseline	Policy Options					
					P1 No active intervention	P2 Reduce existing actions	P3 Continue with existing actions to maintain current risk	P4 Take further action to sustain current risk	P5 Take further action to reduce current risk	P6 Take further action to increase frequency of flooding
		AEP fluvial flood event								Deliberately flooding specific areas to make space for water would cause large-scale community disruption in those areas. We have not identified any areas in the policy unit where we could do this without increasing risk to critical assets and critical transport routes
4.	Reduce economic damages caused by flooding in Abertillery, Llanhilleth, Cwm	The total cost of property economic damages during the 1% AEP fluvial flood event	The 1% AEP fluvial flood economic property damages are £7.6m	The 1% AEP fluvial flood economic property damages will be £24.5m	The 1% AEP fluvial flood economic property damages would be £44.3m	The 1% AEP fluvial flood economic property damages would be £33.4m	The 1% AEP fluvial flood economic property damages would be £24.5m	The 1% AEP fluvial flood economic property damages would be £9.7m	The 1% AEP fluvial flood economic property damages would be £2.4m	There is no scope for carrying out policy six in this policy unit. Increased frequency of flooding to make

Policy unit name/number:		Policy unit 5: Upper Ebbw								
N o.	Specific (appraisal) objectives	Indicators	Current baseline	Future baseline	Policy Options					
					P1 No active intervention	P2 Reduce existing actions	P3 Continue with existing actions to maintain current risk	P4 Take further action to sustain current risk	P5 Take further action to reduce current risk	P6 Take further action to increase frequency of flooding
	and Ebbw Vale	The total cost of agricultural damages during the 1% AEP fluvial flood event	The 1% AEP fluvial flood agricultural damages are £173,000	The 1% AEP fluvial flood agricultural damages will be £183,000	The 1% AEP fluvial flood agricultural damages would be £204,000	The 1% AEP fluvial flood agricultural damages would be £211,000	The 1% AEP fluvial flood agricultural damages would be £183,000	The 1% AEP fluvial flood agricultural damages would be £182,000	The 1% AEP fluvial flood agricultural damages would be £168,000	space for water could result in a significant increase in economic damages. Deliberately flooding specific areas to make space for water would cause large-scale community disruption in those areas. We have not identified any areas in the policy unit where we could do this without increasing risk to critical assets and critical transport routes
5.	Optimise the level of Flood Risk Management expenditure. Ensure investment is proportional to the risks	The indicative costs of our flood risk management actions	We currently spend approximately £48,000 per year on maintenance and operations	We will spend more than we currently spend on maintenance and operations as risk is going to increase in the future in the Eastern Valleys, placing more demand on our resources and expenditure.	No construction or maintenance costs associated with undertaking this policy but it would be necessary to devise a strategy, and withdraw over a number of years, monitoring the situation once this had been done.	We would expect costs to reduce by half to £24,000 per year. However, the risks would significantly increase	We would continue to spend £48,000 per year on maintenance and operations. Risks would increase into the future	Indicative costs to improve and build new defences would cost approximately £1.5 million. Fluvial risk would be significantly reduced. Maintenance costs will increase as a result.	Indicative costs to improve and build new defences would cost approximately £5.0 million. Fluvial flood risk would be reduced even further. Maintenance costs will increase as a result.	There is no scope for carrying out policy six in this policy unit. Constructing formal flood storage areas would cost many millions of pounds. Deliberately promoting flooding through schemes that make space for water would cause large scale community disruption to this policy unit and the

Policy unit name/number:		Policy unit 5: Upper Ebbw								
N o.	Specific (appraisal) objectives	Indicators	Current baseline	Future baseline	Policy Options					
					P1 No active intervention	P2 Reduce existing actions	P3 Continue with existing actions to maintain current risk	P4 Take further action to sustain current risk	P5 Take further action to reduce current risk	P6 Take further action to increase frequency of flooding
										Eastern Valleys as a whole
ENVIRONMENT										
6.	Ensure no deterioration of designated international and national nature conservation sites	The percentage area of each SSSI affected during the 1% AEP fluvial flood event	There are no SSSIs at flood risk during the 1% AEP fluvial flood event	There will be no SSSIs at flood risk during the 1% AEP fluvial flood event	There would be no SSSIs at flood risk during the 1% AEP fluvial flood event	There would be no SSSIs at flood risk during the 1% AEP fluvial flood event	There would be no SSSIs at flood risk during the 1% AEP fluvial flood event	There would be no SSSIs at flood risk during the 1% AEP fluvial flood event	There would be no SSSIs at flood risk during the 1% AEP fluvial flood event	There is no scope for carrying out policy six in this policy unit. Increased frequency of flooding to make space for water would result in a higher percentage area of risk to designated sites.
7.	Protect and improve habitats and species diversity, particularly BAP habitats and those relying on freshwater	BAP habitats and species at flood risk during the 1% AEP flood event	The following BAP habitats are at flood risk during a 1% AEP fluvial flood event: <ul style="list-style-type: none"> Blanket bog Fens Lakes and reservoirs Mesotrophic lakes Reedbeds Rhos pastures Rivers, streams and floodplains Wet woodland <p>The following BAP species are at flood risk during a 1% AEP fluvial flood event:</p>	The following BAP habitats are likely to experience more frequent and longer duration of flooding in the future: <ul style="list-style-type: none"> Blanket bog Fens Lakes and reservoirs Mesotrophic lakes Reedbeds Rhos pastures Rivers, streams and floodplains Wet woodland <p>The following BAP species are likely to experience more frequent and longer</p>	The following BAP habitats are likely to experience more frequent and longer duration flooding as a result of Policy 1: <ul style="list-style-type: none"> Blanket bog Fens Lakes and reservoirs Mesotrophic lakes Reedbeds Rhos pastures Rivers, streams and floodplains Wet woodland <p>The following BAP species are likely to experience more frequent and longer</p>	The following BAP habitats are likely to experience more frequent and longer duration flooding as a result of Policy 2: <ul style="list-style-type: none"> Blanket bog Fens Lakes and reservoirs Mesotrophic lakes Reedbeds Rhos pastures Rivers, streams and floodplains Wet woodland <p>The following BAP species are likely to experience more frequent and longer</p>	The following BAP habitats are likely to experience more frequent and longer duration flooding as a result of Policy 3: <ul style="list-style-type: none"> Blanket bog Fens Lakes and reservoirs Mesotrophic lakes Reedbeds Rhos pastures Rivers, streams and floodplains Wet woodland <p>The following BAP species are likely to experience more frequent and longer</p>	The following BAP habitats are likely to be at risk to the same extent as under current baseline conditions, as a result of Policy 4: <ul style="list-style-type: none"> Blanket bog Fens Lakes and reservoirs Mesotrophic lakes Reedbeds Rhos pastures Rivers, streams and floodplains Wet woodland <p>The following BAP species are likely to</p>	The following BAP habitats are likely to experience less frequent and shorter duration flooding as a result of Policy 5: <ul style="list-style-type: none"> Blanket bog Fens Lakes and reservoirs Mesotrophic lakes Reedbeds Rhos pastures Rivers, streams and floodplains Wet woodland <p>The following</p>	There is no scope for carrying out policy six in this policy unit. Increased frequency of flooding to make space for water would result in an increased number of BAP species being at risk from flooding. Deliberately promoting flooding through schemes that make space for water would cause large scale damage to BAP habitats and species in the

Policy unit name/number:		Policy unit 5: Upper Ebbw								
N o.	Specific (appraisal) objectives	Indicators	Current baseline	Future baseline	Policy Options					
					P1 No active intervention	P2 Reduce existing actions	P3 Continue with existing actions to maintain current risk	P4 Take further action to sustain current risk	P5 Take further action to reduce current risk	P6 Take further action to increase frequency of flooding
			<ul style="list-style-type: none"> Great Crested Newt Greater Horseshoe Bat Lesser Horseshoe Bat Otter Pipistrelle Bat 	duration of flooding in the future: <ul style="list-style-type: none"> Great Crested Newt Otter 	duration flooding as a result of Policy 1: <ul style="list-style-type: none"> Great Crested Newt Otter 	duration flooding as a result of Policy 2: <ul style="list-style-type: none"> Great Crested Newt Otter 	duration flooding as a result of Policy 3: <ul style="list-style-type: none"> Great Crested Newt Otter 	be at risk to the same extent as under current baseline conditions, as a result of Policy 4: <ul style="list-style-type: none"> Great Crested Newt Otter 	BAP species are likely to experience less frequent and shorter duration flooding as a result of Policy 5: <ul style="list-style-type: none"> Great Crested Newt Otter 	Upper Ebbw and the Eastern Valleys as a whole
8.	Manage flood risk to Listed Buildings in Ebbw Vale, Aberbeeg and Llanhilleth and ensure sites which are currently 'safe' do not become at risk of flooding.	The number of Listed Buildings within the 1% AEP fluvial flood extent	There are 5 listed buildings at flood risk from a 1% AEP fluvial flood event	There will be 6 listed buildings at flood risk from a 1% AEP fluvial flood event	There would be 6 listed buildings at flood risk from a 1% AEP fluvial flood event	There would be 6 listed buildings at flood risk from a 1% AEP fluvial flood event	There would be 6 listed buildings at flood risk from a 1% AEP fluvial flood event	There would be 6 listed buildings at flood risk from a 1% AEP fluvial flood event	There would be 5 listed buildings at flood risk from a 1% AEP fluvial flood event	There is no scope for carrying out policy six in this policy unit. Deliberately promoting flooding through schemes that make space for water would increase the number of listed buildings at risk.

Form 12.7: Summary of the relative overall losses (including flood risk management costs) and gains (including flood alleviation benefits), thus demonstrating the rationale behind selecting the preferred option

Policy unit name/number:	Policy unit 5: Upper Ebbw		
Policy options	Losses	Gains	Preferred policy option
Policy option P1			
Environmental	<p>LOW- More frequent and longer duration flooding may adversely affect habitats intolerant of waterlogging. Impacts will be particularly severe if inundation is from low quality water or non-fluvial sources.</p> <p>LOW- Increase in BAP species at risk of flooding from a 1% AEP fluvial flood event.</p> <p>LOW- The number of listed buildings at flood risk from a 1% AEP fluvial flood event would increase by 1. The total number at flood risk is 6.</p>	<p>LOW+ More frequent and longer duration flooding may enhance water-dependent habitats.</p> <p>LOW+ Stopping river maintenance and not maintaining defences may benefit BAP species through reduced disturbance. In particular, Otter are likely to benefit.</p>	Not preferred option – risk to people, property and the economy would remain very high and there would be very significant and high increases in risks in the future
Social	<p>HIGH- 2,174 additional people at risk from flooding.</p> <p>HIGH- 1,409 additional people located within flood risk areas where flood depths exceed 0.5 metres.</p> <p>HIGH- 1,021 additional residential properties at risk from flooding.</p> <p>HIGH- 1,147 additional properties would not be within an existing flood warning area.</p> <p>MEDIUM- 2 additional health services, 1 school, 4 community centres and 15 retail buildings at risk from flooding.</p> <p>MEDIUM- An additional 0.32km² of land where depths exceed 0.5 metres at risk from flooding.</p>		
Economic	<p>HIGH- £36.7m increase in economic damages to properties.</p> <p>LOW- 1 additional electricity station at risk from flooding.</p> <p>LOW- £31,000 increase in agricultural damages.</p> <p>LOW- 0.6km increase in length of the A467 through Nantyglo and 0.7km of the A467 through Llanhilleth at risk from flooding.</p>		
Policy option P2			

Policy unit name/number:	Policy unit 5: Upper Ebbw		
Policy options	Losses	Gains	Preferred policy option
Environmental	<p>LOW- More frequent and longer duration flooding may adversely affect habitats intolerant of waterlogging. Impacts will be particularly severe if inundation is from low quality water or non-fluvial sources.</p> <p>LOW- Increase in BAP species at risk of flooding from a 1% AEP fluvial flood event.</p> <p>LOW- The number of listed buildings at flood risk from a 1% AEP fluvial flood event would increase by 1. The total number at flood risk is 6.</p>	<p>LOW+ More frequent and longer duration flooding may enhance water-dependent habitats.</p> <p>LOW+ Reduced maintaining defences may benefit BAP species through reduced disturbance. In particular, Otter are likely to benefit.</p>	Not preferred option – reducing flood risk management in any areas of the Upper Ebbw policy unit would result in high increases in risk to people, property and the economy.
Social	<p>HIGH- 1,656 additional people at risk from flooding.</p> <p>HIGH- 792 additional people located within flood risk areas where flood depths exceed 0.5 metres.</p> <p>HIGH- 796 additional residential properties at risk from flooding.</p> <p>MEDIUM- 199 additional properties would not be within an existing flood warning area.</p> <p>MEDIUM- 1 additional health service, 1 school, 4 community centres and 13 retail buildings at risk from flooding.</p> <p>MEDIUM- An additional 0.25km² of land where depths exceed 0.5 metres at risk from flooding.</p>		
Economic	<p>HIGH- £25.8m increase in economic damages to properties.</p> <p>LOW- 1 additional electricity station at risk from flooding.</p> <p>LOW- £38,000 increase in agricultural damages.</p> <p>LOW- 0.6km increase in length of the A467 through Nantyglo and 0.6km of the A467 through Llanhilleth at risk from flooding.</p>	<p>MEDIUM+ - £24,000 ASM saving due to reducing maintenance activities.</p>	
Policy option P3			

Policy unit name/number:	Policy unit 5: Upper Ebbw		
Policy options	Losses	Gains	Preferred policy option
Environmental	<p>LOW- More frequent and longer duration flooding may adversely affect habitats intolerant of waterlogging. Impacts will be particularly severe if inundation is from low quality water or non-fluvial sources.</p> <p>LOW- Increase in BAP species at risk of flooding from a 1% AEP fluvial flood event.</p> <p>LOW- The number of listed buildings at flood risk from a 1% AEP fluvial flood event would increase by 1. The total number at flood risk is 6.</p>	<p>LOW+ More frequent and longer duration flooding may enhance water-dependent habitats.</p>	Not preferred option – maintaining our current level of management is not a sustainable option in this policy unit. Risk to people, property and the economy would significantly increase in the future under this option.
Social	<p>HIGH- 1,081 additional people at risk from flooding.</p> <p>HIGH- 738 additional people located within flood risk areas where flood depths exceed 0.5 metres.</p> <p>MEDIUM- 531 additional residential properties at risk from flooding.</p> <p>MEDIUM- 112 additional properties would not be within an existing flood warning area.</p> <p>MEDIUM- 1 additional school, 3 community centres and 4 retail buildings at risk from flooding.</p> <p>LOW- An additional 0.1km² of land where depths exceed 0.5 metres at risk from flooding.</p>		
Economic	<p>HIGH- £16.9m increase in economic damages to properties.</p> <p>LOW- 1 additional electricity station at risk from flooding.</p> <p>LOW- £10,000 increase in agricultural damages.</p> <p>LOW- 0.6km increase in length of the A467 through Nantyglo at risk from flooding.</p>	<p>NEUTRAL= No change in maintenance and operations expenditure.</p>	
Policy option P4			

Policy unit name/number:	Policy unit 5: Upper Ebbw		
Policy options	Losses	Gains	Preferred policy option
Environmental	<p>NEUTRAL = No change in the frequency or duration of flooding to BAP habitats or species.</p> <p>MEDIUM- Delivery of CFMP policy to sustain current flood risk may reduce the quality and quantity of the BAP habitat and species within the policy unit. Lakes and reservoirs; mesotrophic lakes; rivers, streams and floodplains and Otter are likely to be particularly affected.</p> <p>LOW- The number of listed buildings at flood risk from a 1% AEP fluvial flood event would increase by 1. The total number at flood risk is 6.</p>	<p>NEUTRAL = No change in the frequency or duration of flooding to BAP habitats or species.</p>	<p>✓ Take further action to sustain current risk</p> <p>Although we will still be accepting a small amount of flood risk under this policy, it greatly reduces future fluvial flood risk close to the current level.</p>
Social	<p>LOW- 28 additional people at risk from flooding.</p> <p>LOW- 18 additional people located within flood risk areas where flood depths exceed 0.5 metres.</p> <p>LOW- 17 additional residential properties at risk from flooding.</p> <p>LOW- 25 additional properties would not be within an existing flood warning area.</p> <p>LOW- 1 additional school and 1 retail building at risk from flooding.</p> <p>LOW- An additional 0.1km² of land where depths exceed 0.5 metres at risk from flooding.</p>		
Economic	<p>LOW- £2.1m increase in economic damages to properties.</p> <p>LOW- £9,000 increase in agricultural damages.</p>	<p>NEUTRAL= No additional critical assets at risk from flooding.</p> <p>NEUTRAL= No additional critical transport routes at risk from flooding.</p>	
Policy option P5			

Policy unit name/number:	Policy unit 5: Upper Ebbw		
Policy options	Losses	Gains	Preferred policy option
Environmental	<p>NEUTRAL = No increase in the number of listed buildings at flood risk from a 1% AEP fluvial flood event. The number at flood risk would be 5.</p> <p>MEDIUM- Delivery of CFMP policy to reduce current flood risk may reduce the quality and quantity of the BAP habitat and species within the policy unit. Lakes and reservoirs; mesotrophic lakes; rivers, streams and floodplains and Otter are likely to be particularly affected.</p> <p>LOW- Less frequent and shorter duration flooding of BAP habitats may adversely affect habitats dependent on waterlogging</p>	<p>NEUTRAL = No increase in the number of listed buildings at flood risk from a 1% AEP fluvial flood event. The number at flood risk would be 5.</p> <p>LOW+ Less frequent and shorter duration flooding of BAP habitats will benefit BAP habitats intolerant of waterlogging.</p>	Not preferred option – although flood risk will be greatly reduced both now and into the future, the high economic costs for building new defences is probably unfeasible in this policy unit. In addition, the current level of risk is low, so reducing damages further than this is not economically justifiable.
Social	<p>LOW- An additional 0.01km² of land where depths exceed 0.5 metres at risk from flooding.</p>	<p>HIGH+ 166 people (-521) at risk from flooding.</p> <p>MEDIUM+ 50 people (-136) located within flood risk areas where flood depths exceed 0.5 metres.</p> <p>MEDIUM+ 76 properties (-155) would not be within an existing flood warning area</p> <p>MEDIUM+ 70 residential properties (-202) at risk from flooding.</p> <p>MEDIUM+ 3 health services (+0), 1 school (-1), 0 community centres (-1) and 3 retail buildings (-5) community assets at risk from flooding.</p>	
Economic		<p>MEDIUM+ £2.4m economic damages to properties (-£5.2m).</p> <p>LOW+ 1 electricity station (-1) at risk from flooding.</p> <p>LOW+ £168,000 economic agricultural damages (-£5,000).</p> <p>NEUTRAL= No additional critical transport routes at risk from flooding.</p>	
Policy option P6			

Policy unit name/number:	Policy unit 5: Upper Ebbw		
Policy options	Losses	Gains	Preferred policy option
Environmental	There is no scope for carrying out policy six in this policy unit. Increased frequency of flooding to make space for water would result in a very high number of people at risk and very high economic damages. Deliberately promoting flooding through schemes that make space for water would cause large-scale community disruption to this policy unit and the Eastern Valleys as a whole.	There is no scope for carrying out policy six in this policy unit. Increased frequency of flooding to make space for water would result in a very high number of people at risk and very high economic damages. Deliberately promoting flooding through schemes that make space for water would cause large-scale community disruption to this policy unit and the Eastern Valleys as a whole.	Not preferred option – there is no scope for carrying out policy six in this policy unit. There is very limited opportunity for increasing the frequency of flooding as a flood risk management option within this policy unit.
Social			
Economic			

Key

HIGH:	<p>High negative</p> <p>A policy has a 'high negative' effect where it could contribute to a social, economic or environmental objective in a significantly negative way.</p> <p>A 'high negative' effect could be:</p> <ul style="list-style-type: none"> (i) a very large increase in current flood risk; (ii) very large projected increases in flood risk under future conditions, and/or; (iii) significant additional social, economic and/or environmental losses.
MEDIUM:	<p>Medium negative</p> <p>A policy has a 'medium negative' effect where it could contribute to a social, economic or environmental objective in a negative way.</p> <p>A 'medium negative' effect could be:</p> <ul style="list-style-type: none"> (i) an increase in current flood risk; (ii) a projected increase in flood risk under future conditions, and/or; (iii) social, economic and/or environmental losses.
LOW:	<p>Low negative</p> <p>A policy has a 'low negative' effect where it could make a limited contribution to a social, economic or environment objective, but where the overall contribution would be negative.</p> <p>A 'low negative' effect could be:</p> <ul style="list-style-type: none"> (i) an overall increase in current flood risk; (ii) an overall increase in flood risk under future conditions, and/or; (iii) overall social, economic and/or environmental losses.
NEUTRAL:	<p>Neutral</p> <p>A policy has a 'neutral' effect where it makes neither a positive or negative contribution to a social, economic or environmental objective.</p> <p>A 'neutral' effect could be:</p> <ul style="list-style-type: none"> (i) no change in current level of risk. In this instance the current level of risk would have to be low, so that the residual risk after a neutral policy was implemented remained acceptable; (ii) no change in flood risk under future conditions. In this instance projected future risk would need to be low so that the residual risk after a neutral policy was implemented remained acceptable, and/or; (iii) no additional social, economic and/or environmental gains or losses. <p>Policy options may also be 'neutral' where they are not relevant in a particular policy unit, or where it is not feasible for a policy option to contribute to an objective.</p>
HIGH:	<p>High positive</p> <p>A policy has a 'high positive' effect where it could contribute to a social, economic or environmental objective in a significantly positive way.</p> <p>A 'high positive' effect could be:</p> <ul style="list-style-type: none"> (i) a very large reduction in current flood risk; (ii) avoiding/reducing very large projected increases in flood risk under future conditions, and/or; (iii) significant additional social, economic and/or environmental gains.
MEDIUM:	<p>Medium positive</p> <p>A policy has a 'medium positive' effect where it could contribute to a social, economic or environmental objective in a positive way.</p> <p>A 'medium positive' effect could be:</p> <ul style="list-style-type: none"> (i) a reduction in current flood risk; (ii) avoiding/reducing projected increases in flood risk under future conditions, and/or; (iii) additional social, economic and/or environmental gains.
LOW:	<p>Low positive</p> <p>A policy has a 'low positive' effect where it could make a limited contribution to a social, economic or environment objective, but where the overall contribution would be positive.</p> <p>A 'low positive' effect could be:</p> <ul style="list-style-type: none"> (i) an overall reduction in current flood risk; (ii) an overall avoidance/reduction in flood risk under future conditions,

Form 12.8: Summary of the preferred policy

Policy Unit name/number:	<p>Policy Unit 5: Upper Ebbw</p> <p>The policy unit is located within the upper reaches of the Eastern Valleys CFMP area. The policy unit covers the main areas of Ebbw Vale, Cwm, Abertillery and Llanhilleth.</p>
Problem / risk:	<p>The main river within this policy unit is the River Ebbw (split into two in the upper areas; Ebbw River and Ebbw Fach River). The main source of flooding within this policy unit is fluvial. Other secondary sources of flooding within this policy unit include surface and sewer flooding. We currently spend approximately £48,000 per year on maintenance and operations in this policy unit.</p> <p>Current fluvial risk within the policy unit presents some flood risk but is considered to be low in comparison to the rest of the Eastern Valleys.</p> <p>Under future conditions the risk to people and property is relatively high for the 0.1% AEP extreme fluvial events.</p>
Policy selected	<p>Policy 4 – Take further action to sustain current risk</p> <p>We have selected this policy based on the risk posed by inland flooding sources and tidal flooding sources. Our goal for selecting policy four for the Upper Ebbw policy unit is to reduce the high future fluvial flood risk. The current flood risk should be managed through influencing and informing.</p> <p>If the risks posed by tidal flooding were removed from the policy appraisal process, preliminary estimates suggest that this policy would remain a P4. This is because there is no tidal flood risk in this policy unit.</p>
Justification and alternative policies considered	<p>Policy 4 sets a framework that reduces flood risk into the future. This policy is appropriate for this policy unit for the following reasons:</p> <ul style="list-style-type: none"> - The future levels of fluvial flood risk are high and the risks present severe consequences for harm to life. - Risks for extreme fluvial events (0.1% AEP) are high. - There are a significant number of properties in the future that will be at flood risk, including numerous residential properties, and critical and community assets. - The current level of maintenance should be continued or improved as to help improve conveyance, reducing the impacts of flooding and maintaining water levels. - The current level of risk is low in this policy unit, reducing damages to this level is economically justifiable. <p>The main area of Abertillery is situated in the upper reaches of the River Ebbw. The main areas of Cwm and Llanhilleth are situated in the upper reaches of the River Ebbw. The main area of Ebbw Vale is situated in the upper reaches of the River Ebbw. The existing floodplain of the River Ebbw in Abertillery, Cwm and Llanhilleth is restricted by the presence of flood defences. There is also a residual risk of these defences breaching, so properties located behind these flood defences are extremely vulnerable.</p> <p>The current scale of fluvial flood risk during a 1% AEP flood event in the main areas of Cwm, Llanhilleth and Abertillery is low. The damages are relatively high in Ebbw Vale. The estimated total property damages for a 10% AEP fluvial flood event in Ebbw Vale are £4.1 million and £4.9 million for the 1% AEP fluvial flood event. In Abertillery, the 10% AEP fluvial flood event property damages are £304,000, for the 1% fluvial flood event they are £550,000. In Cwm, the 10% AEP fluvial flood event property damages are £8,300, for the 1% fluvial flood event they are £988,000. In Llanhilleth, the 10% AEP fluvial flood event property damages are zero as no properties flood, for the 1% AEP fluvial flood event they are £50,000. The level of risk for the 0.1% AEP fluvial flood event is high in Ebbw Vale, Abertillery and Cwm, with estimated total property damages being £5.5 million, £5.8 million and £5.5 million, respectively. It can be seen that the damages principally arise from the more extreme events, which is due to our flood defences</p>

	<p>in Abertillery and Cwm, which have a SoP of 1% AEP in most places, overtopping. The defences in Llanhilleth are not overtopped in the 0.1% AEP fluvial flood event in most places. Approximately 166 properties are at flood risk in Ebbw Vale, 28 in Abertillery, 5 in Llanhilleth and 62 in Cwm in the 1% AEP fluvial flood event. Critical assets that are currently at risk include 1 electricity station in Abertillery. There are no critical transport routes at flood risk in the 1% AEP fluvial flood event.</p> <p>In the future, the 1% AEP fluvial flood event damages for the main areas of Ebbw Vale, Llanhilleth, Abertillery and Cwm are high. Damages significantly increase to £5.9 million, £8.6 million, £7.5 million and £1.4 million, respectively. The numbers of properties affected for Ebbw Vale, Llanhilleth, Abertillery and Cwm are 184, 269, 276 and 89, respectively. These large increases are due to our flood defences overtopping in Cwm, Llanhilleth and Abertillery. The numbers and lengths of critical assets at risk also increase into the future.</p> <p>The expected current annual damages in the main areas of Ebbw Vale, Llanhilleth, Abertillery and Cwm are £838,000/yr, £2,000/yr £57,000/yr and £36,000/yr, respectively. The expected annual damages could increase by over 200% in the future as a result of the impacts of climate change and further development planned within the catchment.</p>
<p>Justification and alternative policies considered</p>	<p>Gains and losses under preferred policy (policy four)</p> <p><i>Social</i> Policy four gives six low losses against our social CFMP objectives and indicators. Flood risk would be significantly reduced for 1% AEP fluvial flood event into the future. We accept that there would still be people and property at flood risk during the 1% AEP fluvial flood event under current conditions, but the consequences of this could be minimised through influencing and informing. For more extreme events such as the 0.1% AEP flood event, we accept that we cannot build structural defences to protect the people, property and the economy, and that there would be significant consequences during such extreme events.</p> <p><i>Economic</i> Policy four gives two low and two neutral losses against our economic CFMP objectives and indicators. Economic damages would be significantly reduced into the future for fluvial flood events. The critical assets at risk would also be reduced.</p> <p><i>Environmental</i> Policy four gives 1 neutral, 1 medium loss and 1 low loss against our environmental CFMP objectives and indicators. Rivers in policy unit five are already managed for flood risk purposes; therefore we would not expect the natural environment to be significantly affected if we took further action to reduce risk to society and the economy. There are a limited number of environmental sites within the policy unit and we do not expect that an increase in flooding will have a significant negative impact on environmental sites.</p> <p>Alternative policies considered</p> <p>Policy one – <i>No active intervention</i>. The increased risk to people (+2,174), properties (+1,083) and the economy (+£37m) would be high and there would be very significant and high increases in risks in the future.</p> <p>Policy two – <i>Reduce current levels of flood risk management</i>. The increased risk to people (+1,656), properties (+842) and the economy (+£26m) would be high and there would be very significant and high increases in risks in the future.</p> <p>Policy three – <i>Maintain current levels of flood risk management</i>. The increased risk to people (+1,081), properties (+560) and the economy (+£17m) would be high and there would be very significant and high increases in risks in the future.</p> <p>Policy five – <i>Take further action to reduce flood risk (now and/or into the future)</i></p>

	<p>Although flood risk would be significantly reduced under this policy, further investment in defences is considered not to be feasible. The remaining risk will be managed through influencing and informing.</p> <p>Policy six – <i>Take action with others to store water or manage run-off in locations that provide overall flood risk reduction or environmental benefits, locally or elsewhere in the catchment.</i> There is no scope for carrying out policy six in this policy unit. There is very limited opportunity for increasing the frequency of flooding as a flood risk management option within this policy unit.</p>
Catchment-wide opportunities & constraints	<p>The greatest opportunity in policy unit five is for us to significantly reduce the risk of flooding to people, property and the economy; these risks are high into the future. In order to do this we need to take further action to sustain the current level of risk in this policy unit.</p> <p>There are few opportunities within this policy unit to reconnect the river with its floodplain in this policy unit as the river is highly constrained by flood defences which protect high numbers of properties.</p>
Actions	<ul style="list-style-type: none"> • The scale of the expected economic damages and risk to people and property indicates that we should develop a Strategy Plan for the Upper Ebbw policy unit within the next 5 years. This will consider where investment for structural responses can and should be implemented to reduce flood risk in Ebbw Vale, Llanhilleth, Abertillery and Cwm, and other areas where the flood risk is high. Moving forward from the Strategy Plan, Pre-feasibility studies will be needed. • Initiate urban drainage studies for Ebbw Vale, Llanhilleth, Abertillery and Cwm to identify surface water drainage issues and potential for remediation. • In partnership with Blaenau Gwent Local Authority, we should enforce stringent building controls on new development within flood risk areas. Suitable land allocations for new development should first be sought outside of flood risk areas. • SUDs and building regulations (resilience) should be incorporated, where appropriate, into all new developments.
Risks, uncertainties & dependencies	<p>The damages to the Upper Ebbw policy unit from flooding are estimates that are considered sufficiently accurate to justify the cost of further investigations into the appropriate intervention to reduce flood risk. More detailed assessments will be required to identify the actual level of investment that can be justified and its relative priority with other flood risk reduction work.</p> <p>We will be accepting some flood risk by selecting policy four; where risks to people and property remain, investment will be focused on influencing and informing, to reduce the consequences if flooding occurs.</p> <p>An existing model of the River Ebbw in Cwm, Abertillery and Llanhilleth was used, this was supplemented by more broadscale modeling to ensure all the risk was assessed in the policy unit. There is more uncertainty with the broadscale modeling than areas with existing models.</p> <p>For this policy to be successful, appropriate policies and actions must be implemented throughout the River Ebbw catchment.</p>

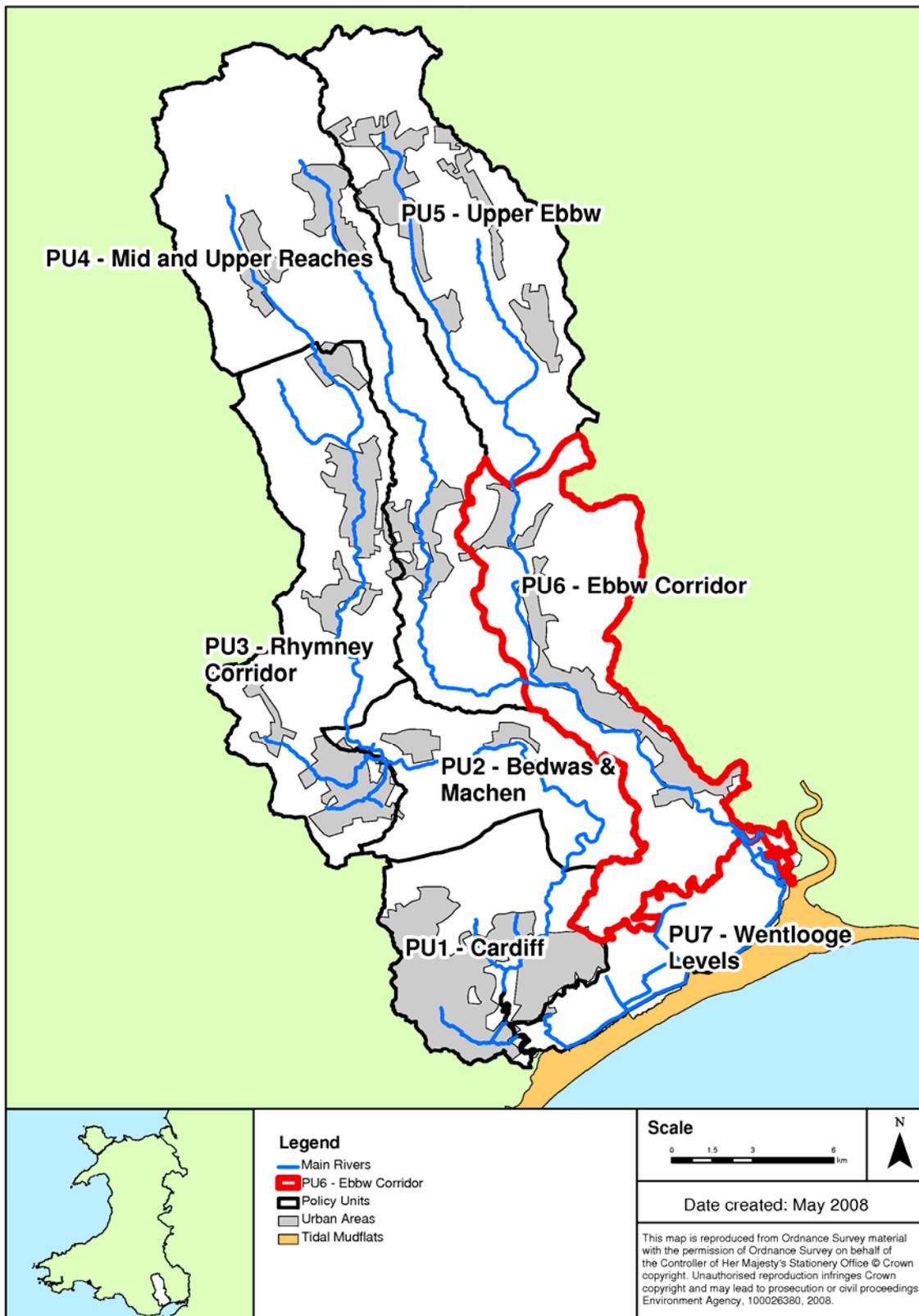
Form 12.9: Requirements for further policy development and appraisal

Is there a need for further policy development?	No
If yes, then mark Policy Options for more detailed development. Some complex policies may require more detailed development, probably at Strategy Plan level.	
Is there a need for further more detailed appraisal?	No
If yes, take forward to Strategy study.	

Form 12.10: Indicators for monitoring, review and evaluation

Set out the indicators that need to be included in the policy implementation plan, for policy monitoring, drawing on the residual risks and likely impacts identified above. This will allow better review and evaluation of the policy when implemented.	
Monitoring	Significance/impact
Hydrometric monitoring of river flows and levels, rainfall and groundwater levels throughout the catchment in order to monitor changes in climate	<ul style="list-style-type: none"> Additional data may change our assessment of current or future conditions
Scientific advancements in flood risk management	<ul style="list-style-type: none"> Improved predictions in changes to river flows
Land use change monitored using satellite imagery	<ul style="list-style-type: none"> Further information on land use change may change future predictions of flood risk
Actual development rates	<ul style="list-style-type: none"> Need to check if urbanisation predictions made are realistic in light of current and future development undertaken
Designation and condition of environmental sites	<ul style="list-style-type: none"> May change the chosen policy if additional sites are designated. Monitoring of site condition will confirm that chosen CFMP policies have not adversely affect designated sites
Designation and condition of historic environmental assets	<ul style="list-style-type: none"> May change the chosen policy if additional sites are designated. Monitoring of site condition will confirm that chosen CFMP policies have not adversely affect designated sites
Detrimental impacts of flood risk management projects on BAP habitats and species	<ul style="list-style-type: none"> To ensure that specific flood risk management projects do not adversely affect BAP habitats and species
Level of uptake of flood warning services	<ul style="list-style-type: none"> Monitor whether the community are aware of the flood risks
Condition of flood defences	<ul style="list-style-type: none"> Need to maintain defences in line with the policy chosen
Actual expenditure on maintenance activities by policy unit, subdivided into activities.	<ul style="list-style-type: none"> Ensure that money is being targeted according to policy chosen
Actual expenditure on capital works to reduce flood risk	<ul style="list-style-type: none"> Need to ensure that these actions are in keeping with the policy chosen
Improved documentation of actual flood events: <ul style="list-style-type: none"> Number of properties/assets/ environmental sites/historic environment assets flooded Source of flooding Cause of flooding Whether due to defence failure 	<ul style="list-style-type: none"> Information on actual flood events needs to be better recorded in order to understand the relative importance of the various sources of flooding
Construction of critical infrastructure	<ul style="list-style-type: none"> May change the chosen policy if additional critical infrastructure is constructed within the floodplain

Spatial location of policy unit 6: Ebbw Corridor



Form 12.5: Summary of current and future levels of and responses to flood risk

<p>Policy unit name/number:</p>	<p>Policy Unit 6: Ebbw Corridor</p>
<p>Current responses to flood risk within the policy unit?</p>	<p>Defences We defend the main urban area of Risca in policy unit six using raised earth and blockstone embankments with petroflex revetments along both sides of the River Ebbw. These were implemented in the 1980s and extend from Risca close to the mouth of the Ebbw, up to Crosskeys. In Bassaleg, there are 1km of defences protecting Tredegar Park Golf Course and Bassaleg. In Risca, there are 3.8km of defences along the left bank of the River Ebbw protecting the urban area of Risca. There is a shorter 0.6km length of defence in Crosskeys, along the left bank of the River Ebbw, adjacent to Waunfawr Park.</p> <p>Flood Warning We provide a flood warning service via Floodline Warnings Direct. Flood Warning Area 103FWFg11 is the only flood warning area in this policy unit, covering fluvial flood risk from the River Ebbw from Tredegar Park to Crosskeys upstream. The lead times for flood warning in policy unit six are unknown. We aim to issue flood warnings at least 2 hours before a flood event occurs. There are currently 414 properties at flood risk during a 1% AEP fluvial flood event, 321 of which lie within the existing flood warning area. Uptake to the flood warning service is unknown.</p> <p>Maintenance of existing structures We carry out routine maintenance works on all main rivers in policy unit six. In Risca and Crosskeys we undertake: routine mowing and spraying to maintain the River Ebbw channel capacity and petriflex repairs to maintain the flood defences in these areas.</p> <p>The Ebbw Corridor policy unit is covered by four asset systems. FR19S135, FR19S091, FR19S090 and FR19S062 are all high risk asset systems and are inspected every 6 to 12 months. We currently spend approximately £53,000 per year on maintenance and operations in policy unit six.</p>
<p>Standards of service that apply to flood defences within the policy unit?</p>	<p>Standard of Protection The defences in the Ebbw Corridor policy unit offer a 1% AEP fluvial Standard of Protection (SoP) in most places. The defences close to the mouth of the River Ebbw, close to Tredegar Park, offer a 0.5% AEP tidal SoP. There is an area of the existing defences in Risca that are below a 1% AEP fluvial SoP, this stretch is close to Commercial Street in Risca and is approximately between the 2% AEP and 1.5% AEP fluvial SoP level.</p> <p>All of these defences are likely to be overtopped when allowances are made for climate change into the future.</p> <p>Condition and maintenance of defences This information is unknown.</p>
<p>What is currently exposed to flooding?</p>	<p>People We estimate that there are currently 466 people at risk of flooding in policy unit six from a 1% AEP fluvial flood event and 12 people at risk from a 0.5% AEP tidal flood event. The majority of the fluvial flood risk comes from the River Ebbw and the main risk to people is in Risca, where either the SoP of the defences is below the 1% AEP event, or where there are no existing defences. Flood risk significantly increases in the 0.1% AEP fluvial and tidal flood events as a result of flood defences being overtopped along the River Ebbw. This increase in risk is the highest in the Eastern Valleys.</p> <p>Community Disruption We estimate that there are currently 414 properties at risk of flooding in policy unit six from a 1% AEP fluvial flood event, 313 of which are residential. Community</p>

assets at risk are one health service in Pontymister, two schools in Pontymister and Newbridge, two community centres in Pontymister and 47 retail buildings. During a 0.5% AEP tidal flood event, 38 properties are at risk, all of which are residential properties. There are no community assets at flood risk during the 0.5% AEP tidal flood event. Community disruption will significantly increase for the 0.1% AEP fluvial and tidal flood events.

Critical Infrastructure

We estimate that there are currently four electricity stations and 0.5km of the A467 between Risca and Newport at flood risk in policy unit six from a 1% AEP fluvial flood event.

We estimate that there is one landfill site (Newport) at flood risk and no critical transport routes in policy unit six from a 0.5% AEP tidal flood event.

Economic Damages

We estimate the total economic property damages resulting from the 1% AEP fluvial and 0.5% AEP tidal flood events to be £13.5 million and £703,000, respectively.

We estimate the total economic agricultural damages resulting from the 1% AEP fluvial and 0.5% AEP tidal flood events to be £174,000 and £24,000, respectively.

Historic Environment

We estimate that 10 listed buildings are currently at flood risk from a 1% AEP fluvial flood event.

No listed buildings are at flood risk from a 0.5% AEP tidal flood event.

Landscape

We estimate that there are currently no landscape receptors at flood risk from a 1% AEP fluvial flood event or a 0.5% AEP tidal flood event in policy unit six.

Recreation

We estimate that there are currently no recreational areas at flood risk in policy unit six from either a 1% AEP fluvial flood event or a 0.5% AEP tidal flood event.

Nature conservation sites

We estimate that there are currently no designated nature conservation sites at flood risk from a 1% AEP fluvial flood event or a 0.5% AEP tidal flood event in policy unit six.

BAP Habitats

The exact location of BAP habitats in the catchment is unknown, but we estimate that several locally important habitats, identified in the Caerphilly and Newport Local BAPs, will be at risk from flooding from both fluvial and tidal sources. These habitats include; coastal and floodplain grazing marsh; coastal saltmarsh; mudflats; ponds; reedbeds; rhos pastures; rivers, streams and floodplains; and standing open water and canals.

Species

The exact location of BAP species in the catchment is unknown, but we estimate that a several locally important species, identified in the Caerphilly and Newport Local BAPs, will be at risk of flooding from both fluvial and tidal sources. These species include Allis Shad; Brown Trout; the Double Line Moth; Great Crested Newt; Otter; Reed Bunting; River Jelly Lichen; Spruce's Brittle-moss; Twaite Shad and Water Vole.

Who and what are currently

Social and economic receptors

People living in areas behind flood defences are the most vulnerable to flooding

<p>most vulnerable to flood damage and losses?</p>	<p>due to the high depths and velocities of flood water that would be expected if a breach occurred in the defence scheme or the defences were overtopped. The main area of Risca has the highest economic damages during a 1% AEP fluvial flood event, most of which are as a result of flooding to residential properties.</p> <p>The people most vulnerable to flooding during a 0.5% AEP tidal flood event are in Tredegar Park, although this risk is low compared to fluvial flood risk.</p> <p>Environmental receptors</p> <p>BAP habitats and species in the unit are at greatest risk from prolonged or frequent floodwater inundation, especially by low quality water, which can indirectly degrade habitats. However, some wetland BAP habitats, and the species they support, may benefit from increased flooding.</p> <p>Tidal flooding can also affect BAP habitats and species, as flooding of saltwater habitats with freshwater, and freshwater habitats with saltwater, can cause long-lasting damage to sensitive plants and animals.</p> <p>The 10 listed buildings currently at risk from a 1% AEP fluvial event are likely to be negatively affected. Frequent inundation, with high depths and velocities of flood water, is likely to have a negative impact.</p>
<p>What are the key factors that could drive future flood risk?</p>	<p>Climate change</p> <p>Climate change is the main driver of future flood risk in the Eastern Valleys. Climate change will result in higher flows and higher tide levels, which will increase water levels in our rivers. This will put pressure on existing flood defences and will result in the current Standard of Protection of our channels and flood defences being reduced. Flooding under our modelled future scenarios of climate change would cause significantly more damage and pose a significantly higher risk to people and property than existing conditions.</p> <p>Land use management changes</p> <p>We have decided not to consider the impact of land use change outside of urban areas on future flood risk in this CFMP. Agricultural intensification and changes in drainage practices are unrealistic scenarios because the Eastern Valleys has poor quality soils that are unsuitable for agricultural intensification. It is also constrained by the steep gradients of the land, meaning arable farming is impossible in certain areas. It is very difficult for us to predict the future of agriculture in the Eastern Valleys beyond the immediate future. It may be that extensification is a more realistic long-term scenario, where land is farmed less intensively and for environmental benefits. However, it is unlikely that extensification would have little impact on flood risk as the area is not intensively farmed at present.</p> <p>Development in the flood plain</p> <p>Increased urbanisation will result in increased flood volumes and higher peak water levels, and flooding would occur more quickly. Unless runoff from new urban development within and outside of floodplains is balanced flood risk will increase locally and downstream. Development in the floodplain should only be allowed when no other suitable land allocations are available and any buildings within floodplains should have flood resilience measures incorporated into their design, and floodplain compensation would be necessary.</p> <p>Flood defence failure</p> <p>In the event of flood defence infrastructure failing during a flood event, the resulting flood water depths and velocities would be very high. There would also be very little flood warning time for people located close to existing flood defences. Therefore, the risk of harm to life would be very high and the resulting economic damages would be very high. The areas most vulnerable to flood defence failure in</p>

What are the possible future levels of flood risk under the main scenarios?

policy unit six are the Risca and Crosskeys, most of which are residential areas.

Our final future scenario that we used to assess possible future levels of flood risk considered a combination of the two main drivers, climate change and urbanisation. We have identified the following. We show the total numbers at risk, with the increase from current conditions in brackets.

People

In the future, we estimate that there will be 3096 (+2630) people at risk of flooding from a 1% AEP fluvial flood event. We estimate that there will be 991 (+902) people at risk of flooding in the future 0.5% AEP tidal flood event. The increase in people at risk during these events is mainly due to our 1% AEP SoP flood defences overtopping. The majority of the flood risk is in Risca.

Community Disruption

In the future, we estimate that there will be 1880 (+1446) properties at risk of flooding from a 1% AEP fluvial flood event, 1626 (+1313) of which are residential. Community assets will also be at flood risk in the future 1% AEP fluvial flood event: four health services (+3) in Risca, Pontymister and Crosskeys, two schools (+0) in Pontymister and Newbridge, five community centres (+3) in Pontymister, Crosskeys and Newbridge and 136 (+89) retail buildings.

We estimate that there will be 410 (+372) properties at risk of flooding in the future 0.5% AEP tidal flood event, 402 (+364) of which are residential. Community assets will also be at flood risk in the future 0.5% AEP tidal flood event: one community centre in Duffryn (+1) and four retail buildings (+4).

Critical Infrastructure

In the future, we estimate that there will be: one police station (+1) in Pontymister, one ambulance station (+1) in Bassaleg, eight electricity stations (+4) in Newbridge, Abercarn and Risca, one COMAH site (+1), 1km (+1) of the railway through Newbridge and Crumlin, 1.7km (+1.2) of the A467 between Risca and Newport, and 0.8km (+0.8) of the A48 in Maes-Glas at flood risk during a 1% AEP fluvial flood event.

In the future, we estimate that there will be: one police station (+1) in Duffryn, one landfill site (+0) and one electricity station (+1) in Duffryn at flood risk during a 0.5% AEP tidal flood event. No critical transport routes would be at flood risk during this event.

Economic Damages

In the future, we estimate the total economic property damages resulting from the 1% AEP fluvial and 0.5% AEP tidal flood events will be £80.3 million (+£66.8m) and £21.3 million (+£20.5m), respectively.

In the future, we estimate the total economic agricultural damages resulting from the 1% AEP fluvial and 0.5% AEP tidal flood events will be £377,000 (+£203,000) and £96,000 (+£72,000), respectively.

Historic Environment

We estimate that, in the future, four additional listed buildings will be at flood risk from a 1% AEP fluvial flood event, resulting in 14 at risk in total.

In the future, we also estimate 15 listed buildings will be at flood risk from a 0.5% AEP tidal flood event.

Landscape

In the future, we estimate that no landscape receptors will be at flood risk from a 1% AEP fluvial flood event or a 0.5% AEP tidal flood event in policy unit six.

What potential responses (or groups of responses) are being considered to manage flood risk?	Recreation In the future, we estimate that there will be one recreational area (+1) at flood risk in policy unit six from a 1% AEP fluvial flood event. No recreational areas are at flood risk in the future 0.5% AEP tidal flood event.	
	Nature conservation sites In the future, we estimate that no designated nature conservation sites will be at flood risk from a 1% AEP fluvial flood event or a 0.5% AEP tidal flood event in policy unit six.	
	BAP Habitats The exact location of BAP habitats in the catchment is unknown. However, we estimate that in the future an increasing area of the locally important BAP habitats identified above will be at risk of flooding.	
	Species The exact location of BAP species in the catchment is unknown. However, we estimate that in the future an increasing number of the locally important BAP species identified above will be at risk of flooding.	
	Generic Response/Strategic	Response
Attenuation/retention	<ul style="list-style-type: none"> ▪ SUDS - new/retrospective 	A potential method for reducing surface water runoff and should be included in all new developments.
Increased or decreased conveyance	<ul style="list-style-type: none"> ▪ River maintenance 	Ongoing maintenance activities include petriflex repairs. Reduced/increased maintenance activities within this policy unit should be considered further.
	<ul style="list-style-type: none"> ▪ Fluvial defences 	We defend some areas in this policy unit, namely Risca and Crosskeys, using raised earth and blockstone defences with petroflex revetments and raise flood defence walls along both sides of the River Ebbw.
Influencing and informing	<ul style="list-style-type: none"> ▪ Flood awareness 	National campaign. Should be continued and awareness increased within this policy unit where the flood risk from fluvial is very high. Also additional tidal risk in the lower areas of the policy unit.
	<ul style="list-style-type: none"> ▪ Flood warning and evacuation 	Flood Warning Area covers fluvial flood risk from the River Ebbw in Risca and Crosskeys. Uptake to FWD unknown but likely to be opportunity to increase. In light of future flood risk, it is likely that the flood warning area may need extending.
	<ul style="list-style-type: none"> ▪ Emergency & disaster planning/response 	Policy unit covered by Caerphilly and Newport Local Authorities. Existing emergency plans in place, which should be reviewed and updated as new information becomes available.
	<ul style="list-style-type: none"> ▪ Planning policy, Development control 	Continue to follow Welsh Assembly Government policies. Caerphilly and Newport Local Authorities should ensure that suitable land allocations outside flood risk areas are sought first.

		<ul style="list-style-type: none"> Building regulations (resilience) 	To be incorporated into all new developments located within flood risk areas.
	Monitoring, advise and survey	<ul style="list-style-type: none"> Data and information 	Should continue despite policy selected.
		<ul style="list-style-type: none"> Asset inspection 	Policy unit classified as high risk and therefore assets are inspected every 6-12 months. It is unlikely this could be increased further but should be explored, and perhaps main flood risk areas targeted.
		<ul style="list-style-type: none"> Hydrometric network 	Existing gauges at Risca and Rhiwderin
	Studies	<ul style="list-style-type: none"> Flood risk mapping 	Flood risk management study completed in 2006 - All studies should be revisited as more data becomes available.
		<ul style="list-style-type: none"> Flood forecasting 	No existing studies. Due to the high fluvial flood risk, a flood forecasting study may be beneficial.
		<ul style="list-style-type: none"> Pre-feasibility 	No existing studies but scheme may be needed along the Ebbw at Risca.
		<ul style="list-style-type: none"> Strategy plans 	Recommended that a strategy plan should be undertaken to better target and prioritise actions in the future.
		<ul style="list-style-type: none"> SAMPs 	Policy unit covered by SAMPs.
		<ul style="list-style-type: none"> Urban drainage plans 	Expected that there are existing plans for the main urban areas such as Risca & Newport. Further significant urban expansion will need plans to ensure that flood risk will not increase within the towns or further downstream.
What gaps and uncertainties are there in knowledge, and what assumptions have been made?	<p>Broadscale modelling</p> <ul style="list-style-type: none"> Broadscale hydrology and hydraulic modelling techniques used; Where no existing models are available, these have been supplemented by other modelling techniques. An existing model of the River Ebbw was used for this policy unit. <p>Future scenarios</p> <ul style="list-style-type: none"> Although climate change projections are based on current guidance, these are still estimations; Urbanisation projections up until the year 2100 are based on current rates of urbanisation. <p>Data limitations</p> <ul style="list-style-type: none"> No data on the percentage uptake of properties located in Flood Warning Areas; No data on the condition of flood defences/maintenance regime. The exact locations of BAP habitats and species within the policy unit are unknown. 		

Broad scale Modelling Tables

Generic Response Modelling

The following tables provide a summary of how flooding will change in response to flood management options which may be adopted within policy unit six and what the implications of these changes might be. We have not applied any specific measures or schemes to the policy unit, but rather have applied what has been termed a 'generic response'. This represents the most likely outcome of a given policy, but is not specific and does not reflect any proposed scheme or project. It simply allows a broad assessment of what the impact of that policy might be.

Our broad scale models have been used to investigate the impact of these changes and have allowed us to quantify the effect on flood damages. We compare the risks for each generic response against the current base case conditions (the risk which currently exists in the catchment today). The results given below for each of the generic responses (i.e. the appropriate scenario for that part of the catchment) are for the 1% AEP fluvial flood event and 0.5% AEP tidal flood event, where applicable.

We have unit costs available for defences, however the costs of flow attenuation schemes are not available. The cost of large scale flow attenuations scheme would be extremely high, as they form heavy structural response to flood risk. More local schemes for attenuating flow would cost less, but the costs would still be high compared to defences.

Policy unit 6: Ebbw Corridor

Generic response: Policy 1 - Withdraw/retreat defences and decreased conveyance

Description: We used our broad scale River Ebbw models to assess the combined effects of not maintaining defences and stopping river maintenance. Channel and floodplain roughness values in our broad scale models were increased from 0.04 and 0.06 to 0.075 and 0.095 respectively, to reflect the increase of roughness expected if maintenance were stopped. Defences were not removed from the model as their impact was considered negligible, due to them being overtopped.

For undefended tidal conditions we used the future 0.1% AEP tidal flood outline as a surrogate for an extreme tidal event, which we would not defend against, as we consider this to be a worse case scenario. Compared to the influence of the tide level, the channel maintenance we undertake has very little effect in tidally-influenced areas. We therefore have shown that the risk would be greater than that from the 0.1% AEP tidal event.

Base case conditions (1% AEP fluvial flood event)

People at risk: Fluvial – 466 Tidal – 89	Economic risk: Fluvial – £13.5m Tidal – £703,000	Properties at risk: Fluvial – 414 Tidal – 38	Environmental sites at risk: Fluvial – No SSSIs at risk Tidal – No SSSIs at risk
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Results of the broad scale modelling

People at risk: Fluvial – 7,356 (+1,479%) Tidal – 994 (+1,017%)	Economic risk: Fluvial – £171.9m (+1,173%) Tidal – £25.6m (+3,542%)	Properties at risk: Fluvial – 3,308 (+699%) Tidal – 441 (+1,061%)	Environmental sites at risk: Fluvial – No SSSIs at risk (no change) Tidal – No SSSIs at risk (no change)
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Conclusions

Cost: Nothing - no active intervention

Conclusion: The results of this modelling have indicated that if we stopped our maintenance of the defences and channels in policy unit six the risk to people, properties and the economy would increase greatly. The impact of 'no active intervention' in this policy unit is significant, because we would be encouraging more flooding to occur. Our defences and the maintenance we undertake on the River Ebbw throughout the Ebbw Corridor policy unit are very important in reducing the risk of flooding and this is why the existing level of risk is quite low.

Policy unit 6: Ebbw Corridor

Generic response: Policy 2 – Reduced maintenance

Description: The active removal of the defences we maintain in and around the Ebbw Corridor policy unit would not be a sustainable flood risk management strategy. The defences in this policy unit currently have a 1% AEP Standard of Protection in most places, so provide considerable protection. We could reduce our flood risk management around the Ebbw Corridor policy unit by relaxing our maintenance activities, such as weed-cutting and clearing. We increased channel and floodplain roughness in the Rhymney broad scale models from 0.04 and 0.06 to 0.055 and 0.075 respectively, to reflect the increase of roughness expected if maintenance were reduced.

Channel roughness has a negligible effect on tidal water levels, so we did not model tidal scenarios for this generic response.

Base case conditions (1% AEP fluvial flood event)

People at risk: Fluvial – 466 Tidal – 89	Economic risk: Fluvial – £13.5m Tidal – £703,000	Properties at risk: Fluvial – 414 Tidal – 38	Environmental sites at risk: Fluvial – No SSSIs at risk Tidal – No SSSIs at risk
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Results of the broad scale modelling (1% AEP fluvial flood event)

People at risk: Fluvial – 3,744 (+703%) Tidal – N/A	Economic risk: Fluvial - £97.9m (+625%) Tidal – N/A	Properties at risk: Fluvial – 2,187 (+428%) Tidal – N/A	Environmental sites at risk: Fluvial – No SSSIs at risk (no change) Tidal – N/A
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Conclusions

Cost: We currently spend approximately £53,000 per year on maintenance and operations in policy unit six. Under policy two we would not stop this regime, but we would scale down our programme, for example we may downgrade the high risk flood risk management systems (FRMS) to medium FRMS, which may reduce funding by up to 50% (to £26,500 per year).

Conclusion:

If we were to reduce our maintenance regime, water levels would be expected to increase and bring additional risk to people. During a 1% AEP fluvial event in the future, the defences we maintain would be overtopped if we did not increase them in line with future increases in water levels. By reducing our maintenance the risk to people, property, the economy and the environment would be increased further. This is because channel capacity would reduce and more flooding would occur.

Policy unit 6: Ebbw Corridor

Generic response: Policy 3 – Continue with existing flood defence actions only

Description: This response to manage risk at the same level assumes that we would not undertake any alternative flood risk management actions, and that we would continue to maintain our defences at their current level. We would also continue our river maintenance, which allows the rivers to flow freely, at the same level. The current level of flood risk management under the chosen future scenario of climate change and increased urbanisation was modelled for Chapter 4.

Base case conditions (1% AEP fluvial flood event)

People at risk: Fluvial – 466 Tidal – 89	Economic risk: Fluvial – £13.5m Tidal – £703,000	Properties at risk: Fluvial – 414 Tidal – 38	Environmental sites at risk: Fluvial – No SSSIs at risk Tidal – No SSSIs at risk
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Results of the broad scale modelling (1% AEP fluvial flood event)

People at risk: Fluvial – 3,096 (+564%) Tidal – 991 (+1,013%)	Economic risk: Fluvial - £80.3m (+495%) Tidal – £21.3m (+2,930%)	Properties at risk: Fluvial – 1,880 (+354%) Tidal – 410 (+979%)	Environmental sites at risk: Fluvial – No SSSIs at risk (no change) Tidal – No SSSIs at risk (no change)
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Conclusions

Cost: The Ebbw Corridor policy unit falls within four high risk flood risk management system, for which we currently spend approximately £53,000 per year on maintenance, assets and operations. We would continue investing this much in the future.

Environment Agency Wales

Conclusion: In the past our management of flood risk has been mainly through building defences. We could continue investing in flood risk management to the same level in the Ebbw Corridor policy unit, by maintaining our defences at their current level. To increase them into the future would require additional investment. The results from this model show that if we did not undertake any additional work in managing flood risk into the future throughout the Ebbw Corridor policy unit, then risks to people, property and the economy would greatly increase, because our existing flood defences would overtop. However, it is important that we consider alternative responses other than focusing on defences alone.

Policy unit 6: Ebbw Corridor

Generic response: Policy 4 – Take further action to improve and create new flood defences

Description: This response to sustain flood risk into the future at the current level assumes that we would not undertake any alternative activities. We have identified several areas within the Ebbw Corridor policy unit where there is a big increase in flood risk in the future. These areas include: Crumlin, Crosskeys, two areas in Risca, Rogerstone and Maes Glas/Tredegear Park. These areas are at risk in the future due to either existing flood defences overtopping or the channel capacity being exceeded. We trimmed our future flood outlines to show that these areas would benefit from either new defences or increasing existing defences.

Base case conditions (1% AEP fluvial flood event)

People at risk: Fluvial – 466 Tidal – 89	Economic risk: Fluvial – £13.5m Tidal – £703,000	Properties at risk: Fluvial – 414 Tidal – 38	Environmental sites at risk: Fluvial – No SSSIs at risk Tidal – No SSSIs at risk
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Results of the broad scale modelling (1% AEP fluvial flood event)

People at risk: Fluvial – 503 (+8%) Tidal – 89 (no change)	Economic risk: Fluvial - £18.1m (+37%) Tidal – £703,000 (no change)	Properties at risk Fluvial – 426 (+3%) Tidal – 38 (no change)	Environmental sites at risk: Fluvial – No SSSIs at risk (no change) Tidal – No SSSIs at risk (no change)
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Conclusions

Cost: We currently spend approximately £53,000 per year on inspecting and maintaining our defence assets in the Ebbw Corridor policy unit. We have based our costs on a new flood wall costing £1,500 per metre and increasing existing defences costing £406 per metre. To construct new and increase the height of existing defences along the River Ebbw in the locations listed above would cost approximately £7m. However, there would also be the cost of undertaking pre-feasibility studies and further maintenance costs, particularly with the new defences. Therefore, in total, the indicative cost would be in excess of £7.5m.

To maintain the current tidal standard of protection into the future, we would need to increase the height of approximately 800m of defences along the right bank of the River Ebbw close to Tredegear Park. This would cost in excess of £300,000.

Conclusion: If we continued to maintain, improve and build new defences to account for the additional risk in the future in the main flood risk areas in the Ebbw Corridor policy unit, there will still be some risk during a 1% AEP fluvial flood event, in comparison to other areas in the Eastern Valleys. Our flood risk management approach is to, where possible, move away from the traditional form of structural responses such as defences, in favour of combinations of softer management options. Improving existing and building new fluvial defences along the River Ebbw in the Ebbw Corridor policy unit will provide protection to approximately 1450 properties, reducing economic damages by approximately £62.2m. Improving existing tidal defences in the Ebbw Corridor policy unit will provide protection to approximately 350 properties, reducing economic damages by £19.5m.

Policy unit 6: Ebbw Corridor

Generic response: Policy 4 – Increased maintenance

Description: We currently undertake widespread channel maintenance across the Ebbw Corridor policy unit. We have the option to increase this further, to increase channel capacity and allow flow to be conveyed more freely. This would theoretically reduce flood risk. Our broad scale model was run with channel and flood plain roughness values reduced by 10%, to simulate an increase in our maintenance.

Maintenance has a negligible effect on tidal water levels; therefore we did not include tidal risk for this generic response.

Base case conditions (1% AEP fluvial flood event)

People at risk: Fluvial - 466	Economic risk: Fluvial – £13.5m	Properties at risk: Fluvial – 414	Environmental sites at risk: Fluvial – No SSSIs at risk Tidal – No SSSIs at risk
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Results of the broad scale modelling (1% AEP fluvial flood event)

People at risk: Fluvial – 3,022 (+548%)	Economic risk: Fluvial - £75.9m (+462%)	Properties at risk: Fluvial – 1,835 (+343%)	Environmental sites at risk: Fluvial – No SSSIs at risk (no change) Tidal – No SSSIs at risk (no change)
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Conclusions

Cost: We currently spend approximately £53,000 per year on maintenance and operations in the Ebbw Corridor policy unit. If we were to increase our maintenance programme costs might be expected to increase by approximately 50% (to £106,000 per year).

Conclusion: In the future, our flood defences would be overtopped if we did not continue to improve them in-line with future increases in water levels. The aim of policy four is to sustain the current level of risk in to the future, although there may be a small amount of risk that we would have to accept. By increasing our channel maintenance throughout the policy unit, we would increase channel capacity. This would allow more water to be contained within the channel, and reduce the flood risk. By undertaking this response alone in the Ebbw Corridor policy unit, the consequences in the future to people, property and the economy would still be very high and only slightly lower than the additional consequences shown for the policy three generic response, continue with existing flood defence actions only. Therefore, this generic response is considered not to be suitable for the Ebbw Corridor policy unit. We already carry out significant maintenance within this policy unit, and it is unlikely that we would be able to increase our current maintenance activities significantly. In addition, the benefits gained from further activities would not out way the additional costs involved. In light of these considerations, we will not be considering this as a generic response to take forward to policy appraisal.

Policy unit 6: Ebbw Corridor

Generic response: Policy 5 – Take further action to improve and create new flood defences

Description: Taking further action to improve and create new flood defences to reduce flood risk, both now and into the future, assumes that sustaining the current level of risk would be unacceptable. There is a significant fluvial flood risk in the Ebbw Corridor policy unit. We have identified under the policy four generic response take further action to improve and create new defences, several areas where defences either could be improved or new ones built. Under policy five, we could take further action to reduce flood risk by building new defences along the River Ebbw in the following areas: Crumlin, Newbridge, Abercarn, Cwmcarn (along the Cwm Carn), Crosskeys and two areas in Risca. However, the scheme along the River Ebbw in Crosskeys would not be economically feasible as cost (see below), would not offset the economic benefit. Therefore, we only trimmed our future fluvial flood outlines (further than the defences P4 generic response) in the remaining locations. This showed that these areas would benefit from new defences.

We consider that the future tidal flood risk is high. We could manage these risks by significantly increasing the height of existing defences along the right bank of the lower Ebbw close to Tredegar Park, as carried out for the P4 defences generic response. In addition to this, a new defence could be built adjacent to Maes-Glas along the left bank of lower Ebbw. We trimmed our future tidal flood outlines to demonstrate the benefits of increasing existing defences in this location.

Base case conditions (1% AEP fluvial flood event)

People at risk: Fluvial – 466 Tidal – 89	Economic risk: Fluvial – £13.5m Tidal – £703,000	Properties at risk: Fluvial – 414 Tidal – 38	Environmental sites at risk: Fluvial – No SSSIs at risk Tidal – No SSSIs at risk
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Results of the broad scale modelling (1% AEP fluvial flood event)

People at risk: Fluvial – 42 (-91%) Tidal – 2 (-98%)	Economic risk: Fluvial - £1.1m (-92%) Tidal – £46,000 (-93%)	Properties at risk Fluvial – 24 (-94%) Tidal – 1 (-97%)	Environmental sites at risk: Fluvial – No SSSIs at risk (no change) Tidal – No SSSIs at risk (no change)
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Conclusions

Cost: We currently spend approximately £53,000 per year on inspecting and maintaining our defence assets in the Ebbw Corridor policy unit. We have based our costs on a new flood wall costing £1,500 per metre and increasing existing defences costing £406 per metre. On top of the costs we estimated in policy four (in excess of £7.5m), we estimated the additional costs under policy five if new defences were built in our selected areas. However, as discussed above and in the conclusion, having weighed up the costs against the benefits, we did not select the new scheme in Crosskeys under policy five (selected areas highlighted in bold):

- **146m of new defence on the left bank of the River Ebbw in Crumlin, adjacent to Station Road, would cost approximately £219,000.**
- **381m of new defence on both the left and right banks of the River Ebbw in Newbridge, close to Bridge Street, would cost approximately £571,500.**
- **746m of new defence on the left bank of the River Ebbw and the right bank of the Nant Gwyddon in Abercarn, would cost approximately £1.1m.**
- **191m of new defence on the right bank of Cwm Carn in Cwmcarn, adjacent to Feeder Row, would cost approximately £286,500.**
- 458m of new defence on the left bank of the River Ebbw in Crosskeys, adjacent to New Park Road, would cost approximately £687,000.
- **945m of new defence on both the right and left banks of the River Ebbw in Risca, close to the Pontymister Industrial Estate, would cost approximately £1.4m.**
- **389m of new defence on both the right and left banks of the River Ebbw in Risca, close to Rivermead Way, would cost approximately £583,500.**

The new defence along the left bank of the lower Ebbw, adjacent to Maes-Glas, would cost £144,000 for a 96m stretch.

Therefore, the total indicative cost under policy five (including cost from P4 defences) is approximately £12m, including costs for pre-feasibility studies.

Conclusion: We recognise that into the future we must be aware of the potential consequences from fluvial flood events. By increasing the height of existing and building new defences we are taking more action to manage flood risks into the future. We suggest that the current and future risk in the following areas is high and the benefits that would be gained from building defences may warrant new investment and should be explored further. These areas will be taken forward in our consideration of policy five in the policy appraisal forms:

- Building a new defence along the left bank of the River Ebbw in Crumlin, adjacent to Station Road, at a cost of £219,000 would protect 9 properties and reduce economic damages by up to £418,000.
- Building a new defence along the left and right banks of the River Ebbw in Newbridge, close to Bridge Street, at a cost of £571,500 would protect 16 properties and reduce economic damages by up to £3.1m.
- Building a new defence along the left bank of the River Ebbw and the right bank of the Nant Gwyddon in Abercarn, at a cost of £1.1m would protect 38 properties and reduce economic damages by up to £1.8m.
- Building a new defence along the right bank of Cwm Carn in Cwmcarn, adjacent to Feeder Row, at a cost of £286,500 would protect 21 properties and reduce economic damages by up to £512,000.
- Building a new defence along the right and left banks of the River Ebbw in Risca, close to the Pontymister Industrial Estate, at a cost of £1.4m would protect 150 properties and reduce economic damages by up to £5.6m.
- Building a new defence along the right and left banks of the River Ebbw in Risca, close to

Rivermead Way, at a cost of £583,500 would protect 168 properties and reduce economic damages by up to £5.7m.

- Building a new tidal defence along the left bank of the lower Ebbw, adjacent to Maes-Glas, at a cost of £144,000 would protect 64 properties and reduce economic damages by up to £1.8m.

However, we recognise that reducing flood risk in the following area would not be economically feasible as the benefits would not offset the level of investment:

- Building a new defence along the left bank of the River Ebbw in Crosskeys, adjacent to New Park Road, at a cost of £687,000 would protect only 9 properties and reduce economic damages by £469,000.

Policy unit 6: Ebbw Corridor

Generic response: Policy 6 – Attenuation

Description: The creation of flow attenuation areas in the Ebbw Corridor policy unit is not feasible. Responses that deliberately promote large scale flooding are not considered as sustainable methods for reducing risk. Setting back defences within either of the main areas in this policy unit is not an option, as much of the floodplain has been developed. There is no scope for broad scale modelling under policy six for the Ebbw Corridor policy unit, so no further action has been undertaken.

Base case conditions (1% AEP fluvial flood event)

People at risk: Fluvial – 466 Tidal – 89	Economic risk: Fluvial – £13.5m Tidal – £703,000	Properties at risk: Fluvial – 414 Tidal – 38	Environmental sites at risk: Fluvial – No SSSIs at risk Tidal – No SSSIs at risk
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Results of the broad scale modelling (1% AEP fluvial flood event)

People at risk: N/A	Economic risk: N/A	Properties at risk: N/A	Environmental sites at risk: N/A
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Conclusions

Cost: N/A

Conclusion: Taking action to increase the frequency of flooding is not feasible in the Ebbw Corridor policy unit, as such, there is not scope for carrying out policy six in this policy unit. Increased frequency of flooding to make space for water would result in a very high number of people at risk and very high economic damages. Deliberately promoting flooding through schemes, which make space for water, would cause large scale community disruption.

The following table summarises the findings of the generic response modelling for policy unit six (Ebbw Corridor). The responses or combination of responses chosen for each policy will be taken forward and compared against the objectives and indicators in table 12.6.

Policy	Generic response
1	Withdraw / retreat defences and stop maintenance
2	Reduced maintenance
3	Risk cannot be managed at the same level of risk by any combination of softer options, such as reducing maintenance and balancing with local flood storage schemes.
4	We have demonstrated that increased maintenance have very little effect for reducing risk in to the future in the Ebbw Corridor policy unit. Local flood storage schemes are not feasibly in this policy unit. Therefore a response of defences alone has been chosen.
5	A combination of defences and alternative flood risk management options would not be suitable. Therefore a defences alone option has been chosen, although measures such as flood warning and evacuation procedures will be considered as well.
6	Not technically feasible in this policy unit.

Form 12.6: Screening of policy options against appraisal objectives

Policy unit name/number:		Policy unit 6: Ebbw Corridor								
N o.	Specific (appraisal) objectives	Indicators	Current baseline	Future baseline	Policy Options					
					P1 No active intervention	P2 Reduce existing actions	P3 Continue with existing actions to maintain current risk	P4 Take further action to sustain current risk	P5 Take further action to reduce current risk	P6 Take further action to increase frequency of flooding
Generic Response					Decreased conveyance Monitoring, advise & survey	Decreased conveyance Influencing and Informing Monitoring, advise & survey Studies	Increased or decreased conveyance Attenuation/retention Influencing and Informing Monitoring, advise & survey Studies	Increased or decreased conveyance Attenuation/retention Influencing and Informing Monitoring, advise & survey Studies	Increased or decreased conveyance Attenuation/retention Influencing and Informing Monitoring, advise & survey Studies	Increased or decreased conveyance Attenuation/retention Influencing and Informing Monitoring, advise & survey Studies
PEOPLE										
1.	Reduce the risk of harm to life in Risca and Bassaleg and Tredegar Park	The number of people within the 1% AEP fluvial and 0.5% AEP tidal flood extents where depths of water exceed 0.5m	There are 34 people at risk where depths exceed 0.5m during a 1% AEP fluvial flood event There are 14 people at risk where depths exceed 0.5m during a 0.5% AEP tidal flood event	There will be 2139 people at risk where depths exceed 0.5m during a 1% AEP fluvial flood event There will be 977 people at risk where depths exceed 0.5m during a 0.5% AEP tidal flood event	There would be 5776 people at risk where depths exceed 0.5m during a 1% AEP fluvial flood event There would be 991 people at risk where depths exceed 0.5m during a 0.5% AEP tidal flood event	There would be 2587 people at risk where depths exceed 0.5m during a 1% AEP fluvial flood event Tidal flood risk not considered for this policy	There would be 2139 people at risk where depths exceed 0.5m during a 1% AEP fluvial flood event There would be 977 people at risk where depths exceed 0.5m during a 0.5% AEP tidal flood event	There would be 362 people at risk where depths exceed 0.5m during a 1% AEP fluvial flood event There would be 14 people at risk where depths exceed 0.5m during a 0.5% AEP tidal flood event	There would be 13 people at risk where depths exceed 0.5m during a 1% AEP fluvial flood event There would be 2 people at risk where depths exceed 0.5m during a 0.5% AEP tidal flood event	There is no scope for carrying out policy six in this policy unit. Increased frequency of flooding to make space for water could result in a significant increase in harm to life. Deliberately flooding specific areas to make space for water

Policy unit name/number:		Policy unit 6: Ebbw Corridor								
N o.	Specific (appraisal) objectives	Indicators	Current baseline	Future baseline	Policy Options					
					P1 No active intervention	P2 Reduce existing actions	P3 Continue with existing actions to maintain current risk	P4 Take further action to sustain current risk	P5 Take further action to reduce current risk	P6 Take further action to increase frequency of flooding
		The number of properties that are at risk during the 1% AEP fluvial and 0.5% tidal flood events but not within an existing flood warning area	93 properties that are at flood risk during a 1% AEP fluvial flood event are not within an existing flood warning area 16 properties that are at flood risk during a 0.5% AEP tidal flood event are not within an existing flood warning area	261 properties that will be at flood risk during a 1% AEP fluvial flood event would not be within an existing flood warning area 34 properties that will be at flood risk during a 0.5% AEP tidal flood event would not be within an existing flood warning area	Flood warning areas would be removed under this policy and therefore all properties would not be within a flood warning area 3308 properties that would be at flood risk during a 1% AEP fluvial flood event would not be within an existing flood warning area 411 properties that would be at flood risk during a 0.5% AEP tidal flood event would not be within an existing flood warning area	270 properties that would be at flood risk during a 1% AEP fluvial flood event would not be within an existing flood warning area Tidal flood risk not considered for this policy	261 properties that would be at flood risk during a 1% AEP fluvial flood event would not be within an existing flood warning area 34 properties that would be at flood risk during a 0.5% AEP tidal flood event would not be within an existing flood warning area	104 properties that would be at flood risk during a 1% AEP fluvial flood event would not be within an existing flood warning area 16 properties that would be at flood risk during a 0.5% AEP tidal flood event would not be within an existing flood warning area	8 properties that would be at flood risk during a 1% AEP fluvial flood event would not be within an existing flood warning area No properties that would be at flood risk during a 0.5% AEP tidal flood event would not be within an existing flood warning area	would cause increase the harm to life in those areas. We have not identified any areas in the policy unit where we could do this without increasing harm to life.

Policy unit name/number:		Policy unit 6: Ebbw Corridor								
N o.	Specific (appraisal) objectives	Indicators	Current baseline	Future baseline	Policy Options					
					P1 No active intervention	P2 Reduce existing actions	P3 Continue with existing actions to maintain current risk	P4 Take further action to sustain current risk	P5 Take further action to reduce current risk	P6 Take further action to increase frequency of flooding
2.	Reduce community disruption caused by flooding in Risca and Bassaleg and Tredegar Park	The number of community assets at risk during the 1% AEP fluvial and 0.5% tidal flood events	There is 1 health service (Pontymister), 2 schools (Pontymister and Newbridge), 2 community centres (Pontymister) and 47 retail buildings at flood risk during the 1% AEP fluvial flood event There are no community assets at flood risk during the 0.5% AEP tidal flood event	There will be 4 health services (Risca, Pontymister, Crosskeys), 2 schools (Pontymister and Newbridge) 5 community centres (Pontymister, Crosskeys and Newbridge) and 136 retail buildings at flood risk during the 1% AEP fluvial flood event There will be 1 community centre (Duffryn) and 4 retail buildings at flood risk during the 0.5% AEP tidal flood event	There would be 5 health services (Risca, Pontymister), 3 schools (Pontymister and Newbridge), 1 hospital (Risca), 11 community centres (Risca, Pontymister, Crosskeys, Newbridge, Duffryn) and 149 retail buildings at flood risk during the 1% AEP fluvial flood event There would be 1 community centre (Duffryn) and 4 retail buildings at flood risk during the 0.5% AEP tidal flood event	There would be 4 health services (Risca, Pontymister) 2 schools (Pontymister, Newbridge), 6 community centres (Pontymister, Risca, Crosskeys, Newbridge) and 140 retail buildings at flood risk during the 1% AEP fluvial flood event Tidal flood risk not considered for this policy	There would be 4 health services (Risca, Pontymister, Crosskeys), 2 schools (Pontymister and Newbridge) 5 community centres (Pontymister, Crosskeys and Newbridge) and 136 retail buildings at flood risk during the 1% AEP fluvial flood event There would be 1 community centre (Duffryn) and 4 retail buildings at flood risk during the 0.5% AEP tidal flood event	There would be 1 health service (Pontymister), 1 school (Newbridge), 3 community centres (Pontymister, Newbridge) and 47 retail buildings at flood risk during the 1% AEP fluvial flood event There would be no community assets at flood risk during the 0.5% AEP tidal flood event	There would be no community assets at flood risk during the 1% AEP fluvial flood event There would be no community assets at flood risk during the 0.5% AEP tidal flood event	There is no scope for carrying out policy six in this policy unit. Increased frequency of flooding to make space for water could result in a significant increase in community disruption. Deliberately flooding specific areas to make space for water would cause large-scale community disruption in those areas. We have not identified any areas in the policy unit where we could do this without increasing community

Policy unit name/number:		Policy unit 6: Ebbw Corridor								
N o.	Specific (appraisal) objectives	Indicators	Current baseline	Future baseline	Policy Options					
					P1 No active intervention	P2 Reduce existing actions	P3 Continue with existing actions to maintain current risk	P4 Take further action to sustain current risk	P5 Take further action to reduce current risk	P6 Take further action to increase frequency of flooding
		<p>The number of residential properties at flood risk during the 1% AEP fluvial and 0.5% tidal flood events</p>	<p>There are 313 residential properties at flood risk during the 1% AEP fluvial flood event</p> <p>There are 38 residential properties at flood risk during the 0.5% AEP tidal flood event</p>	<p>There will be 1,626 residential properties at flood risk during the 1% AEP fluvial flood event</p> <p>There will be 402 residential properties at flood risk during the 0.5% AEP tidal flood event</p>	<p>There would be 2,998 residential properties at flood risk during the 1% AEP fluvial flood event</p> <p>There would be 403 residential properties at flood risk during the 0.5% AEP tidal flood event</p>	<p>There would be 1,904 residential properties at flood risk during the 1% AEP fluvial flood event</p> <p>Tidal flood risk not considered for this policy</p>	<p>There would be 1,626 residential properties at flood risk during the 1% AEP fluvial flood event</p> <p>There would be 402 residential properties at flood risk during the 0.5% AEP tidal flood event</p>	<p>There would be 322 residential properties at flood risk during the 1% AEP fluvial flood event</p> <p>There would be 38 residential properties at flood risk during the 0.5% AEP tidal flood event</p>	<p>There would be 21 residential properties at flood risk during the 1% AEP fluvial flood event</p> <p>There would be 1 residential property at flood risk during the 0.5% AEP tidal flood event</p>	<p>disruption.</p>
		<p>The duration of flooding (<1 day, 1 day to 5 days, > 5 days)</p>	<p>The duration of flooding is between one to five days for the 1% AEP fluvial flood event</p> <p>The duration of flooding is greater than 5 days for the 0.5% AEP tidal flood event</p>	<p>The duration of flooding will be between one to five days for the 1% AEP fluvial flood event</p> <p>The duration of flooding will be greater than 5 days for the 0.5% AEP tidal flood event</p>	<p>The duration of flooding would be between one to five days for the 1% AEP fluvial flood event</p> <p>The duration of flooding would be greater than 5 days for the 0.5% AEP tidal flood event</p>	<p>The duration of flooding would be between one to five days for the 1% AEP fluvial flood event</p> <p>Tidal flood risk not considered for this policy</p>	<p>The duration of flooding would be between one to five days for the 1% AEP fluvial flood event</p> <p>The duration of flooding would be greater than 5 days for the 0.5% AEP tidal flood event</p>	<p>The duration of flooding would be between one to five days for the 1% AEP fluvial flood event</p> <p>The duration of flooding would be greater than 5 days for the 0.5% AEP tidal flood event</p>	<p>The duration of flooding would be between one to five days for the 1% AEP fluvial flood event</p> <p>The duration of flooding would be greater than 5 days for the 0.5% AEP tidal flood event</p>	

Policy unit name/number:		Policy unit 6: Ebbw Corridor								
N o.	Specific (appraisal) objectives	Indicators	Current baseline	Future baseline	Policy Options					
					P1 No active intervention	P2 Reduce existing actions	P3 Continue with existing actions to maintain current risk	P4 Take further action to sustain current risk	P5 Take further action to reduce current risk	P6 Take further action to increase frequency of flooding
		The area of flooding during the 1% AEP fluvial and 0.5% tidal flood events where depth of flooding exceeds 0.5 metres	The flooded area where depths exceed 0.5 metres is 1.06km ² (Risca) during a 1% AEP fluvial flood event The flooded area where depths exceed 0.5 metres is 0.2km ² (Duffryn) during a 0.5% AEP tidal flood event	The flooded area where depths exceed 0.5 metres will be 2.43km ² (Risca) during a 1% AEP fluvial flood event The flooded area where depths exceed 0.5 metres will be 0.67km ² (Duffryn) during a 0.5% AEP tidal flood event	The flooded area where depths exceed 0.5 metres would be 4.19km ² (Risca) during a 1% AEP fluvial flood event The flooded area where depths exceed 0.5 metres would be 0.71km ² (Duffryn) during a 0.5% AEP tidal flood event	The flooded area where depths exceed 0.5 metres would be 2.72km ² (Risca) during a 1% AEP fluvial flood event Tidal flood risk not considered for this policy	The flooded area where depths exceed 0.5 metres would be 2.43km ² (Risca) during a 1% AEP fluvial flood event The flooded area where depths exceed 0.5 metres would be 0.67km ² (Duffryn) during a 0.5% AEP tidal flood event	The flooded area where depths exceed 0.5 metres would be 1.34km ² (Risca) during a 1% AEP fluvial flood event The flooded area where depths exceed 0.5 metres would be 0.2km ² (Duffryn) during a 0.5% AEP tidal flood event	The flooded area where depths exceed 0.5 metres would be 1.1km ² (Risca) during a 1% AEP fluvial flood event The flooded area where depths exceed 0.5 metres would be 0.19km ² (Duffryn) during a 0.5% AEP tidal flood event	
ECONOMICS										
3.	Reduce flood risk to critical transport routes and critical assets in Newbridge, Bassaleg and Tredegar Park and Risca	The number, length and type of critical asset (police, ambulance, fire station), infrastructure (STW, WTW, gas, electricity, rail or major roads) at risk during the 1% AEP fluvial and 0.5% tidal flood events	There is 4 electricity stations (Newbridge, Abercarn and Risca) and 0.5km of the A467 at flood risk during the 1% AEP fluvial flood event There is 1 landfill site (Newport) and no critical transport routes at flood risk during the 0.5% AEP tidal flood event	There will be 1 police station (Pontymister), 1 ambulance station (Bassaleg), 8 electricity stations (Newbridge, Abercarn and Risca), 1 COMAH site, 1km of the railway in Crumlin /Newbridge, 1.7km of the A467 and 0.8km of the A48 at flood risk during the 1% AEP fluvial flood event There will be 1	There would be 3 police stations (Duffryn, Pontymister), 1 fire station (Risca), 1 ambulance station (Bassaleg), 12 electricity stations (Newbridge, Abercarn, Risca, Crosskeys), 1 COMAH site, 1 landfill site, 2.2km of the railway in Crumlin /Newbridge, 2.5km of the A467 and 1.4km of the A48 at flood risk during the	There would be 1 police station (Pontymister), 1 fire station (Risca), 1 ambulance station (Bassaleg), 9 electricity stations (Newbridge, Abercarn, Risca, Crosskeys), 1 COMAH site, 2.2km of the railway in Crumlin /Newbridge, 2.3km of the A467 and 1km of the A48 at flood risk during the 1% AEP fluvial flood event	There would be 1 police station (Pontymister), 1 ambulance station (Bassaleg), 8 electricity stations (Newbridge, Abercarn and Risca), 1 COMAH site, 1km of the railway in Crumlin /Newbridge, 1.7km of the A467 and 0.8km of the A48 at flood risk during the 1% AEP fluvial flood event There would be 1	There would be 5 electricity stations (Newbridge, Abercarn, Risca), 0.8km of the railway in Crumlin /Newbridge and 0.9km of the A467 at flood risk during the 1% AEP fluvial flood event There would be 1 landfill site (Newport) and no critical transport routes at flood risk during the 0.5% AEP tidal flood	There would be 2 electricity stations (Abercarn, Risca) and 0.7km of the railway in Crumlin /Newbridge at flood risk during the 1% AEP fluvial flood event There would be 1 landfill site (Newport) and no critical transport routes	There is no scope for carrying out policy six in this policy unit. Increased frequency of flooding to make space for water could result in a significant increase in risk to critical assets and critical transport routes. Deliberately flooding specific areas to make space for water would cause large-scale community

Policy unit name/number:		Policy unit 6: Ebbw Corridor								
N o.	Specific (appraisal) objectives	Indicators	Current baseline	Future baseline	Policy Options					
					P1 No active intervention	P2 Reduce existing actions	P3 Continue with existing actions to maintain current risk	P4 Take further action to sustain current risk	P5 Take further action to reduce current risk	P6 Take further action to increase frequency of flooding
				police station (Duffryn), 1 electricity station (Duffryn), 1 landfill site (Newport) and no critical transport routes at flood risk during the 0.5% AEP tidal flood event	1% AEP fluvial flood event There would be 1 police station (Duffryn), 1 electricity station (Duffryn), 1 landfill site (Newport) and no critical transport routes at flood risk during the 0.5% AEP tidal flood event	Tidal flood risk not considered for this policy	police station (Duffryn), 1 electricity station (Duffryn), 1 landfill site (Newport) and no critical transport routes at flood risk during the 0.5% AEP tidal flood event	event	at flood risk during the 0.5% AEP tidal flood event	disruption in those areas. We have not identified any areas in the policy unit where we could do this without increasing risk to critical assets and critical transport routes
4.	Reduce economic damages caused by flooding in Risca and Bassaleg and Tredegar Park	The total cost of property economic damages during the 1% AEP fluvial and 0.5% tidal flood events	The 1% AEP fluvial flood economic property damages are £13.5m The 0.5% AEP tidal flood economic property damages are £703,000	The 1% AEP fluvial flood economic property damages will be £80.3m The 0.5% AEP tidal flood economic property damages will be £21.2m	The 1% AEP fluvial flood economic property damages would be £171.9m The 0.5% AEP tidal flood economic property damages would be £25.6m	The 1% AEP fluvial flood economic property damages would be £97.9m Tidal flood risk not considered for this policy	The 1% AEP fluvial flood economic property damages will be £80.3m The 0.5% AEP tidal flood economic property damages would be £21.2m	The 1% AEP fluvial flood economic property damages would be £18.1m The 0.5% AEP tidal flood economic property damages would be £703,000	The 1% AEP fluvial flood economic property damages would be £1.1m The 0.5% AEP tidal flood economic property damages would be £46,000	There is no scope for carrying out policy six in this policy unit. Increased frequency of flooding to make space for water could result in a significant increase in economic damages. Deliberately flooding specific

Policy unit name/number:		Policy unit 6: Ebbw Corridor								
N o.	Specific (appraisal) objectives	Indicators	Current baseline	Future baseline	Policy Options					
					P1 No active intervention	P2 Reduce existing actions	P3 Continue with existing actions to maintain current risk	P4 Take further action to sustain current risk	P5 Take further action to reduce current risk	P6 Take further action to increase frequency of flooding
		The total cost of agricultural damages during the 1% AEP fluvial flood extent and/or the 0.5% AEP tidal flood extent	The 1% AEP fluvial flood agricultural damages are £174,000 The 0.5% AEP tidal flood agricultural damages are £24,000	The 1% AEP fluvial flood agricultural damages will be £377,000 The 0.5% AEP tidal flood agricultural damages will be £96,000	The 1% AEP fluvial flood agricultural damages would be £572,000 The 0.5% AEP tidal flood agricultural damages would be £101,000	The 1% AEP fluvial flood agricultural damages would be £409,000 Tidal flood risk not considered for this policy	The 1% AEP fluvial flood agricultural damages will be £377,000 The 0.5% AEP tidal flood agricultural damages would be £96,000	The 1% AEP fluvial flood agricultural damages would be £197,000 The 0.5% AEP tidal flood agricultural damages would be £24,000	The 1% AEP fluvial flood agricultural damages would be £158,000 The 0.5% AEP tidal flood agricultural damages would be £23,000	areas to make space for water would cause large-scale community disruption in those areas. We have not identified any areas in the policy unit where we could do this without increasing risk to critical assets and critical transport routes
5.	Optimise the level of Flood Risk Management expenditure. Ensure investment is proportional to the risks	The indicative costs of our flood risk management actions	We currently spend approximately £53,000 per year on maintenance and operations	We will spend more than we currently spend on maintenance and operations as risk is going to increase in the future in the Eastern Valleys, placing more demand on our resources and expenditure.	No construction or maintenance costs associated with undertaking this policy but it would be necessary to devise a strategy, and withdraw over a number of years, monitoring the situation once this had been done.	We would expect costs to reduce by half to £26,500 per year. However, the risks would significantly increase	We would continue to spend £53,000 per year on maintenance and operations. However, the risks would significantly increase	Indicative costs to improve and build new defences would cost approximately £7.8 million. However, there would still be significant fluvial flood risk. Maintenance costs will increase as a result.	Indicative costs to improve and build new defences would cost approximately £12 million. Both fluvial and tidal flood risk would be significantly reduced. Maintenance costs will increase as a result.	There is no scope for carrying out policy six in this policy unit. Constructing formal flood storage areas would cost many millions of pounds. Deliberately promoting flooding through schemes that make space for water would cause large scale community disruption to this policy unit and the Eastern Valleys as a whole

Policy unit name/number:		Policy unit 6: Ebbw Corridor								
N o.	Specific (appraisal) objectives	Indicators	Current baseline	Future baseline	Policy Options					
					P1 No active intervention	P2 Reduce existing actions	P3 Continue with existing actions to maintain current risk	P4 Take further action to sustain current risk	P5 Take further action to reduce current risk	P6 Take further action to increase frequency of flooding
ENVIRONMENT										
6.	Ensure no deterioration of designated international and national nature conservation sites	The percentage area of each SSSI affected during the 1% AEP fluvial and 0.5% AEP tidal flood events	There are no SSSIs at flood risk during a 1% AEP fluvial flood event or a 0.5% AEP tidal flood event	There will be no SSSIs at flood risk during the 1% AEP fluvial flood event or a 0.5% AEP tidal flood event	There would be no SSSIs at flood risk during the 1% AEP fluvial flood event or a 0.5% AEP tidal flood event	There would be no SSSIs at flood risk during the 1% AEP fluvial flood event Tidal flood risk not considered for this policy	There would be no SSSIs at flood risk during the 1% AEP fluvial flood event or a 0.5% AEP tidal flood event	There would be no SSSIs at flood risk during the 1% AEP fluvial flood event or a 0.5% AEP tidal flood event	There would be no SSSIs at flood risk during the 1% AEP fluvial flood event or a 0.5% AEP tidal flood event	There is no scope for carrying out policy six in this policy unit. Increased frequency of flooding to make space for water would result in a higher percentage area of risk to designated sites.
7.	Protect and improve habitats and species diversity, particularly BAP habitats and those relying on freshwater	BAP habitats and species at flood risk during the 1% AEP fluvial and 0.5% AEP tidal flood events	The following BAP habitats are at flood risk during a 1% AEP fluvial flood event and a 0.5% AEP tidal flood event: • Coastal and	The following BAP habitats are likely to experience more frequent and longer duration of flooding in the future: • Coastal and floodplain	The following BAP habitats are likely to experience more frequent and longer duration flooding as a result of Policy 1: • Coastal and floodplain	The following BAP habitats are likely to experience more frequent and longer duration flooding as a result of Policy 2: • Coastal and floodplain	The following BAP habitats are likely to experience more frequent and longer duration flooding as a result of Policy 3: • Coastal and floodplain	The following BAP habitats are likely to be at risk to the same extent as under current baseline conditions, as a result of Policy 4:	The following BAP habitats are likely to experience less frequent and shorter duration flooding as a result of Policy 5:	There is no scope for carrying out policy six in this policy unit. Increased frequency of flooding to make space for water

Policy unit name/number:		Policy unit 6: Ebbw Corridor								
N o.	Specific (appraisal) objectives	Indicators	Current baseline	Future baseline	Policy Options					
					P1 No active intervention	P2 Reduce existing actions	P3 Continue with existing actions to maintain current risk	P4 Take further action to sustain current risk	P5 Take further action to reduce current risk	P6 Take further action to increase frequency of flooding
			floodplain grazing marsh <ul style="list-style-type: none"> Coastal saltmarsh Mudflats Ponds Reedbeds Rhos pastures Rivers, streams and floodplains Standing open water and canals <p>The following BAP species are at flood risk during a 1% AEP fluvial flood event and a 0.5% AEP tidal flood event:</p> <ul style="list-style-type: none"> Allis Shad Brown Trout Double Line Moth Great Crested Newt Otter Reed Bunting River Jelly Lichen Spruce's Brittle-moss Twaite Shad Water Vole 	grazing marsh <ul style="list-style-type: none"> Coastal saltmarsh Mudflats Ponds Reedbeds Rhos pastures Rivers, streams and floodplains Standing open water and canals <p>The following BAP species are likely to experience more frequent and longer duration of flooding in the future:</p> <ul style="list-style-type: none"> Allis Shad Brown Trout Double Line Moth Great Crested Newt Otter Reed Bunting River Jelly Lichen Spruce's Brittle-moss Twaite Shad Water Vole 	grazing marsh <ul style="list-style-type: none"> Coastal saltmarsh Mudflats Ponds Reedbeds Rhos pastures Rivers, streams and floodplains Standing open water and canals <p>The following BAP species are likely to experience more frequent and longer duration flooding as a result of Policy 1:</p> <ul style="list-style-type: none"> Allis Shad Brown Trout Double Line Moth Great Crested Newt Otter Reed Bunting River Jelly Lichen Spruce's Brittle-moss Twaite Shad Water Vole 	grazing marsh <ul style="list-style-type: none"> Coastal saltmarsh Mudflats Ponds Reedbeds Rhos pastures Rivers, streams and floodplains Standing open water and canals <p>The following BAP species are likely to experience more frequent and longer duration flooding as a result of Policy 2:</p> <ul style="list-style-type: none"> Allis Shad Brown Trout Double Line Moth Great Crested Newt Otter Reed Bunting River Jelly Lichen Spruce's Brittle-moss Twaite Shad Water Vole <p>Tidal flood risk not considered for this policy.</p>	grazing marsh <ul style="list-style-type: none"> Coastal saltmarsh Mudflats Ponds Reedbeds Rhos pastures Rivers, streams and floodplains Standing open water and canals <p>The following BAP species are likely to experience more frequent and longer duration flooding as a result of Policy 3:</p> <ul style="list-style-type: none"> Allis Shad Brown Trout Double Line Moth Great Crested Newt Otter Reed Bunting River Jelly Lichen Spruce's Brittle-moss Twaite Shad Water Vole 	Coastal and floodplain grazing marsh <ul style="list-style-type: none"> Coastal saltmarsh Mudflats Ponds Reedbeds Rhos pastures Rivers, streams and floodplains Standing open water and canals <p>The following BAP species are likely to be at risk to the same extent as under current baseline conditions, as a result of Policy 4:</p> <ul style="list-style-type: none"> Allis Shad Brown Trout Double Line Moth Great Crested Newt Otter Reed Bunting River Jelly Lichen Spruce's Brittle-moss Twaite Shad Water Vole 	Coastal and floodplain grazing marsh <ul style="list-style-type: none"> Coastal saltmarsh Mudflats Ponds Reedbeds Rhos pastures Rivers, streams and floodplains Standing open water and canals <p>The following BAP species are likely to experience less frequent and shorter duration flooding as a result of Policy 5:</p> <ul style="list-style-type: none"> Allis Shad Brown Trout Double Line Moth Great Crested Newt Otter Reed Bunting River Jelly Lichen Spruce's Brittle-moss Twaite Shad 	would result in an increased number of BAP species being at risk from flooding. Deliberately promoting flooding through schemes that make space for water would cause large scale damage to BAP habitats and species in the Ebbw Corridor and the Eastern Valleys as a whole

Policy unit name/number:		Policy unit 6: Ebbw Corridor								
N o.	Specific (appraisal) objectives	Indicators	Current baseline	Future baseline	Policy Options					
					P1 No active intervention	P2 Reduce existing actions	P3 Continue with existing actions to maintain current risk	P4 Take further action to sustain current risk	P5 Take further action to reduce current risk	P6 Take further action to increase frequency of flooding
8.	Manage flood risk to Listed Buildings in Risca, Crumlin and Abercarn and ensure sites which are currently 'safe' do not become at risk of flooding.	The number of Listed Buildings within the 1% AEP fluvial and 0.5% AEP tidal flood extents	There are 10 Listed Buildings at flood risk during the 1% AEP fluvial flood event There are no listed buildings at flood risk during a 0.5% AEP tidal flood event	There will be 14 listed buildings at flood risk during the 1% AEP fluvial flood event There will be 15 listed buildings at flood risk during a 0.5% AEP tidal flood event	There would be 30 listed buildings at flood risk during the 1% AEP fluvial flood event There would be 15 listed buildings at flood risk during the 0.5% AEP tidal flood event	There would be 14 listed buildings at flood risk during the 1% AEP fluvial flood event Tidal flood risk not considered for this policy	There would be 14 listed buildings at flood risk during the 1% AEP fluvial flood event There would be 15 listed buildings at flood risk during the 0.5% AEP tidal flood event	There would be 5 listed buildings at flood risk during the 1% AEP fluvial flood event. No listed buildings would be at flood risk from a 0.5% AEP tidal flood event	<ul style="list-style-type: none"> Water Vole There would be 5 listed buildings at flood risk during the 1% AEP fluvial flood event. No listed buildings would be at flood risk from a 0.5% AEP tidal flood event	There is no scope for carrying out policy six in this policy unit. Deliberately promoting flooding through schemes that make space for water would increase the number of historic assets at risk.

Form 12.7: Summary of the relative overall losses (including flood risk management costs) and gains (including flood alleviation benefits), thus demonstrating the rationale behind selecting the preferred option

Policy unit name/number:	Policy unit 6: Ebbw Corridor		
Policy options	Losses	Gains	Preferred policy option
Policy option P1			
Environmental	<p>MEDIUM- The number of listed buildings at flood risk from a 1% AEP fluvial flood event increases from 10 to 30.</p> <p>MEDIUM- The number of listed buildings at flood risk from a 0.5% AEP tidal flood event increases from 0 to 15.</p> <p>LOW- More frequent and longer duration flooding may adversely affect habitats intolerant of waterlogging. Impacts will be particularly severe if inundation is from low quality water or if freshwater habitats are flooded by salt water.</p> <p>LOW- Increase in BAP species at risk of flooding from a 1% AEP fluvial flood event.</p>	<p>LOW+ More frequent and longer duration flooding may enhance water-dependent habitats.</p> <p>LOW+ Stopping river maintenance and not maintaining defences may benefit BAP species through reduced disturbance. In particular, Allis and Twaite Shad, Brown Trout, Otter, Reed Bunting and Water Vole are likely to benefit.</p>	Not preferred option – risk to people, property and the economy would remain very high and there would be very significant and high increases in risks in the future
Social	<p>HIGH- 6,890 additional people at risk from flooding in the 1% AEP fluvial flood event. 905 additional people at risk from flooding in the 0.5% AEP tidal flood event.</p> <p>HIGH- 5,742 additional people located within flood risk areas where flood depths exceed 0.5 metres in the 1% AEP fluvial flood event. 977 additional people located within flood risk areas where flood depths exceed 0.5 metres in the 0.5% AEP tidal flood event.</p> <p>HIGH- 2,685 additional residential properties at risk from flooding in the 1% AEP fluvial flood event. 365 additional residential properties at risk from flooding in the 0.5% AEP tidal flood event.</p> <p>HIGH- 415 additional properties would not be within an existing flood warning area in the 1% AEP fluvial flood event. 18 additional properties would not be within an existing flood warning area in the 0.5% AEP tidal flood event.</p> <p>HIGH- 4 additional health services, 1 school, 1 hospital, 9 community centres and 102 retail buildings would be at risk from flooding in the 1% AEP fluvial flood event. 1 additional community centre and 4 retail buildings would be at risk from flooding in the 0.5% AEP tidal flood event.</p> <p>HIGH- An additional 3.13km² of land where depths exceed 0.5 metres at risk from flooding in the 1% AEP fluvial flood event. An additional 0.51km² of land where depths exceed 0.5 metres at risk from flooding in the 0.5% AEP tidal flood event.</p>		

Policy unit name/number:	Policy unit 6: Ebbw Corridor		
Policy options	Losses	Gains	Preferred policy option
Economic	<p>HIGH- £158.4m increase in economic damages to properties in the 1% AEP fluvial flood event. £24.9m increase in economic damages to properties in the 0.5% AEP tidal flood event.</p> <p>HIGH- 3 additional police stations, 1 fire station, 1 ambulance station, 8 electricity stations, 1 COMAH site, 1 landfill site, 2.2km of railway, 2km of the A467 and 1.4km of the A48 would be at risk from flooding in the 1% AEP fluvial flood event. 1 additional police station and 1 electricity station would be at risk from flooding in the 0.5% AEP tidal flood event.</p> <p>LOW - £398,000 increase in agricultural damages in the 1% AEP fluvial flood event. £77,000 increase in agricultural damages in the 0.5% AEP tidal flood event.</p>	<p>MEDIUM+ - £53,000 ASM saving due to stopping maintenance activities</p>	
Policy option P2			
Environmental	<p>LOW- More frequent and longer duration flooding may adversely affect habitats intolerant of waterlogging. Impacts will be particularly severe if inundation is from low quality water or if freshwater habitats are flooded by salt water.</p> <p>LOW- Increase in BAP species at risk of flooding from a 1% AEP fluvial flood event.</p> <p>LOW- The number of listed buildings at flood risk from a 1% AEP fluvial flood event increases from 10 to 14.</p>	<p>LOW+ More frequent and longer duration flooding may enhance water-dependent habitats.</p> <p>LOW+ Reduced maintenance may benefit BAP species through reduced disturbance. In particular, Allis and Twaite Shad, Brown Trout, Otter, Reed Bunting and Water Vole are likely to benefit.</p>	Not preferred option – reducing flood risk management in any areas of the Ebbw Corridor policy unit would result in high increases in risk to people, property and the economy.
Social	<p>HIGH- 3,278 additional people at risk from flooding in the 1% AEP fluvial flood event.</p> <p>HIGH- 2,553 additional people located within flood risk areas where flood depths exceed 0.5 metres in the 1% AEP fluvial flood event.</p> <p>HIGH- 1,591 additional residential properties at risk from flooding in the 1% AEP fluvial flood event.</p> <p>MEDIUM- 177 additional properties would not be within an existing flood warning area in the 1% AEP fluvial flood event.</p> <p>MEDIUM- 3 additional health services, 4 community centres and 93 retail buildings would be at risk from flooding in the 1% AEP fluvial flood event.</p> <p>MEDIUM- An additional 1.66km² of land where depths exceed 0.5 metres at risk from flooding in the 1% AEP fluvial flood event.</p>		

Policy unit name/number:	Policy unit 6: Ebbw Corridor		
Policy options	Losses	Gains	Preferred policy option
Economic	<p>HIGH- £84.4m increase in economic damages to properties in the 1% AEP fluvial flood event.</p> <p>HIGH- 1 additional police station, 1 fire station, 1 ambulance station, 5 electricity stations, 1 COMAH site, 2.2km of railway, 1.8km of the A467 and 1km of the A48 would be at risk from flooding in the 1% AEP fluvial flood event.</p> <p>MEDIUM- £235,000 increase in agricultural damages in the 1% AEP fluvial flood event.</p>	<p>LOW+ £26,500 ASM saving due to reducing maintenance activities</p>	
Policy option P3			
Environmental	<p>MEDIUM- The number of listed buildings at flood risk from a 0.5% AEP tidal flood event increases from 0 to 15.</p> <p>LOW- More frequent and longer duration flooding may adversely affect habitats intolerant of waterlogging. Impacts will be particularly severe if inundation is from low quality water or if freshwater habitats are flooded by salt water.</p> <p>LOW- Increase in BAP species at risk of flooding from a 1% AEP fluvial flood event.</p> <p>LOW- The number of listed buildings at flood risk from a 1% AEP fluvial flood event increases from 10 to 14.</p>	<p>LOW+ More frequent and longer duration flooding may enhance water-dependent habitats.</p>	<p>Not preferred option – maintaining our current level of management is not a sustainable option in this policy unit. Risk to people, property and the economy would significantly increase in the future under this option.</p>

Policy unit name/number:	Policy unit 6: Ebbw Corridor		
Policy options	Losses	Gains	Preferred policy option
Social	<p>HIGH- 2,630 additional people at risk from flooding in the 1% AEP fluvial flood event. 902 additional people at risk from flooding in the 0.5% AEP tidal flood event.</p> <p>HIGH- 2,105 additional people located within flood risk areas where flood depths exceed 0.5 metres in the 1% AEP fluvial flood event. 963 additional people located within flood risk areas where flood depths exceed 0.5 metres in the 0.5% AEP tidal flood event.</p> <p>HIGH- 1,313 additional residential properties at risk from flooding in the 1% AEP fluvial flood event. 364 additional residential properties at risk from flooding in the 0.5% AEP tidal flood event.</p> <p>MEDIUM- 168 additional properties would not be within an existing flood warning area in the 1% AEP fluvial flood event. 18 additional properties would not be within an existing flood warning area in the 0.5% AEP tidal flood event.</p> <p>MEDIUM- 3 additional health services, 3 community centres and 89 retail buildings would be at risk from flooding in the 1% AEP fluvial flood event. 1 additional community centre and 4 retail buildings would be at risk from flooding in the 0.5% AEP tidal flood event.</p> <p>MEDIUM- An additional 1.37km² of land where depths exceed 0.5 metres at risk from flooding in the 1% AEP fluvial flood event. An additional 0.47km² of land where depths exceed 0.5 metres at risk from flooding in the 0.5% AEP tidal flood event.</p>		
Economic	<p>HIGH- £66.8m increase in economic damages to properties in the 1% AEP fluvial flood event. £20.5m increase in economic damages to properties in the 0.5% AEP tidal flood event.</p> <p>MEDIUM- 1 additional police station, 1 ambulance station, 4 electricity stations, 1 COMAH site, 1km of railway, 1.2km of the A467 and 0.8km of the A48 would be at risk from flooding in the 1% AEP fluvial flood event. 1 additional police station and 1 electricity station would be at risk from flooding in the 0.5% AEP tidal flood event.</p> <p>MEDIUM- £203,000 increase in agricultural damages in the 1% AEP fluvial flood event. £72,000 increase in agricultural damages in the 0.5% AEP tidal flood event.</p>	NEUTRAL= No increase in ASM as we would continue to maintain at the current level.	
Policy option P4			

Policy unit name/number:	Policy unit 6: Ebbw Corridor		
Policy options	Losses	Gains	Preferred policy option
Environmental	<p>NEUTRAL = No change in the frequency or duration of flooding to BAP habitats or species.</p> <p>NEUTRAL= No listed buildings at flood risk from a 0.5% AEP tidal flood event.</p> <p>MEDIUM- Delivery of CFMP policy to sustain current flood risk may reduce the quality and quantity of the BAP habitat and species within the policy unit. Rivers, streams and floodplains, Brown Trout, Allis and Twaite Shad, Otter and Water Vole are likely to be particularly affected.</p>	<p>NEUTRAL = No change in the frequency or duration of flooding to BAP habitats or species.</p> <p>NEUTRAL= No listed buildings at flood risk from a 0.5% AEP tidal flood event.</p> <p>LOW+ Decrease in the number of listed buildings affected by a 1% AEP fluvial flood event. 5 listed buildings will benefit from increased protection from fluvial flooding, reducing the number at flood risk from a 1% AEP event from 10 to 5.</p>	<p>✓ Take further action to sustain current risk</p> <p>Although we will still be accepting some flood risk under this policy, it greatly reduces future flood risk, both fluvial and tidal.</p>
Social	<p>LOW- 37 additional people at risk from flooding in the 1% AEP fluvial flood event. No additional people at risk from flooding in the 0.5% AEP tidal flood event.</p> <p>MEDIUM- 328 additional people located within flood risk areas where flood depths exceed 0.5 metres in the 1% AEP fluvial flood event. No additional people located within flood risk areas where flood depths exceed 0.5 metres in the 0.5% AEP tidal flood event.</p> <p>LOW- 9 additional residential properties at risk from flooding in the 1% AEP fluvial flood event. No additional residential properties at risk from flooding in the 0.5% AEP tidal flood event.</p> <p>LOW- 11 additional properties would not be within an existing flood warning area in the 1% AEP fluvial flood event. No change in number of properties not within an existing flood warning area in the 0.5% AEP tidal flood event.</p> <p>NEUTRAL= 1 additional community centre and 1 LESS school would be at risk from flooding in the 1% AEP fluvial flood event. No additional community assets would be at risk from flooding in the 0.5% AEP tidal flood event.</p> <p>MEDIUM- An additional 0.28km² of land where depths exceed 0.5 metres at risk from flooding in the 1% AEP fluvial flood event. There would be no additional land where depths exceed 0.5 metres at risk from flooding in the 0.5% AEP tidal flood event.</p>		

Policy unit name/number:	Policy unit 6: Ebbw Corridor		
Policy options	Losses	Gains	Preferred policy option
Economic	<p>MEDIUM- £4.6m increase in economic damages to properties in the 1% AEP fluvial flood event. No increase in economic damages to properties in the 0.5% AEP tidal flood event.</p> <p>LOW- 1 additional electricity station, 0.8km of railway and 0.4km of the A467 would be at risk from flooding in the 1% AEP fluvial flood event. No additional critical assets would be at risk from flooding in the 0.5% AEP tidal flood event.</p> <p>LOW- £23,000 increase in agricultural damages in the 1% AEP fluvial flood event. No increase in agricultural damages in the 0.5% AEP tidal flood event.</p>		
Policy option P5			
Environmental	<p>NEUTRAL= No listed buildings at flood risk from a 0.5% AEP tidal flood event.</p> <p>MEDIUM- Delivery of CFMP policy to reduce current flood risk may reduce the quality and quantity of the BAP habitat and species within the policy unit. Rivers, streams and floodplains, Brown Trout, Allis and Twaite Shad, Otter and Water Vole are likely to be particularly affected.</p> <p>LOW- Less frequent and shorter duration flooding of BAP habitats may adversely affect habitats dependent on waterlogging</p>	<p>NEUTRAL= No listed buildings at flood risk from a 0.5% AEP tidal flood event.</p> <p>LOW+ Decrease in the number of listed buildings affected by a 1% AEP fluvial flood event. 5 listed buildings will benefit from increased protection from fluvial flooding, reducing the number at flood risk from a 1% AEP event from 10 to 5.</p> <p>LOW+ Less frequent and shorter duration flooding of BAP habitats will benefit BAP habitats intolerant of waterlogging.</p>	Not preferred option – although flood risk will be greatly reduced both now and into the future, the high economic costs for building new defences is probably unfeasible in this policy unit.

Policy unit name/number:	Policy unit 6: Ebbw Corridor		
Policy options	Losses	Gains	Preferred policy option
Social	<p>LOW- An additional 0.04km² of land where depths exceed 0.5 metres at risk from flooding in the 1% AEP fluvial flood event. A decrease of 0.01 km² of land where depths exceed 0.5 metres at risk from flooding in the 0.5% AEP tidal flood event.</p>	<p>HIGH+ 42 people (-424) at risk from flooding in the 1% AEP fluvial flood event. 2 people (-87) at risk from flooding in the 0.5% AEP tidal flood event.</p> <p>MEDIUM+ 13 people (-21) located within flood risk areas where flood depths exceed 0.5 metres in the 1% AEP fluvial flood event. 2 people (-12) located within flood risk areas where flood depths exceed 0.5 metres in the 0.5% AEP tidal flood event.</p> <p>MEDIUM+ 8 properties (-85) would not be within an existing flood warning area in the 1% AEP fluvial flood event. No properties (-16) would not be within an existing flood warning area in the 0.5% AEP tidal flood event.</p> <p>MEDIUM+ 21 residential properties (-292) at risk from flooding in the 1% AEP fluvial flood event. 1 residential property (-37) at risk from flooding in the 0.5% AEP tidal flood event.</p> <p>HIGH+ No community assets at risk from flooding in the 1% AEP fluvial flood event. No community assets at risk from flooding in the 0.5% AEP tidal flood event.</p>	
Economic		<p>HIGH+ £1.1m economic damages to properties (-£12.4m) in the 1% AEP fluvial flood event. £46,000 economic damages to properties (-£657,000) in the 0.5% AEP tidal flood event.</p> <p>LOW+ 2 electricity stations (-2) and 0.7km of the railway (+0.7km) at risk from flooding (-0.5km of the A467) in the 1% AEP fluvial flood event. No critical assets at risk from flooding in the 0.5% AEP tidal flood event.</p> <p>LOW+ £158,000 economic agricultural damages (-£16,000) in the 1% AEP fluvial flood event. £23,000 economic agricultural damages (-£1,000) in the 0.5% AEP tidal flood event.</p>	
Policy option P6			

Policy unit name/number:	Policy unit 6: Ebbw Corridor		
Policy options	Losses	Gains	Preferred policy option
Environmental	There is no scope for carrying out policy six in this policy unit. Increased frequency of flooding to make space for water would result in a very high number of people at risk and very high economic damages. Deliberately promoting flooding through schemes that make space for water would cause large-scale community disruption to the Ebbw Corridor and the Eastern Valleys as a whole.	There is no scope for carrying out policy six in this policy unit. Increased frequency of flooding to make space for water would result in a very high number of people at risk and very high economic damages. Deliberately promoting flooding through schemes that make space for water would cause large-scale community disruption to the Ebbw Corridor and the Eastern Valleys as a whole.	Not preferred option – there is no scope for carrying out policy six in this policy unit. There is very limited opportunity for increasing the frequency of flooding as a flood risk management option within this policy unit.
Social			
Economic			

Key

HIGH:	<p>High negative</p> <p>A policy has a 'high negative' effect where it could contribute to a social, economic or environmental objective in a significantly negative way.</p> <p>A 'high negative' effect could be:</p> <ul style="list-style-type: none"> (i) a very large increase in current flood risk; (ii) very large projected increases in flood risk under future conditions, and/or; (iii) significant additional social, economic and/or environmental losses.
MEDIUM:	<p>Medium negative</p> <p>A policy has a 'medium negative' effect where it could contribute to a social, economic or environmental objective in a negative way.</p> <p>A 'medium negative' effect could be:</p> <ul style="list-style-type: none"> (i) an increase in current flood risk; (ii) a projected increase in flood risk under future conditions, and/or; (iii) social, economic and/or environmental losses.
LOW:	<p>Low negative</p> <p>A policy has a 'low negative' effect where it could make a limited contribution to a social, economic or environment objective, but where the overall contribution would be negative.</p> <p>A 'low negative' effect could be:</p> <ul style="list-style-type: none"> (i) an overall increase in current flood risk; (ii) an overall increase in flood risk under future conditions, and/or; (iii) overall social, economic and/or environmental losses.
NEUTRAL:	<p>Neutral</p> <p>A policy has a 'neutral' effect where it makes neither a positive or negative contribution to a social, economic or environmental objective.</p> <p>A 'neutral' effect could be:</p> <ul style="list-style-type: none"> (i) no change in current level of risk. In this instance the current level of risk would have to be low, so that the residual risk after a neutral policy was implemented remained acceptable; (ii) no change in flood risk under future conditions. In this instance projected future risk would need to be low so that the residual risk after a neutral policy was implemented remained acceptable, and/or; (iii) no additional social, economic and/or environmental gains or losses. <p>Policy options may also be 'neutral' where they are not relevant in a particular policy unit, or where it is not feasible for a policy option to contribute to an objective.</p>
HIGH:	<p>High positive</p> <p>A policy has a 'high positive' effect where it could contribute to a social, economic or environmental objective in a significantly positive way.</p> <p>A 'high positive' effect could be:</p> <ul style="list-style-type: none"> (i) a very large reduction in current flood risk; (ii) avoiding/reducing very large projected increases in flood risk under future conditions, and/or; (iii) significant additional social, economic and/or environmental gains.
MEDIUM:	<p>Medium positive</p> <p>A policy has a 'medium positive' effect where it could contribute to a social, economic or environmental objective in a positive way.</p> <p>A 'medium positive' effect could be:</p> <ul style="list-style-type: none"> (i) a reduction in current flood risk; (ii) avoiding/reducing projected increases in flood risk under future conditions, and/or; (iii) additional social, economic and/or environmental gains.
LOW:	<p>Low positive</p> <p>A policy has a 'low positive' effect where it could make a limited contribution to a social, economic or environment objective, but where the overall contribution would be positive.</p> <p>A 'low positive' effect could be:</p> <ul style="list-style-type: none"> (i) an overall reduction in current flood risk; (ii) an overall avoidance/reduction in flood risk under future conditions,

Form 12.8: Summary of the preferred policy

Policy Unit name/number:	Policy Unit 6: Ebbw Corridor The policy unit is located within the mid-lower reaches of the Eastern Valleys CFMP area. The policy unit covers the main areas of Risca, Bassaleg and Tredegar Park and Newbridge.
Problem / risk:	<p>The main rivers within this policy unit are the River Ebbw, Nant Gwyddon and Nant Carn. There are two main sources of flooding within this policy unit; fluvial and tidal. Other secondary sources of flooding within this policy unit include surface and sewer flooding. We currently spend approximately £53,000 per year on maintenance and operations in this policy unit.</p> <p>Current fluvial risk within the policy unit is relatively high for the 1% AEP fluvial flood event. In the future, flood defences will be overtopped and as a result fluvial flood risk during a 1% AEP event significantly increases. Tidal flood risk increases significantly in the future.</p> <p>Under both current and future conditions the risk to people and property is very high for the 0.1% AEP extreme fluvial and tidal events.</p>
Policy selected	<p>Policy 4 – Take further action to sustain current risk</p> <p>We have selected this policy based on the risk posed by inland flooding sources and tidal flooding sources. Our goal for selecting policy four for the Ebbw Corridor policy unit is to reduce the high future fluvial and tidal flood risk to the current level. The current flood risk should be managed through influencing and informing.</p> <p>If the risks posed by tidal flooding were removed from the policy appraisal process, preliminary estimates suggest that this policy would remain a P4. This is because the future fluvial flood risk is high in the future.</p>
Justification and alternative policies considered	<p>Policy 4 sets a framework that reduces flood risk into the future. This policy is appropriate for this policy unit for the following reasons:</p> <ul style="list-style-type: none"> - The future levels of fluvial and tidal flood risk are high and the risks present severe consequences for harm to life. - Risks for extreme fluvial events (0.1% AEP) are very high. - There are a significant number of properties in the future that will be at flood risk, including numerous critical and community assets. - The current level of maintenance should be continued or improved as to help improve conveyance, reducing the impacts of flooding and maintaining water levels. <p>The main areas of Risca and Bassaleg and Tredegar Park are situated in the lower reaches of the River Ebbw. The main area of Newbridge is situated in the middle reaches of the River Ebbw. The existing floodplain of the River Ebbw in Risca and Bassaleg and Tredegar Park is restricted by the presence of flood defences, constructed in the 1980s. There is also a residual risk of these defences breaching, so properties located behind these flood defences are extremely vulnerable. There is a tidal risk of flooding in Bassaleg and Tredegar Park, but not in Risca or Newbridge.</p> <p>The current scale of fluvial flood risk during a 1% AEP flood event in the main area of Risca is higher than average, in Newbridge and Bassaleg and Tredegar Park it is low. The estimated total property damages are small for a 10% AEP fluvial flood event in Risca and £9.8 million for the 1% AEP fluvial flood event. In Newbridge, the 10% AEP fluvial flood event property damages is £432,000, for the 1% fluvial flood event it is £2 million. In Bassaleg and Tredegar Park, the 10% AEP fluvial flood event property damages are £85,000, for the 1% AEP fluvial flood event it is £93,000. The level of risk for the 0.1% AEP fluvial flood event is high in Risca and Bassaleg and Tredegar Park with estimated total property damages being £93 million and £12 million, respectively. The 0.1% AEP fluvial flood event damages in Newbridge are less significant, £4.4 million. It can be seen that the damages principally arise from the more extreme events, which is due to our flood defences in Risca and Bassaleg and Tredegar Park, which have a SoP of 1% AEP in most</p>

places, overtopping. Approximately 346 properties are at flood risk in Risca, 1 in Bassaleg and Tredegar Park and 23 in Newbridge in the 1% AEP fluvial flood event. Critical assets that are currently at risk include 0.5km of the A467 in Risca, and 4 electricity stations in Newbridge, Abercarn and Risca.

The current 0.5% AEP tidal flood event property damages in Bassaleg and Tredegar Park are low, £703,000.

In the future, the 1% AEP fluvial flood event damages for the main areas of Risca and Bassaleg and Tredegar Park are high. Damages significantly increase to £53 million and £9.8 million, respectively, affecting approximately 1,450 properties in Risca and 252 properties in Bassaleg and Tredegar Park. This large increase is due to our flood defences overtopping. In Newbridge, the damages increase to £6.7 million, affecting approximately 115 properties. There is a high increase in the number of critical and community assets at risk, including a police station and fire station in the main area of Risca, and an ambulance station in Bassaleg and Tredegar Park.

In the future 0.5% AEP tidal flood event property damages in Bassaleg and Tredegar Park increase significantly to £20.5 million.

The expected annual damages in the main areas of Risca, Bassaleg and Tredegar Park and Newbridge are £384,000/yr, £83,000/yr and £161,000/yr, respectively. The expected annual damages could increase by over 200% in the future as a result of the impacts of climate change and further development planned within the catchment.

The main reason for selecting a P4 rather than a P5 in this policy unit is that the current fluvial and tidal flood risk is comparatively low and implementing a P5 may not be economically feasible or justifiable.

Justification and alternative policies considered

Gains and losses under preferred policy (policy four)

Social

Policy four gives three low and two medium losses, with one neutral, against our social CFMP objectives and indicators. Flood risk would be significantly reduced for 1% AEP fluvial and 0.5% AEP tidal flood events into the future. We accept that there would still be people and property at flood risk during the 1% AEP fluvial and 0.5% AEP tidal flood events under current conditions, but the consequences of this could be minimised through influencing and informing. For more extreme events such as the 0.1% AEP flood event, we accept that we cannot build structural defences to protect the people, property and the economy, and that there would be significant consequences during such extreme events.

Economic

Policy four gives one medium and two low losses against our economic CFMP objectives and indicators. Economic damages would be significantly reduced into the future for both fluvial and tidal flood events. The critical assets at risk would also be significantly reduced. Although current damages are significant in this policy unit, it is unfeasible to reduce these any further, under a policy five.

Environmental

Policy four gives 2 neutral, 1 medium loss and 1 low gain against our environmental CFMP objectives and indicators. Rivers in policy unit six are already managed for flood risk purposes; therefore we would not expect the natural environment to be significantly affected if we took further action to reduce risk to society and the economy. There are a limited number of environmental sites within the policy unit and we do not expect that an increase in flooding will have a significant negative impact on environmental sites.

Alternative policies considered

	<p>Policy one – <i>No active intervention</i>. The increased risk to people (+6,890), properties (+2,890) and the economy (+£158m) would be very high and there would be very significant and high increases in risks in the future.</p> <p>Policy two – <i>Reduce current levels of flood risk management</i>. The increased risk to people (+3,280), properties (+1,770) and the economy (+£84m) would be very high and there would be very significant and high increases in risks in the future.</p> <p>Policy three – <i>Maintain current levels of flood risk management</i>. The increased risk to people (+3,050), properties (+1,470) and the economy (+£67m) would be very high and there would be very significant and high increases in risks in the future.</p> <p>Policy five – <i>Take further action to reduce flood risk (now and/or into the future)</i> Although flood risk would be significantly reduced under this policy, further investment in defences is considered not to be feasible. The remaining risk will be managed through influencing and informing.</p> <p>Policy six – <i>Take action with others to store water or manage run-off in locations that provide overall flood risk reduction or environmental benefits, locally or elsewhere in the catchment</i>. There is no scope for carrying out policy six in this policy unit. There is very limited opportunity for increasing the frequency of flooding as a flood risk management option within this policy unit.</p>
<p>Catchment-wide opportunities & constraints</p>	<p>The greatest opportunity in policy unit six is for us to significantly reduce the risk of flooding to people, property and the economy; these risks are very high into the future. In order to do this we need to take further action to sustain the current level of risk in this policy unit.</p> <p>There are few opportunities within this policy unit to reconnect the river with its floodplain in this policy unit as the river is highly constrained by flood defences which protect high numbers of properties.</p>
<p>Actions</p>	<ul style="list-style-type: none"> • The scale of the expected economic damages and risk to people and property indicates that we should develop a Strategy Plan for the Ebbw Corridor policy unit, in particular Risca, within the next 5 years. This will consider where investment for structural responses can and should be implemented to reduce flood risk in Risca and other areas where the flood risk is high. Moving forward from the Strategy Plan, Pre-feasibility studies will be needed. • Initiate an urban drainage study for Risca to identify surface water drainage issues and potential for remediation. • In partnership with Caerphilly and Newport Local Authorities, we should enforce stringent building controls on new development within flood risk areas. Suitable land allocations for new development should first be sought outside of flood risk areas. • SUDs and building regulations (resilience) should be incorporated, where appropriate, into all new developments.
<p>Risks, uncertainties & dependencies</p>	<p>The damages to the Ebbw Corridor policy unit from flooding are estimates that are considered sufficiently accurate to justify the cost of further investigations into the appropriate intervention to reduce flood risk. More detailed assessments will be required to identify the actual level of investment that can be justified and its relative priority with other flood risk reduction work.</p> <p>We will be accepting some flood risk by selecting policy four, where risks to people and property remain, investment will be focused on influencing and informing, to reduce the consequences if flooding occurs.</p> <p>An existing model of the River Ebbw was used for the majority of this policy unit, this was supplemented by more broadscale modeling to ensure all the risk was assessed in the policy unit. There is more uncertainty with the broadscale modeling than areas with existing models.</p> <p>For this policy to be successful, appropriate policies and actions must be</p>

implemented throughout the River Ebbw catchment.

Form 12.9: Requirements for further policy development and appraisal

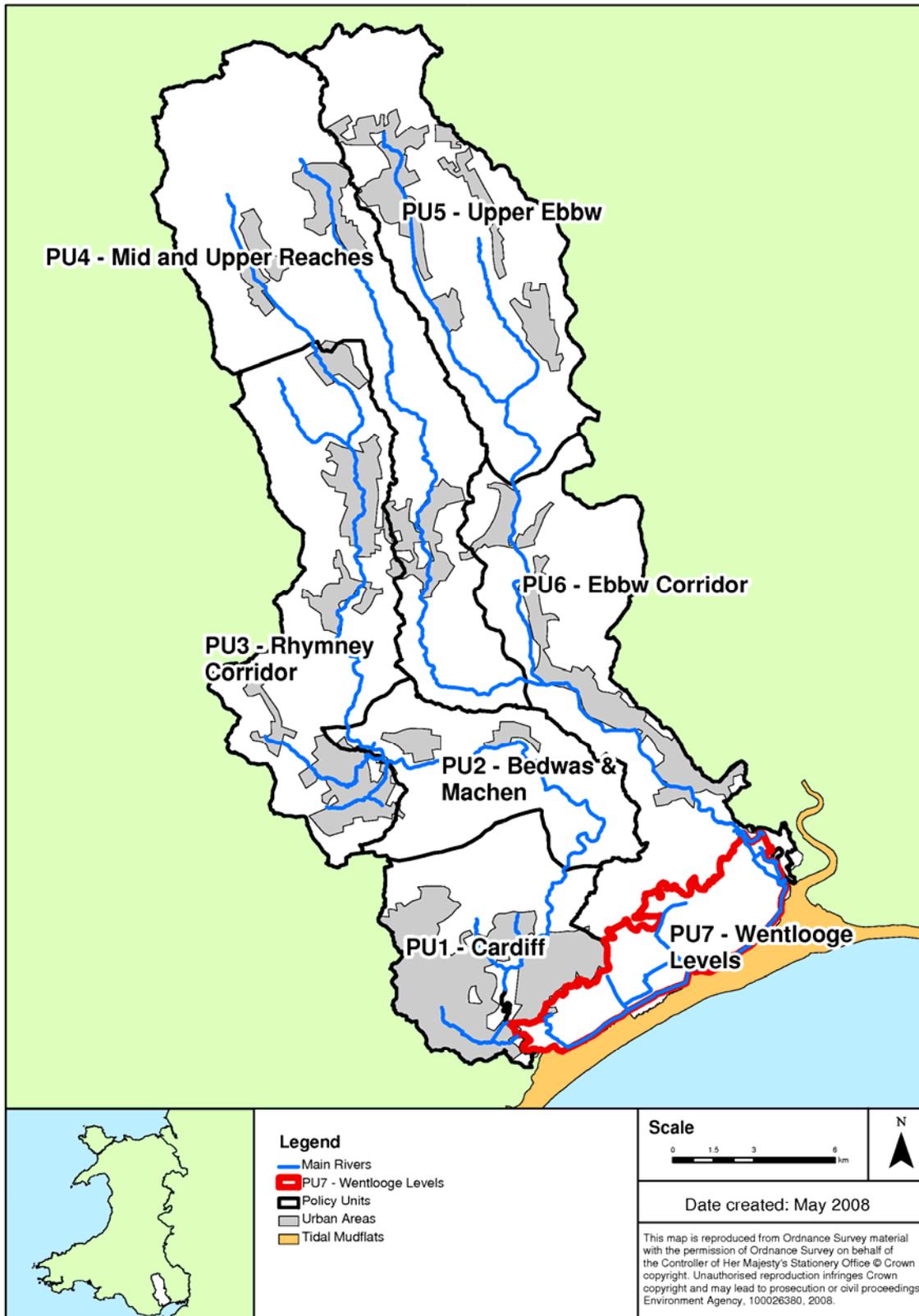
Is there a need for further policy development?	No
If yes, then mark Policy Options for more detailed development. Some complex policies may require more detailed development, probably at Strategy Plan level.	
Is there a need for further more detailed appraisal?	No
If yes, take forward to Strategy study.	

Form 12.10: Indicators for monitoring, review and evaluation

Set out the indicators that need to be included in the policy implementation plan, for policy monitoring, drawing on the residual risks and likely impacts identified above. This will allow better review and evaluation of the policy when implemented.

Monitoring	Significance/impact
Hydrometric monitoring of river flows and levels, sea level, rainfall and groundwater levels throughout the catchment in order to monitor changes in climate	<ul style="list-style-type: none"> Additional data may change our assessment of current or future conditions
Scientific advancements in flood risk management	<ul style="list-style-type: none"> Improved sea level rise predictions Improved predictions in changes to river flows
Land use change monitored using satellite imagery	<ul style="list-style-type: none"> Further information on land use change may change future predictions of flood risk
Actual development rates	<ul style="list-style-type: none"> Need to check if urbanisation predictions made are realistic in light of current and future development undertaken
Designation and condition of environmental sites	<ul style="list-style-type: none"> May change the chosen policy if additional sites are designated. Monitoring of site condition will confirm that chosen CFMP policies have not adversely affect designated sites
Designation and condition of historic environmental assets	<ul style="list-style-type: none"> May change the chosen policy if additional sites are designated. Monitoring of site condition will confirm that chosen CFMP policies have not adversely affect designated sites
Detrimental impacts of flood risk management projects on BAP habitats and species	<ul style="list-style-type: none"> To ensure that specific flood risk management projects do not adversely affect BAP habitats and species
Level of uptake of flood warning services	<ul style="list-style-type: none"> Monitor whether the community are aware of the flood risks
Condition of flood defences	<ul style="list-style-type: none"> Need to maintain defences in line with the policy chosen
Actual expenditure on maintenance activities by policy unit, subdivided into activities.	<ul style="list-style-type: none"> Ensure that money is being targeted according to policy chosen
Actual expenditure on capital works to reduce flood risk	<ul style="list-style-type: none"> Need to ensure that these actions are in keeping with the policy chosen
Improved documentation of actual flood events: <ul style="list-style-type: none"> Number of properties/assets/ environmental sites/historic environment assets flooded Source of flooding Cause of flooding Whether due to defence failure 	<ul style="list-style-type: none"> Information on actual flood events needs to be better recorded in order to understand the relative importance of the various sources of flooding
Construction of critical infrastructure	<ul style="list-style-type: none"> May change the chosen policy if additional critical infrastructure is constructed within the floodplain

Spatial location of policy unit 7: The Wentlooge Levels



Form 12.5: Summary of current and future levels of and responses to flood risk

<p>Policy unit name/number:</p>	<p>Policy Unit 7: Wentlooge Levels</p>
<p>Current responses to flood risk within the policy unit?</p>	<p>Defences There are no fluvial flood defences in the Wentlooge Levels policy unit. The tidal defences along the River Ebbw (in PU6) protect parts of this policy unit.</p> <p>The coastal defences in the Wentlooge Levels policy unit take the form of a continuous earth embankment, reinforced in places by revetments of blockstone, rock armour, concrete walls and concrete wave return structures. These protect the Wentlooge Levels from direct flooding from the sea.</p> <p>Flood Warning We provide a flood warning service via Floodline Warnings Direct. Flood Warning Area 103FWFCt04 covers both coastal flood risk and fluvial flood risk from the reens and drainage network in the Wentlooge Levels policy unit. The lead times for flood warning in policy unit two are unknown. We aim to issue flood warnings at least 2 hours before a flood event occurs. There are currently no properties at flood risk during a 1% AEP fluvial flood event. Uptake to the flood warning service is unknown.</p> <p>Maintenance of existing structures Both we and the Wentlooge Levels IDB carry out routine maintenance works on all main rivers and reens/drains in PU7. This takes the form of vegetation removal both within the channel and on the banks, re-profiling of watercourses, silt traps, selective mowing and tree retention along banks. These activities maintain the channel capacities of the watercourses in the Wentlooge Levels and also ensure channel conveyance is maintained.</p> <p>The Wentlooge Levels policy unit is covered by one asset system, FR19S135 which is a high risk asset system inspected every 6 to 12 months. We currently spend approximately £92,000 per year on maintenance and operations in the Wentlooge Levels.</p>
<p>Standards of service that apply to flood defences within the policy unit?</p>	<p>Standard of Protection The coastal defence in the Wentlooge Levels policy unit offers a 0.5% AEP SoP in most places. The tidal defences along the River Ebbw (in PU5) offer a 0.5% AEP tidal SoP in most places.</p> <p>Condition and maintenance of defences This information is unknown.</p>
<p>What is currently exposed to flooding?</p>	<p>People We estimate that there are currently no people at risk of flooding from a 1% AEP fluvial flood event. 12 people are at risk of flooding from a 0.5% AEP tidal flood event. The tidal flood risk comes from the River Ebbw.</p> <p>There are no people at risk from the 0.1% AEP fluvial flood event. Flood risk does increase significantly during the 0.1% AEP tidal flood event because the flood defence along the River Ebbw is overtopped during a 0.1% AEP tidal flood event. The worst affected area by this flood event is Duffryn.</p> <p>Community Disruption We estimate that there are currently no properties at risk of flooding from a 1% AEP fluvial flood event. There are 8 properties at risk of flooding from a 0.5% AEP tidal flood event, all of which are residential. There are no community assets at risk from fluvial or tidal flooding.</p>

	<p>Critical Infrastructure We estimate that there are no critical assets or transport routes at flood risk during a 1% AEP fluvial flood event or a 0.5% AEP tidal flood event.</p> <p>Economic Damages We estimate the total economic property damages resulting from the 1% AEP fluvial flood event to be zero. We estimate the total economic property damages for the 0.5% AEP tidal flood event to be £300,000. We estimate the total economic agricultural damages resulting from the 1% AEP fluvial flood event to be £68,000. We estimate the total economic agricultural damages from the 0.5% AEP tidal flood event to be £11,000.</p> <p>Historic Environment No listed buildings are at risk from a 1% AEP fluvial flood or a 0.5% AEP tidal flood event.</p> <p>Landscape We estimate that there are no landscape receptors at flood risk from a 1% AEP fluvial flood event or a 0.5% AEP tidal flood event.</p> <p>Recreation We estimate that there is currently one recreational area at flood risk from a 1% AEP fluvial flood event. No recreational areas are at flood risk from a 0.5% AEP tidal flood event.</p> <p>Nature conservation sites We estimate that 2.6% of the Gwent Levels – Rumney and Peterstone SSSI and 0.6% of the Gwent Levels – St. Brides SSSI are at risk from a 1% AEP fluvial flood event. For a 0.1% AEP fluvial flood event the areas at risk increase to 4.5% and 1.5% respectively. No designated nature conservation sites are at risk from a 0.5% AEP tidal flood event.</p> <p>BAP Habitats The exact location of BAP habitats in the catchment is unknown, but we estimate that several locally important habitats, identified in the Cardiff and Newport Local BAPs, will be at risk from flooding from both fluvial and tidal sources. These habitats include; coastal and floodplain grazing marsh; coastal saltmarsh; mudflats; reedbeds; and rivers, streams and floodplains.</p> <p>Species The exact location of BAP species in the catchment is unknown, but we estimate that several locally important species, identified in the Cardiff and Newport Local BAPs, will be at risk of flooding from both fluvial and tidal sources. These species include Allis Shad; Brown Trout; the Double Line Moth; Great Crested Newt; Otter; Spruce’s Brittle-moss; Twaite Shad and Water Vole.</p>
<p>Who and what are currently most vulnerable to flood damage and losses?</p>	<p>Social and economic receptors The greatest risk to people and property is in the Duffryn Estate from tidal flood events along the River Ebbw.</p> <p>Environmental receptors The two SSSIs in the Gwent Levels may be vulnerable to flooding as a large proportion of each site is at risk. However, as part of the natural hydrological regime periodic flooding of these wetland sites is unlikely to have a significant adverse affect. Some flooding may even enhance water-dependent habitats. However, flooding from non-fluvial sources and by low quality water is likely to have</p>

	<p>a negative impact on these two SSSIs.</p> <p>BAP habitats and species in the unit are at greatest risk from prolonged or frequent floodwater inundation, especially by low quality water, which can indirectly degrade habitats. However, some wetland BAP habitats, and the species they support, may benefit from increased flooding.</p> <p>Tidal flooding can also affect BAP habitats and species, as flooding of saltwater habitats with freshwater, and freshwater habitats with saltwater, can cause long-lasting damage to sensitive plants and animals.</p>
<p>What are the key factors that could drive future flood risk?</p>	<p>Climate change</p> <p>Climate change is the main driver of future flood risk in the Eastern Valleys. Climate change will result in higher flows and higher tide levels, which will increase water levels in our rivers. Flooding under our modelled future scenarios of climate change would cause significantly more damage and pose a significantly higher risk to people and property than existing conditions for tidal flood events. The risk does not change for future fluvial flood events.</p> <p>Land use management changes</p> <p>We have decided not to consider the impact of land use change outside of urban areas on future flood risk in this CFMP. Agricultural intensification and changes in drainage practices are unrealistic scenarios because the Eastern Valleys has poor quality soils that are unsuitable for agricultural intensification. It is also constrained by the steep gradients of the land, meaning arable farming is impossible in certain areas. It is very difficult for us to predict the future of agriculture in the Eastern Valleys beyond the immediate future. It may be that extensification is a more realistic long-term scenario, where land is farmed less intensively and for environmental benefits. However, it is unlikely that extensification would have little impact on flood risk as the area is not intensively farmed at present.</p> <p>There is little scope for changes in land use management in this policy unit due to the environmentally designated sites and the function of the reed system.</p> <p>Development in the flood plain</p> <p>Increased urbanisation will result in increased flood volumes and higher peak water levels, and flooding would occur more quickly. Unless runoff from new urban development within and outside of floodplains is balanced flood risk will increase locally and downstream. Development in the floodplain should only be allowed when no other suitable land allocations are available and any buildings within floodplains should have flood resilience measures incorporated into their design, and floodplain compensation would be necessary.</p> <p>Flood defence failure</p> <p>There are no fluvial flood defences in the Wentlooge Levels policy unit, therefore this scenario is not applicable. There would be a risk of flooding if the tidal flood defences along the River Ebbw in policy unit 5 overtopped or breached.</p> <p>Flooding directly from the sea is not considered in the CFMP, but the greatest risk to people, properties and the economy in the Wentlooge Levels is if the sea overtopped or breached the coastal defences.</p>
<p>What are the possible future levels of flood risk under the main scenarios?</p>	<p>Our final future scenario that we used to assess possible future levels of flood risk considered a combination of the two main drivers, climate change and urbanisation. We have identified the following. We show the total numbers at risk, with the increase from current conditions in brackets:</p> <p>People</p> <p>In the future, we estimate that there will be no people at risk of flooding from a 1% AEP fluvial flood event. In the future 0.5% AEP tidal flood event, we estimate that there will be 716 (+704) people at risk of flooding. The increase in people at risk</p>

during the tidal flood event is due to the River Ebbw defences overtopping.

Community Disruption

In the future, we estimate that there will be no properties at risk of flooding from a 1% AEP fluvial flood event. In the future 0.5% AEP tidal flood event, we estimate that there will be 231 (+223) properties at risk of flooding, of which 231 (+223) are residential. In the future 1% AEP fluvial and 0.5% AEP tidal flood events there are no community assets at flood risk.

Critical Infrastructure

In the future, we estimate that there will be no critical assets or transport routes at flood risk during a 1% AEP fluvial or 0.5% AEP tidal flood event.

Economic Damages

In the future, we estimate the total economic property damages resulting from the 1% AEP fluvial flood event will be zero. In the future 0.5% AEP tidal flood event, we estimate that the total economic property damages will be £8.5 million (+£8.2m). In the future, we estimate the total economic agricultural damages resulting from the 1% AEP fluvial flood event will be £79,000 (+£11,000). In the future 0.5% AEP tidal flood event, we estimate that the total economic agricultural damages will be £27,000 (+£16,000).

Historic Environment

In the future, we estimate that no listed buildings will be at flood risk from a 1% AEP fluvial flood event or a 0.5% AEP tidal flood event.

Landscape

In the future, we estimate that there are no landscape receptors at flood risk from a 1% AEP fluvial flood event or a 0.5% AEP tidal flood event in policy unit seven.

Recreation

In the future, we estimate that there will be one recreational area (+0) at flood risk in a 1% AEP fluvial flood event. There are no recreational areas at flood risk during the future 0.5% AEP tidal flood event.

Nature conservation sites

We estimate that, in the future, the area of the Gwent Levels – Rumney and Peterstone SSSI at flood risk from a 1% AEP fluvial flood event will increase from 2.6% to 2.9%. The area of the Gwent Levels – St. Brides SSSI at flood risk will increase from 0.6% to 0.7%.

In the future, no designated nature conservation sites will be at flood risk from a 0.5% AEP tidal flood event.

BAP Habitats

The exact location of BAP habitats in the catchment is unknown. However, we estimate that in the future an increasing area of the locally important BAP habitats identified above will be at risk of flooding.

Species

The exact location of BAP species in the catchment is unknown. However, we estimate that in the future an increasing number of the locally important BAP species identified above will be at risk of flooding.

What potential	Generic Response/Strategic	Response
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responses (or groups of responses) are being considered to manage flood risk?	Rural land use change	<ul style="list-style-type: none"> Agricultural drainage 	Land quality within this policy unit is generally good to moderate. Therefore, there could be opportunities for changing farming practices, but it is very difficult to predict the future of agriculture in the Eastern Valleys beyond the immediate future.
		<ul style="list-style-type: none"> Sensitive farming practices/set-aside 	Land quality within this policy unit is generally good to moderate. Therefore, there could be opportunities for changing farming practices, but it is very difficult to predict the future of agriculture in the Eastern Valleys beyond the immediate future.
	Attenuation/retention	<ul style="list-style-type: none"> SUDS – new/retrospective 	A potential method for reducing surface water runoff and should be included in all new developments - but unlikely to be much development within this policy unit.
	Increased conveyance	<ul style="list-style-type: none"> River maintenance 	Assumed ongoing maintenance activities. Maintenance is essential for controlling levels, for the purposes of flood risk and for optimum habitat conditions, and therefore it cannot be stopped or decreased. There may be potential to increase maintenance.
		<ul style="list-style-type: none"> De-silting 	Assumed ongoing de-silting activities. Essential for maintaining levels and therefore it cannot be stopped or decreased. There may be potential to increase the frequency of de-silting.
		<ul style="list-style-type: none"> Fluvial defences 	The defences along the River Ebbw will be covered under policy unit six. There are tidal defences along the River Rhymney but there is little flood risk to the Wentlooge Levels from this source.
	Influencing and informing	<ul style="list-style-type: none"> Flood awareness 	National campaign. Should be continued and awareness increased within this policy unit where there is flood risk from tidal flooding.
		<ul style="list-style-type: none"> Flood warning and evacuation 	Existing flood warning area. Uptake to FWD is unknown but likely to be an opportunity to increase this.
		<ul style="list-style-type: none"> Emergency & disaster planning/response 	Covered by Cardiff & Newport Local Authorities - Existing emergency plans should be in place, which should be reviewed and updated as new information becomes available.
		<ul style="list-style-type: none"> Planning policy, development control 	Continue to follow Welsh Assembly Government policies. Cardiff & Newport Local Authorities should ensure that suitable land allocations outside flood risk areas are sought first.
	<ul style="list-style-type: none"> Building regulations (resilience) 	To be incorporated into all new developments located within flood risk areas.	

	Monitoring, Advise, Survey	▪ Data & information	Should continue despite policy selected.
		▪ Asset inspection	Policy unit classified as high risk and therefore assets are inspected every 6-12 months. It is unlikely this could be increased further but should be explored.
	Studies	▪ Flood Risk Mapping	Necessary for improved delineation of flood zones.
		▪ SAMPs	Policy unit covered by SAMPs. These may need to be reviewed to take into account future flood risk.
What gaps and uncertainties are there in knowledge, and what assumptions have been made?	<p>Broadscale Mapping</p> <ul style="list-style-type: none"> ▪ As there was no model available for the Wentlooge Levels, a broadscale mapping technique was used to reflect as accurately as possible the flooding that would be expected under different flood events. Therefore, the results presented here should only be considered as indicative. <p>Future Scenarios</p> <ul style="list-style-type: none"> ▪ Although climate change projections are based on current guidance, these are still estimations; ▪ Urbanisation projections up until the year 2100 are based on current rates of urbanisation. <p>Data Limitations</p> <ul style="list-style-type: none"> ▪ No data on the percentage uptake of properties located in Flood Warning Areas; ▪ The exact locations of BAP habitats and species within the policy unit are unknown. 		

Broad scale Modelling Tables

Generic Response Modelling

The following tables provide a summary of how flooding will change in response to flood management options which may be adopted within policy unit seven and what the implications of these changes might be. We have not applied any specific measures or schemes to the policy unit, but rather have applied what has been termed a 'generic response'. This represents the most likely outcome of a given policy, but is not specific and does not reflect any proposed scheme or project. It simply allows a broad assessment of what the impact of that policy might be.

Our broad scale models have been used to investigate the impact of these changes and have allowed us to quantify the effect on flood damages. We compare the risks for each generic response against the current base case conditions (the risk which currently exists in the catchment today). The results given below for each of the generic responses (i.e. the appropriate scenario for that part of the catchment) are for the 1% AEP fluvial flood event and the 0.5% AEP tidal flood event, where applicable.

We have unit costs available for defences, however the costs of flow attenuation schemes are not available. The cost of large scale flow attenuations scheme would be extremely high, as they form heavy structural response to flood risk. More local schemes for attenuating flow would cost less, but the costs would still be high compared to defences.

Policy unit 7: Wentlooge Levels

Generic response: Policy 1 - Withdraw/retreat defences and decreased conveyance

Description: We used the future 0.1% AEP fluvial flood outline to assess the combined effects of not maintaining defences and stopping maintenance of the reens and the drainage network. We used this as the surrogate event as we consider it to be the worst case scenario, which we would not defend against into the future. This event reflects the expected increases in water levels that would result from not maintaining flood defences and stopping the maintenance of the reens and the drainage network.

The tidal risk in the Wentlooge Levels is from the River Ebbw only, the nature of the controls on the reens means that there is no tidal influence on these. For undefended tidal conditions we used the future 0.1% AEP tidal flood outline as a surrogate for an extreme tidal event, which we would not defend against, as we consider this to be a worse case scenario. Compared to the influence of the tide level, the channel maintenance we undertake has very little effect in tidally-influenced areas. We therefore have shown that the risk would be greater than that from the 0.1% AEP tidal event.

Base case conditions (1% AEP fluvial flood event)

People at risk: Fluvial – 0	Economic risk: Fluvial – £0	Properties at risk: Fluvial – 0	Environmental sites at risk: Fluvial – 2.6% of Gwent Levels – Rumney and Peterstone SSSI is at risk 0.6% of Gwent Levels – St. Brides SSSI is at risk
Tidal - 12	Tidal - £296,000	Tidal - 8	Tidal – No SSSIs at risk

Results of the broad scale modelling

People at risk: Fluvial – 0 (0%)	Economic risk: Fluvial – £0 (0%)	Properties at risk: Fluvial – 0 (0%)	Environmental sites at risk: Fluvial – 5.7% of Gwent Levels – Rumney and Peterstone SSSI is at risk (+3.1%) 2.5% of Gwent Levels – St. Brides SSSI is at risk (+1.9%)
Tidal – 719 (+5,892%)	Tidal - £8.9m (+2,907%)	Tidal – 231 (+2,788%)	Tidal – No SSSIs at risk (no change)

Conclusions

Cost: Nothing - no active intervention

Conclusion: Our results for the Wentlooge Levels show that if we stopped our maintenance of the defences and the reens and drains in the Wentlooge Levels the risk to people, properties and the economy would increase for tidal flooding, it would not change for fluvial flooding. Our maintenance and the IDB's maintenance of the reens and drains are important in reducing the risk of flooding and this is one reason why the existing level of risk is low. Our results for the tidal scenario show that if we stopped our maintenance of the defences and channels along the River Ebbw, the risk to people, properties and the economy would increase greatly.

We would withdraw our current flood warning service that we provide under this generic response.

Policy unit 7: Wentlooge Levels

Generic response: Policy 2 – Reduced maintenance

Description: We could reduce our flood risk management within the Wentlooge Levels by relaxing our maintenance activities, such as weed-cutting and clearing of the reens and drainage network. We have used the future 0.5% AEP fluvial flood outline as a surrogate to assess the impacts of reducing

maintenance activities in the Wentlooge Levels. This reflects the increase in roughness that would be expected if maintenance were reduced.

Channel roughness has a negligible effect on tidal water levels, so we did not map tidal scenarios for this generic response.

Base case conditions (1% AEP fluvial flood event)

People at risk: Fluvial - 0	Economic risk: Fluvial – £0	Properties at risk: Fluvial – 0	Environmental sites at risk: Fluvial – 2.6% of Gwent Levels – Rumney and Peterstone SSSI is at risk 0.6% of Gwent Levels – St. Brides SSSI is at risk Tidal – No SSSIs at risk
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Results of the broad scale modelling (1% AEP fluvial flood event)

People at risk: Fluvial - 0 (0%)	Economic risk: Fluvial - £0 (0%)	Properties at risk: Fluvial – 0 (0%)	Environmental sites at risk: Fluvial – 3.4% of Gwent Levels – Rumney and Peterstone SSSI is at risk (+0.8%) 0.9% of Gwent Levels – St. Brides SSSI is at risk (+0.3%) Tidal – No SSSIs at risk (no change)
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Conclusions

Cost: We currently spend approximately £92,000 per year on maintenance and operations in the Wentlooge Levels. Under policy two we would not stop this regime, but we would scale down our programme, for example we may downgrade the Wentlooge Levels policy unit from a high risk flood risk management system (FRMS) to a medium FRMS, which may reduce funding by up to 50% (to £46,000 per year).

Conclusion:

If we were to reduce our maintenance regime, water levels would be expected to increase. However, reducing this maintenance is unlikely to impact on people and property significantly. Our maintenance and the IDB’s maintenance of the reens and drains are important in reducing the risk of flooding and this is one reason why the existing level of risk is low.

Policy unit 7: Wentlooge Levels

Generic response: Policy 3 – Continue with existing flood defence actions only

Description: This response to manage risk at the same level assumes that we would not undertake any alternative flood risk management actions, and that we would continue to maintain our defences at their current level. We would also continue our river maintenance, which allows the rivers to flow freely, at the same level. The current level of flood risk management under the chosen future scenario of climate change and increased urbanisation was mapped for Chapter 4.

Base case conditions (1% AEP fluvial flood event / 0.5% AEP tidal flood event)

People at risk: Fluvial – 0 Tidal - 12	Economic risk: Fluvial – £0 Tidal - £296,000	Properties at risk: Fluvial – 0 Tidal - 8	Environmental sites at risk: Fluvial – 2.6% of Gwent Levels – Rumney and Peterstone SSSI is at risk 0.6% of Gwent Levels – St.
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			Brides SSSI is at risk Tidal – No SSSIs at risk
Results of the broad scale modelling (1% AEP fluvial flood event / 0.5% AEP tidal flood event)			
People at risk: Fluvial – 0 (0%) Tidal – 716 (+5,867%)	Economic risk: Fluvial – £0 (0%) Tidal - £8.5m (+2,771%)	Properties at risk: Fluvial – 0 (0%) Tidal - 231 (+2,788%)	Environmental sites at risk: Fluvial – 2.9% of Gwent Levels – Rumney and Peterstone SSSI is at risk (+0.3%) 0.7% of Gwent Levels – St. Brides SSSI is at risk (+0.1%) Tidal – No SSSIs at risk (no change)
Conclusions			
Cost: Wentlooge Levels policy unit falls predominantly within one high risk flood risk management system, for which we currently spend approximately £92,000 per year on maintenance, assets and operations. We would continue investing this much in the future.			
Conclusion: In the past our management of flood risk has been mainly the maintenance of the reens and drains in the Wentlooge Levels. We could continue investing in flood risk management to the same level in the Wentlooge Levels, by maintaining our reens and drains at their current level. The results show that if we kept our maintenance at the current level into the future across the Wentlooge Levels, then fluvial risks to people, property and the economy would not increase. Tidal flood risk does increase, but this would be improved by the selection of policy four for policy unit six as the defences would be raised as part of this. However, it is important that we consider alternative responses other than focusing on maintenance alone.			

Policy unit 7: Wentlooge Levels			
Generic response: Policy 4 – Take further action to improve and create new flood defences			
Description: This response to sustain flood risk into the future at the current level assumes that we would not undertake any alternative activities. All the increase of risk into the future would be managed by increasing and maintaining our defences. We have not identified any areas within the Wentlooge Levels policy unit where there is a big increase in flood risk in the future, as there is no risk to people or to property from fluvial flooding. The defences that protect the Wentlooge Levels from tidal flooding along the River Ebbw are located in policy unit six, so will be managed under the policy selected for that policy unit.			
Base case conditions (1% AEP fluvial flood event / 0.5% AEP tidal flood event)			
People at risk: Fluvial – 0 Tidal - 12	Economic risk: Fluvial – £0 Tidal - £296,000	Properties at risk: Fluvial – 0 Tidal - 8	Environmental sites at risk: Fluvial – 2.6% of Gwent Levels – Rumney and Peterstone SSSI is at risk 0.6% of Gwent Levels – St. Brides SSSI is at risk Tidal – No SSSIs at risk
Results of the broad scale modelling (1% AEP fluvial flood event / 0.5% AEP tidal flood event)			
People at risk: Fluvial – 0 (0%) Tidal – 12 (no change)	Economic risk: Fluvial – £0 (0%) Tidal - £296,000 (no change)	Properties at risk: Fluvial – 0 (0%) Tidal – 8 (no change)	Environmental sites at risk: Fluvial – 2.9% of Gwent Levels – Rumney and Peterstone SSSI is at risk (+0.3%) 0.7% of Gwent Levels – St.

			Brides SSSI is at risk (+0.1%) Tidal – No SSSIs at risk (no change)
Conclusions			
<p>Cost: We currently spend approximately £92,000 per year on inspecting and maintaining our channels in the Wentlooge Levels policy unit.</p> <p>To maintain the current tidal standard of protection into the future, we would need to increase the height of approximately 1.4km of defences along the right bank of the River Ebbw adjacent to Duffryn. This would cost in excess of £500,000. Although this would protect parts of the Wentlooge Levels, the new defences would actually be in the neighbouring policy unit six, therefore the costs of this have been included in policy unit six.</p> <p>Conclusion: Our flood risk management approach is to, where possible, move away from the traditional form of structural responses such as defences, in favour of combinations of softer management options. Due to the negligible fluvial flood risk to people and property under future conditions, this generic response would not be economically justifiable. The management of the defences along the River Ebbw falls under policy unit six.</p> <p>To raise flood defences along the River Ebbw, to protect from tidal flooding, will protect 223 properties and reduce economic damages by £8.3m in the Wentlooge Levels (included in policy unit six).</p>			

Policy unit 7: Wentlooge Levels			
Generic response: Policy 4 – Increased maintenance			
<p>Description: We currently undertake widespread channel maintenance across the Wentlooge Levels policy unit. We have the option to increase this further, to increase channel capacity and allow flow to be conveyed more freely. This would theoretically reduce flood risk. We have used the current 0.5% AEP fluvial flood outline as a surrogate for this generic response as this suitably reflects the expected reduction in water levels in comparison to the future 1% AEP fluvial flood event.</p> <p>Maintenance has a negligible effect on tidal water levels; therefore we did not include tidal risk for this generic response.</p>			
Base case conditions (1% AEP fluvial flood event)			
People at risk: Fluvial - 0	Economic risk: Fluvial – £0	Properties at risk: Fluvial – 0	Environmental sites at risk: Fluvial – 2.6% of Gwent Levels – Rumney and Peterstone SSSI is at risk 0.6% of Gwent Levels – St. Brides SSSI is at risk
Results of the broad scale modelling (1% AEP fluvial flood event)			
People at risk: Fluvial – 0 (0%)	Economic risk: Fluvial - £0 (0%)	Properties at risk Fluvial – 0 (0%)	Environmental sites at risk: Fluvial – 2.9% of Gwent Levels – Rumney and Peterstone SSSI is at risk (+0.3%) 0.7% of Gwent Levels – St. Brides SSSI is at risk (+0.1%) Tidal – No SSSIs at risk (no change)

Conclusions

Cost: We currently spend approximately £92,000 per year on maintenance and operations in the Wentlooge Levels. If we were to increase our maintenance programme costs might be expected to increase by approximately 50% (to £138,000 per year).

Conclusion: The aim of policy four is to sustain the current level of risk in to the future, although there may be a small amount of risk that we would have to accept. By increasing our channel maintenance throughout the policy unit, we would increase channel capacity. This would allow more water to be contained within the channel, and reduce the flood risk to the surrounding urban areas. By undertaking this response in the Wentlooge Levels would not be economically justifiable as the fluvial flood risk to people and property is negligible anyway. For this reason, we will not be taking this generic response forward to policy appraisal.

Currently only a small number of people in the Wentlooge Levels flood warning area receive warning, and we will look to improve this in the future.

Policy unit 7: Wentlooge Levels

Generic response: Policy 5 – Take further action to improve and create new flood defences

Description: Taking further action by creating new flood defences to reduce flood risk, both now and into the future, assumes that sustaining the current level of risk would be unacceptable. However, as the fluvial flood risk to people and property is negligible under our future scenario, there are no areas where new defences would be beneficial. The results presented here are the same as the future results.

There are no additional areas that have been trimmed for this generic response, in comparison to the policy four generic response, for the tidal scenario flood event. This is because we consider the existing tidal risk to the Wentlooge Levels to be at a low level. This is managed under policy unit six.

Base case conditions (1% AEP fluvial flood event / 0.5% AEP tidal flood event)

People at risk: Fluvial – 0	Economic risk: Fluvial – £0	Properties at risk: Fluvial – 0	Environmental sites at risk: Fluvial – 2.6% of Gwent Levels – Rumney and Peterstone SSSI is at risk
Tidal - 12	Tidal - £296,000	Tidal - 8	0.6% of Gwent Levels – St. Brides SSSI is at risk
			Tidal – No SSSIs at risk

Results of the broad scale modelling (1% AEP fluvial flood event / 0.5% AEP tidal flood event)

People at risk: Fluvial – 0 (0%)	Economic risk: Fluvial – £0 (0%)	Properties at risk: Fluvial – 0 (0%)	Environmental sites at risk: Fluvial – 2.9% of Gwent Levels – Rumney and Peterstone SSSI is at risk (+0.3%)
Tidal – 12 (no change)	Tidal - £296,000 (no change)	Tidal – 8 (no change)	0.7% of Gwent Levels – St. Brides SSSI is at risk (+0.1%)
			Tidal – No SSSIs at risk (no change)

Conclusions

Cost: We currently spend approximately £92,000 per year on inspecting and maintaining our channels in the Wentlooge Levels policy unit.

There would be no additional cost to manage tidal flood risk further into the future in policy unit six.

Conclusion: Due to the negligible fluvial flood risk to people and property under future conditions, building new flood defences is not required in this policy unit. The management of the defences along the River Ebbw falls under policy unit six. To raise flood defences along the River Ebbw, to protect from tidal

flooding, will protect 223 properties and reduce economic damages by £8.3m in the Wentlooge Levels (included in policy unit six).

There is no tidal flood risk from the River Rhymney, however, the management of these defences falls under PU1.

Currently only a small number of people in the Wentlooge Levels flood warning area receive warning, and we will look to improve this in the future.

Policy unit 7: Wentlooge Levels

Generic response: Policy 6 – Attenuation

Description: The creation of flow attenuation areas in the Wentlooge Levels policy unit is not feasible. Given that the Wentlooge Levels already acts as a large scale flood storage area for the Eastern Valleys, there is no scope to increase flooding in this area any further. There is no scope for broad scale modelling under policy 6 for the Wentlooge Levels policy unit, so no further action has been undertaken.

Base case conditions (1% AEP fluvial flood event)

People at risk: Fluvial - 0	Economic risk: Fluvial – £0	Properties at risk: Fluvial – 0	Environmental sites at risk: Fluvial – 2.6% of Gwent Levels – Rumney and Peterstone SSSI is at risk 0.6% of Gwent Levels – St. Brides SSSI is at risk
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Results of the broad scale modelling (1% AEP fluvial flood event)

People at risk: N/A	Economic risk: N/A	Properties at risk: N/A	Environmental sites at risk: N/A
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Conclusions

Cost: N/A

Conclusion: Taking action to increase the frequency of flooding is not feasible in the Wentlooge Levels policy unit, as such, there is not scope for carrying out policy six in this policy unit as the area is already used as a flood storage area.

The following table summarises the findings of the generic response modelling for policy unit seven (Wentlooge Levels). The responses or combination of responses chosen for each policy will be taken forward and compared against the objectives and indicators in table 12.6.

Policy	Generic response
1	Withdraw / retreat defences and stop maintenance
2	Reduced maintenance
3	Fluvial risk could be managed at the same level of risk by simply continuing our current activities in this policy unit.
4	Increased maintenance is a feasible option in this policy unit, although may not be economically justifiable.
5	There are no fluvial defences in this policy unit and the building of new ones is not required due to the minimal flood risk. The tidal defences along the River Ebbw are covered in policy unit 6. The coastal defences in this policy unit are covered under the Severn Estuary SMP.
6	Not technically feasible in this policy unit.

Form 12.6: Screening of policy options against appraisal objectives

Policy unit name/number:		Policy Unit 7: Wentlooge Levels								
N o.	Specific (appraisal) objectives	Indicators	Current baseline	Future baseline	Policy Options					
					P1 No active intervention	P2 Reduce existing actions	P3 Continue with existing actions to maintain current risk	P4 Take further action to sustain current risk	P5 Take further action to reduce current risk	P6 Take further action to increase frequency of flooding
Generic Response					Decreased conveyance Monitoring, advise & survey	Decreased conveyance Influencing and Informing Monitoring, advise & survey Studies	Increased or decreased conveyance Attenuation/retention Influencing and Informing Monitoring, advise & survey Studies	Increased or decreased conveyance Attenuation/retention Influencing and Informing Monitoring, advise & survey Studies	Increased or decreased conveyance Attenuation/retention Influencing and Informing Monitoring, advise & survey Studies	Increased or decreased conveyance Attenuation/retention Influencing and Informing Monitoring, advise & survey Studies
PEOPLE										
1.	Reduce community disruption caused by flooding in the Wentlooge Levels	The number of community assets at risk during the 1% AEP fluvial and 0.5% tidal flood events	There are no community assets at flood risk during the 1% AEP fluvial or 0.5% AEP tidal flood events	There will be no community assets at flood risk during the 1% AEP fluvial or 0.5% AEP tidal flood events	There would be no community assets at flood risk during the 1% AEP fluvial or 0.5% AEP tidal flood events	There would be no community assets at flood risk during the 1% AEP fluvial or 0.5% AEP tidal flood events	There would be no community assets at flood risk during the 1% AEP fluvial or 0.5% AEP tidal flood events	There would be no community assets at flood risk during the 1% AEP fluvial or 0.5% AEP tidal flood events	There would be no community assets at flood risk during the 1% AEP fluvial or 0.5% AEP tidal flood events	There is no scope for carrying out policy six in this policy unit. Increased frequency of flooding to make space for water

Policy unit name/number:		Policy Unit 7: Wentlooge Levels								
N o.	Specific (appraisal) objectives	Indicators	Current baseline	Future baseline	Policy Options					
					P1 No active intervention	P2 Reduce existing actions	P3 Continue with existing actions to maintain current risk	P4 Take further action to sustain current risk	P5 Take further action to reduce current risk	P6 Take further action to increase frequency of flooding
		<p>The number of residential properties at flood risk during the 1% AEP fluvial and 0.5% tidal flood events</p>	<p>There are no residential properties at flood risk during the 1% AEP fluvial flood event</p> <p>There are 8 residential properties at flood risk during the 0.5% AEP tidal flood event</p>	<p>There will be no residential properties at flood risk during the 1% AEP fluvial flood event</p> <p>There will be 231 residential properties at flood risk during the 0.5% AEP tidal flood event</p>	<p>There would be no residential properties at flood risk during the 1% AEP fluvial flood event</p> <p>There would be 231 residential properties at flood risk during the 0.5% AEP tidal flood event</p>	<p>There would be no residential properties at flood risk during the 1% AEP fluvial flood event</p> <p>Tidal flood risk not considered for this policy</p>	<p>There would be no residential properties at flood risk during the 1% AEP fluvial flood event</p> <p>There would be 231 residential properties at flood risk during the 0.5% AEP tidal flood event</p>	<p>There would be no residential properties at flood risk during the 1% AEP fluvial flood event</p> <p>There would be 8 residential properties at flood risk during the 0.5% AEP tidal flood event</p>	<p>There would be no residential properties at flood risk during the 1% AEP fluvial flood event</p> <p>There would be 8 residential properties at flood risk during the 0.5% AEP tidal flood event</p>	<p>could result in a significant increase in community disruption. Deliberately flooding specific areas to make space for water would cause large-scale community disruption in those areas. We have not identified any areas in the policy unit where we could do this without increasing community disruption.</p>
		<p>The duration of flooding (<1 day, 1 day to 5 days, > 5 days)</p>	<p>The duration of flooding is greater than 5 days for the 1% AEP fluvial flood event</p> <p>The duration of flooding is greater than 5 days for the 0.5% AEP tidal flood event</p>	<p>The duration of flooding will be greater than 5 days for the 1% AEP fluvial flood event</p> <p>The duration of flooding will be greater than 5 days for the 0.5% AEP tidal flood event</p>	<p>The duration of flooding would be greater than 5 days for the 1% AEP fluvial flood event</p> <p>The duration of flooding would be greater than 5 days for the 0.5% AEP tidal flood event</p>	<p>The duration of flooding would be greater than 5 days for the 1% AEP fluvial flood event</p> <p>Tidal flood risk not considered for this policy</p>	<p>The duration of flooding would be greater than 5 days for the 1% AEP fluvial flood event</p> <p>The duration of flooding would be greater than 5 days for the 0.5% AEP tidal flood event</p>	<p>The duration of flooding would be greater than 5 days for the 1% AEP fluvial flood event</p> <p>The duration of flooding would be greater than 5 days for the 0.5% AEP tidal flood event</p>	<p>The duration of flooding would be greater than 5 days for the 1% AEP fluvial flood event</p> <p>The duration of flooding would be greater than 5 days for the 0.5% AEP tidal flood event</p>	

Policy unit name/number:		Policy Unit 7: Wentlooge Levels								
N o.	Specific (appraisal) objectives	Indicators	Current baseline	Future baseline	Policy Options					
					P1 No active intervention	P2 Reduce existing actions	P3 Continue with existing actions to maintain current risk	P4 Take further action to sustain current risk	P5 Take further action to reduce current risk	P6 Take further action to increase frequency of flooding
		The area of flooding during the 1% AEP fluvial and 0.5% tidal flood events where depth of flooding exceeds 0.5 metres	The flooded area where depths exceed 0.5 metres is 0.2km ² during a 1% AEP fluvial flood event The flooded area where depths exceed 0.5 metres is 0.08km ² (Trowbridge) during a 0.5% AEP tidal flood event	The flooded area where depths exceed 0.5 metres will be 0.23km ² during a 1% AEP fluvial flood event The flooded area where depths exceed 0.5 metres will be 0.22km ² during a 0.5% AEP tidal flood event	The flooded area where depths exceed 0.5 metres would be 0.34km ² during a 1% AEP fluvial flood event The flooded area where depths exceed 0.5 metres would be 0.23km ² during a 0.5% AEP tidal flood event	The flooded area where depths exceed 0.5 metres would be 0.25km ² during a 1% AEP fluvial flood event Tidal flood risk not considered for this policy	The flooded area where depths exceed 0.5 metres would be 0.23km ² during a 1% AEP fluvial flood event The flooded area where depths exceed 0.5 metres would be 0.22km ² during a 0.5% AEP tidal flood event	The flooded area where depths exceed 0.5 metres would be 0.23km ² during a 1% AEP fluvial flood event The flooded area where depths exceed 0.5 metres would be 0.08km ² during a 0.5% AEP tidal flood event	The flooded area where depths exceed 0.5 metres would be 0.23km ² during a 1% AEP fluvial flood event The flooded area where depths exceed 0.5 metres would be 0.08km ² during a 0.5% AEP tidal flood event	
ECONOMICS										
4.	Reduce economic damages caused by flooding in the Wentlooge Levels	The total cost of property economic damages during the 1% AEP fluvial and 0.5% tidal flood events	The 1% AEP fluvial flood economic property damages are £0 The 0.5% AEP tidal flood economic property damages are £296,000.	The 1% AEP fluvial flood economic property damages will be £0 The 0.5% AEP tidal flood economic property damages will be £8.5m	The 1% AEP fluvial flood economic property damages would be £0 The 0.5% AEP tidal flood economic property damages would be £8.9m	The 1% AEP fluvial flood economic property damages would be £0 Tidal flood risk not considered for this policy	The 1% AEP fluvial flood economic property damages would be £0 The 0.5% AEP tidal flood economic property damages would be £8.5m	The 1% AEP fluvial flood economic property damages would be £0 The 0.5% AEP tidal flood economic property damages would be £296,000	The 1% AEP fluvial flood economic property damages would be £0 The 0.5% AEP tidal flood economic property damages would be £296,000	There is no scope for carrying out policy six in this policy unit. Increased frequency of flooding to make space for water could result in a significant increase in economic damages. Deliberately flooding specific areas to make

Policy unit name/number:		Policy Unit 7: Wentlooge Levels								
N o.	Specific (appraisal) objectives	Indicators	Current baseline	Future baseline	Policy Options					
					P1 No active intervention	P2 Reduce existing actions	P3 Continue with existing actions to maintain current risk	P4 Take further action to sustain current risk	P5 Take further action to reduce current risk	P6 Take further action to increase frequency of flooding
		The total cost of agricultural damages during the 1% AEP fluvial flood extent and/or the 0.5% AEP tidal flood extent	The 1% AEP fluvial flood agricultural damages are £68,000 The 0.5% AEP tidal flood agricultural damages are £11,000	The 1% AEP fluvial flood agricultural damages will be £79,000 The 0.5% AEP tidal flood agricultural damages will be £27,000	The 1% AEP fluvial flood agricultural damages would be £153,000 The 0.5% AEP tidal flood agricultural damages would be £27,000	The 1% AEP fluvial flood agricultural damages would be £91,000 Tidal flood risk not considered for this policy	The 1% AEP fluvial flood agricultural damages would be £79,000 The 0.5% AEP tidal flood agricultural damages would be £27,000	The 1% AEP fluvial flood agricultural damages would be £79,000 The 0.5% AEP tidal flood agricultural damages would be £11,000	The 1% AEP fluvial flood agricultural damages would be £79,000 The 0.5% AEP tidal flood agricultural damages would be £11,000	space for water would cause large-scale damage to property. We have not identified any areas in the policy unit where we could do this without increasing the economic damages significantly
5.	Optimise the level of Flood Risk Management expenditure. Ensure investment is proportional to the risks	The indicative costs of our flood risk management actions	We currently spend approximately £92,000 per year on maintenance and operations	We will spend more than we currently spend on maintenance and operations as risk is going to increase in the future in the Eastern Valleys, placing more demand on our resources and expenditure.	No construction or maintenance costs associated with undertaking this policy but it would be necessary to devise a strategy, and withdraw over a number of years, monitoring the situation once this had been done.	We would expect costs to reduce by half to £46,000 per year. However, the risks would significantly increase	We would continue to spend £92,000 per year on maintenance and operations	Indicative costs to improve and build new defences would cost approximately £5.0 million. Tidal flood risk would be managed by raising the flood defence along the River Ebbw in policy unit 6. Maintenance costs will increase as a result.	Indicative costs to improve and build new defences would cost approximately £7.0 million. There would be no action to reduce tidal flood risk any further than P4. Maintenance costs will increase as a result.	There is no scope for carrying out policy six in this policy unit. Constructing formal flood storage areas would cost many millions of pounds. Deliberately promoting flooding through schemes that make space for water would cause large scale disruption to the Wentlooge Levels and the Eastern Valleys as a whole
ENVIRONMENT										
6.	Ensure no deterioration of designated national nature conservation sites in particular	The percentage area of each SSSI affected during the 1% AEP fluvial	2.6% of the Gwent Levels – Rumney and Peterstone SSSI and 0.6% of the Gwent Levels – St. Brides SSSI is	2.9% of the Gwent Levels – Rumney and Peterstone SSSI and 0.7% of the Gwent Levels – St. Brides SSSI will	5.7% of the Gwent Levels – Rumney and Peterstone SSSI and 2.5% of the Gwent Levels – St. Brides SSSI	3.4% of the Gwent Levels – Rumney and Peterstone SSSI and 0.9% of the Gwent Levels – St. Brides SSSI	2.9% of the Gwent Levels – Rumney and Peterstone SSSI and 0.7% of the Gwent Levels – St. Brides SSSI	2.9% of the Gwent Levels – Rumney and Peterstone SSSI and 0.7% of the Gwent Levels – St. Brides SSSI	2.9% of the Gwent Levels – Rumney and Peterstone SSSI and 0.7% of the Gwent Levels – St. Brides SSSI	There is no scope for carrying out policy six in this policy unit. Increased frequency of

Policy unit name/number:		Policy Unit 7: Wentlooge Levels								
N O.	Specific (appraisal) objectives	Indicators	Current baseline	Future baseline	Policy Options					
					P1 No active intervention	P2 Reduce existing actions	P3 Continue with existing actions to maintain current risk	P4 Take further action to sustain current risk	P5 Take further action to reduce current risk	P6 Take further action to increase frequency of flooding
	the Gwent Levels Rumney and Peterstone SSSI and the Gwent levels St. Brides SSSI	flood event	at flood risk during the 1% AEP fluvial flood event There are no designated national nature conservation sites at flood risk during the 0.5% AEP tidal flood event	be at flood risk during the 1% AEP fluvial flood event There will be no designated national nature conservation sites at flood risk during the 0.5% AEP tidal flood event	would be at flood risk during the 1% AEP fluvial flood event. Flooding may negatively affect these sites if flooding is from low quality water or non-fluvial sources, but, it may benefit the wetland habitats and reens on these sites. There would be no designated national nature conservation sites at flood risk during the 0.5% AEP tidal flood event	would be at flood risk during the 1% AEP fluvial flood event. Flooding may negatively affect these sites if flooding is from low quality water or non-fluvial sources, but, it may benefit the wetland habitats and reens on these sites. There would be no designated national nature conservation sites at flood risk during the 0.5% AEP tidal flood event	would be at flood risk during the 1% AEP fluvial flood event. Flooding may negatively affect these sites if flooding is from low quality water or non-fluvial sources, but, it may benefit the wetland habitats and reens on these sites. There would be no designated national nature conservation sites at flood risk during the 0.5% AEP tidal flood event	would be at flood risk during the 1% AEP fluvial flood event. Flooding may negatively affect these sites if flooding is from low quality water or non-fluvial sources, but, it may benefit the wetland habitats and reens on these sites. There would be no designated national nature conservation sites at flood risk during the 0.5% AEP tidal flood event	St. Brides SSSI would be at flood risk during the 1% AEP fluvial flood event. Flooding may negatively affect these sites if flooding is from low quality water or non-fluvial sources, but, it may benefit the wetland habitats and reens on these sites. There would be no designated national nature conservation sites at flood risk during the 0.5% AEP tidal flood event	flooding to make space for water would result in a higher percentage area of risk to designated sites. Deliberately promoting flooding through schemes that make space for water would cause large scale disruption to the Wentlooge Levels and the Eastern Valleys as a whole
7.	Protect and improve habitats and species diversity, particularly BAP habitats and those relying on freshwater	BAP habitats and species at risk during the 1% AEP fluvial and 0.5% AEP tidal flood events	The following BAP habitats are at flood risk during a 1% AEP fluvial flood event and a 0.5% AEP tidal flood event: <ul style="list-style-type: none"> Coastal and floodplain grazing marsh Coastal saltmarsh Mudflats 	The following BAP habitats are likely to experience more frequent and longer duration of flooding in the future: <ul style="list-style-type: none"> Coastal and floodplain grazing marsh Coastal saltmarsh Mudflats Reedbeds 	The following BAP habitats are likely to experience more frequent and longer duration flooding as a result of Policy 1: <ul style="list-style-type: none"> Coastal and floodplain grazing marsh Coastal saltmarsh Mudflats Reedbeds 	The following BAP habitats are likely to experience more frequent and longer duration flooding as a result of Policy 2: <ul style="list-style-type: none"> Coastal and floodplain grazing marsh Coastal saltmarsh Mudflats Reedbeds 	The following BAP habitats are likely to experience more frequent and longer duration flooding as a result of Policy 3: <ul style="list-style-type: none"> Coastal and floodplain grazing marsh Coastal saltmarsh Mudflats Reedbeds 	The following BAP habitats are likely to be at risk to the same extent as under current baseline conditions, as a result of Policy 4: <ul style="list-style-type: none"> Coastal and floodplain grazing marsh Coastal saltmarsh 	The following BAP habitats are likely to experience less frequent and shorter duration flooding as a result of Policy 5: <ul style="list-style-type: none"> Coastal and floodplain grazing marsh Coastal saltmarsh 	There is no scope for carrying out policy six in this policy unit. Increased frequency of flooding to make space for water would result in a higher percentage area of risk to designated sites. Deliberately

Policy unit name/number:		Policy Unit 7: Wentlooge Levels								
N o.	Specific (appraisal) objectives	Indicators	Current baseline	Future baseline	Policy Options					
					P1 No active intervention	P2 Reduce existing actions	P3 Continue with existing actions to maintain current risk	P4 Take further action to sustain current risk	P5 Take further action to reduce current risk	P6 Take further action to increase frequency of flooding
			<ul style="list-style-type: none"> Reedbeds Rivers, streams and floodplains <p>The following BAP species are at flood risk during a 1% AEP fluvial flood event and a 0.5% AEP tidal flood event:</p> <ul style="list-style-type: none"> Allis Shad Brown Trout Double Line Moth Great Crested Newt Otter Spruce's Brittle-moss Twaite Shad Water Vole 	<ul style="list-style-type: none"> Rivers, streams and floodplains <p>The following BAP species are likely to experience more frequent and longer duration of flooding in the future:</p> <ul style="list-style-type: none"> Allis Shad Brown Trout Double Line Moth Great Crested Newt Otter Spruce's Brittle-moss Twaite Shad Water Vole 	<ul style="list-style-type: none"> Rivers, streams and floodplains <p>The following BAP species are likely to experience more frequent and longer duration flooding as a result of Policy 1:</p> <ul style="list-style-type: none"> Allis Shad Brown Trout Double Line Moth Great Crested Newt Otter Spruce's Brittle-moss Twaite Shad Water Vole 	<ul style="list-style-type: none"> Rivers, streams and floodplains <p>The following BAP species are likely to experience more frequent and longer duration flooding as a result of Policy 2:</p> <ul style="list-style-type: none"> Allis Shad Brown Trout Double Line Moth Great Crested Newt Otter Spruce's Brittle-moss Twaite Shad Water Vole 	<ul style="list-style-type: none"> Rivers, streams and floodplains <p>The following BAP species are likely to experience more frequent and longer duration flooding as a result of Policy 3:</p> <ul style="list-style-type: none"> Allis Shad Brown Trout Double Line Moth Great Crested Newt Otter Spruce's Brittle-moss Twaite Shad Water Vole 	<ul style="list-style-type: none"> Mudflats Reedbeds Rivers, streams and floodplains <p>The following BAP species are likely to be at risk to the same extent as under current baseline conditions, as a result of Policy 4:</p> <ul style="list-style-type: none"> Allis Shad Brown Trout Double Line Moth Great Crested Newt Otter Spruce's Brittle-moss Twaite Shad Water Vole 	<ul style="list-style-type: none"> Mudflats Reedbeds Rivers, streams and floodplains <p>The following BAP species are likely to experience less frequent and shorter duration flooding as a result of Policy 5:</p> <ul style="list-style-type: none"> Allis Shad Brown Trout Double Line Moth Great Crested Newt Otter Spruce's Brittle-moss Twaite Shad Water Vole 	<p>promoting flooding through schemes that make space for water would cause large scale disruption to the Wentlooge Levels and the Eastern Valleys as a whole</p>

Policy unit name/number:		Policy Unit 7: Wentlooge Levels									
N o.	Specific (appraisal) objectives	Indicators	Current baseline	Future baseline	Policy Options						
					P1 No active intervention	P2 Reduce existing actions	P3 Continue with existing actions to maintain current risk	P4 Take further action to sustain current risk	P5 Take further action to reduce current risk	P6 Take further action to increase frequency of flooding	
8.	Manage flood risk to Listed Buildings in the Wentlooge Levels and ensure sites which are currently 'safe' do not become at risk of flooding.	The number of Listed Buildings within the 1% AEP fluvial flood extent	There are no Listed Buildings at flood risk during the 1% AEP fluvial flood event There are no listed buildings at flood risk from a 0.5% AEP tidal flood event	There will be no Listed Buildings at flood risk during the 1% AEP fluvial flood event There will be no listed buildings at flood risk from a 0.5% AEP tidal flood event	There would be no Listed Buildings at flood risk during the 1% AEP fluvial flood event There would be no listed buildings at flood risk from a 0.5% AEP tidal flood event	There would be no Listed Buildings at flood risk during the 1% AEP fluvial flood event There would be no listed buildings at flood risk from a 0.5% AEP tidal flood event	There would be no Listed Buildings at flood risk during the 1% AEP fluvial flood event There would be no listed buildings at flood risk from a 0.5% AEP tidal flood event	There would be no Listed Buildings at flood risk during the 1% AEP fluvial flood event There would be no listed buildings at flood risk from a 0.5% AEP tidal flood event	There would be no Listed Buildings at flood risk during the 1% AEP fluvial flood event There would be no listed buildings at flood risk from a 0.5% AEP tidal flood event	There would be no Listed Buildings at flood risk during the 1% AEP fluvial flood event There would be no listed buildings at flood risk from a 0.5% AEP tidal flood event	There is no scope for carrying out policy six in this policy unit. Deliberately promoting flooding through schemes that make space for water would cause large scale disruption to the Wentlooge Levels and the Eastern Valleys as a whole

Form 12.7: Summary of the relative overall losses (including flood risk management costs) and gains (including flood alleviation benefits), thus demonstrating the rationale behind selecting the preferred option

Policy unit name/number:	Policy unit 7: Wentlooge Levels		
Policy options	Losses	Gains	Preferred policy option
Policy option P1			
Environmental	<p>LOW- A 3.1% increase in the area of the Gwent Levels – Rumney and Peterstone SSSI and an 1.9% increase in the area of the Gwent Levels – St. Brides SSSI at risk from a 1% AEP fluvial flood event may negatively affect these sites, particularly if flooding is from low quality water or non-fluvial sources.</p> <p>LOW- More frequent and longer duration flooding may adversely affect habitats intolerant of waterlogging. Impacts will be particularly severe if inundation is from low quality water or non-fluvial sources.</p> <p>LOW- Increase in BAP species at risk of flooding from a 1% AEP fluvial flood event.</p>	<p>LOW+ A 3.1% increase in the area of the Gwent Levels –Rumney and Peterstone SSSI and an 1.9% increase in the area of the Gwent Levels – St. Brides SSSI at risk from a 1% AEP fluvial flood event may benefit the wetland habitats and reens of these sites.</p> <p>LOW+ More frequent and longer duration flooding may enhance water-dependent habitats.</p> <p>LOW+ Stopping river maintenance and not maintaining defences may benefit BAP species through reduced disturbance. In particular, Allis and Twaite Shad, Otter and Water Vole are likely to benefit.</p>	Not preferred option – risk to people, property and the economy would remain very high and there would be very significant and high increases in risks in the future
Social	<p>MEDIUM- No additional people at risk from flooding in the 1% AEP fluvial flood event. 707 additional people at risk from flooding in the 0.5% AEP tidal flood event.</p> <p>MEDIUM- No additional people located within flood risk areas where flood depths exceed 0.5 metres in the 1% AEP fluvial flood event. 704 additional people located within flood risk areas where flood depths exceed 0.5 metres in the 0.5% AEP tidal flood event.</p> <p>MEDIUM- No additional residential properties at risk from flooding in the 1% AEP fluvial flood event. 223 additional residential properties at risk from flooding in the 0.5% AEP tidal flood event.</p> <p>MEDIUM- No additional properties would not be within an existing flood warning area in the 1% AEP fluvial flood event. 231 additional properties would not be within an existing flood warning area in the 0.5% AEP tidal flood event.</p> <p>NEUTRAL= No additional community assets would be at risk from flooding in the 1% AEP fluvial and 0.5% AEP tidal flood events.</p> <p>LOW- An additional 0.14km² of land where depths exceed 0.5 metres at risk from flooding in the 1% AEP fluvial flood event. An additional 0.15km² of land where depths exceed 0.5 metres at risk from flooding in the 0.5% AEP tidal flood event.</p>		

Policy unit 7: Wentlooge Levels			
Policy unit name/number:			
Policy options	Losses	Gains	Preferred policy option
Economic	<p>MEDIUM- No increase in economic damages to properties in the 1% AEP fluvial flood event. £8.6m increase in economic damages to properties in the 0.5% AEP tidal flood event.</p> <p>NEUTRAL= No additional critical assets would be at risk from flooding in the 1% AEP fluvial or 0.5% AEP tidal flood events.</p> <p>LOW- £85,000 increase in agricultural damages in the 1% AEP fluvial flood event. £16,000 increase in agricultural damages in the 0.5% AEP tidal flood event.</p>	<p>MEDIUM+ - £92,000 ASM saving due to stopping maintenance activities</p>	
Policy option P2			
Environmental	<p>LOW- A 0.8% increase in the area of the Gwent Levels –Rumney and Peterstone SSSI and a 0.3% increase in the area of the Gwent Levels – St. Brides SSSI at risk from a 1% AEP fluvial flood event may negatively affect these sites, particularly if flooding is from low quality water or non-fluvial sources.</p> <p>LOW- More frequent and longer duration flooding may adversely affect habitats intolerant of waterlogging. Impacts will be particularly severe if inundation is from low quality water or non-fluvial sources.</p> <p>LOW- Increase in BAP species at risk of flooding from a 1% AEP fluvial flood event.</p>	<p>LOW+ A 0.8% increase in the area of the Gwent Levels –Rumney and Peterstone SSSI and a 0.3% increase in the area of the Gwent Levels – St. Brides SSSI at risk from a 1% AEP fluvial flood event may benefit the wetland habitats and reens of these sites.</p> <p>LOW+ More frequent and longer duration flooding may enhance water-dependent habitats.</p> <p>LOW+ Reduced maintenance may benefit BAP species through reduced disturbance. In particular, Allis and Twaite Shad, Otter and Water Vole are likely to benefit.</p>	<p>Not preferred option – reducing flood risk management in any areas of the Wentlooge Levels policy unit would result in high increases in risk to people, property and the economy.</p>
Social	<p>NEUTRAL= No additional people at risk from flooding in the 1% AEP fluvial flood event.</p> <p>NEUTRAL= No additional people located within flood risk areas where flood depths exceed 0.5 metres in the 1% AEP fluvial flood event.</p> <p>NEUTRAL= No additional residential properties at risk from flooding in the 1% AEP fluvial flood event.</p> <p>NEUTRAL= No change in number of properties not within an existing flood warning area in the 1% AEP fluvial flood event.</p> <p>NEUTRAL= No additional community buildings would be at risk from flooding in the 1% AEP fluvial flood event.</p> <p>LOW- An additional 0.05km² of land where depths exceed 0.5 metres at risk from flooding in the 1% AEP fluvial flood event.</p>		

Policy unit 7: Wentlooge Levels			
Policy unit name/number:	Losses	Gains	Preferred policy option
Economic	<p>NEUTRAL= No increase in economic damages to properties in the 1% AEP fluvial flood event.</p> <p>NEUTRAL= No additional critical assets would be at risk from flooding in the 1% AEP fluvial flood event.</p> <p>LOW- £23,000 increase in agricultural damages in the 1% AEP fluvial flood event.</p>	<p>LOW+ £46,000 ASM saving due to reducing maintenance activities</p>	
Policy option P3			
Environmental	<p>LOW- A 0.3% increase in the area of the Gwent Levels –Rumney and Peterstone SSSI and a 0.1% increase in the area of the Gwent Levels – St. Brides SSSI at risk from a 1% AEP fluvial flood event may negatively affect these sites, particularly if flooding is from low quality water or non-fluvial sources.</p> <p>LOW- More frequent and longer duration flooding may adversely affect habitats intolerant of waterlogging. Impacts will be particularly severe if inundation is from low quality water or non-fluvial sources.</p> <p>LOW- Increase in BAP species at risk of flooding from a 1% AEP fluvial flood event.</p>	<p>LOW+ A 0.3% increase in the area of the Gwent Levels –Rumney and Peterstone SSSI and a 0.1% increase in the area of the Gwent Levels – St. Brides SSSI at risk from a 1% AEP fluvial flood event may benefit the wetland habitats and reens of these sites.</p> <p>LOW+ More frequent and longer duration flooding may enhance water-dependent habitats.</p>	<p>✓ Continue with existing actions to maintain current risk</p> <p>Fluvial flood risk is the same as current conditions. Although tidal flood risk increases, this will be reduced by the implementation of a P4 in policy unit six.</p>
Social	<p>MEDIUM- No additional people at risk from flooding in the 1% AEP fluvial flood event. 704 additional people at risk from flooding in the 0.5% AEP tidal flood event.</p> <p>MEDIUM- No additional people located within flood risk areas where flood depths exceed 0.5 metres in the 1% AEP fluvial flood event. 702 additional people located within flood risk areas where flood depths exceed 0.5 metres in the 0.5% AEP tidal flood event.</p> <p>MEDIUM- No additional residential properties at risk from flooding in the 1% AEP fluvial flood event. 223 additional residential properties at risk from flooding in the 0.5% AEP tidal flood event.</p> <p>NEUTRAL= No change in number of properties not within an existing flood warning area in the 1% AEP fluvial flood event. No change in number of properties not within an existing flood warning area in the 0.5% AEP tidal flood event.</p> <p>NEUTRAL= No additional community assets would be at risk from flooding in the 1% AEP fluvial or 0.5% AEP tidal flood events.</p> <p>LOW- An additional 0.03km² of land where depths exceed 0.5 metres at risk from flooding in the 1% AEP fluvial flood event. An additional 0.14km² of land where depths exceed 0.5 metres at risk from flooding in the 0.5% AEP tidal flood event.</p>		

Policy unit name/number:	Policy unit 7: Wentlooge Levels		
Policy options	Losses	Gains	Preferred policy option
Economic	<p>MEDIUM- No increase in economic damages to properties in the 1% AEP fluvial flood event. £8.2m increase in economic damages to properties in the 0.5% AEP tidal flood event.</p> <p>NEUTRAL= No additional critical assets would be at risk from flooding in the 1% AEP fluvial or 0.5% AEP tidal flood events.</p> <p>LOW- £11,000 increase in agricultural damages in the 1% AEP fluvial flood event. £16,000 increase in agricultural damages in the 0.5% AEP tidal flood event.</p>	<p>NEUTRAL= No increase in ASM as we would continue to maintain at the current level.</p>	
Policy option P4			
Environmental	<p>LOW- A 0.3% increase in the area of the Gwent Levels – Rumney and Peterstone SSSI and a 0.1% increase in the area of the Gwent Levels – St. Brides SSSI at risk from a 1% AEP fluvial flood event may negatively affect these sites, particularly if flooding is from low quality water or non-fluvial sources.</p> <p>NEUTRAL = No change in the frequency or duration of flooding to BAP habitats or species.</p> <p>MEDIUM- Delivery of CFMP action to sustain current flood risk may reduce the quality and quantity of the BAP habitat and species within the policy unit. Rivers, streams and floodplains, Brown Trout, Allis and Twaite Shad, Otter and Water Vole are likely to be particularly affected.</p>	<p>LOW+ A 0.3% increase in the area of the Gwent Levels – Rumney and Peterstone SSSI and a 0.1% increase in the area of the Gwent Levels – St. Brides SSSI at risk from a 1% AEP fluvial flood event may benefit the wetland habitats and reens of these sites.</p> <p>NEUTRAL = No change in the frequency or duration of flooding to BAP habitats or species.</p>	<p>Not preferred option – increasing our current level of management is not a sustainable option in this policy unit.</p>

Policy unit name/number:	Policy unit 7: Wentlooge Levels			
Policy options	Losses		Gains	Preferred policy option
Social	<p>NEUTRAL= No additional people at risk from flooding in the 1% AEP fluvial flood event. No additional people at risk from flooding in the 0.5% AEP tidal flood event.</p> <p>NEUTRAL= No additional people located within flood risk areas where flood depths exceed 0.5 metres in the 1% AEP fluvial flood event. No additional people located within flood risk areas where flood depths exceed 0.5 metres in the 0.5% AEP tidal flood event.</p> <p>NEUTRAL= No additional residential properties at risk from flooding in the 1% AEP fluvial flood event. No additional residential properties at risk from flooding in the 0.5% AEP tidal flood event.</p> <p>NEUTRAL= No change in number of properties not within an existing flood warning area in the 1% AEP fluvial flood event. No change in number of properties not within an existing flood warning area in the 0.5% AEP tidal flood event.</p> <p>NEUTRAL= No additional community assets would be at risk from flooding in the 1% AEP fluvial or 0.5% AEP tidal flood events.</p> <p>LOW- An additional 0.03km² of land where depths exceed 0.5 metres at risk from flooding in the 1% AEP fluvial flood event. There would be no additional land where depths exceed 0.5 metres at risk from flooding in the 0.5% AEP tidal flood event.</p>			
Economic	<p>NEUTRAL= No increase in economic damages to properties in the 1% AEP fluvial flood event. No increase in economic damages to properties in the 0.5% AEP tidal flood event.</p> <p>NEUTRAL= No additional critical assets would be at risk from flooding in the 1% AEP fluvial or 0.5% AEP tidal flood events.</p> <p>LOW- £11,000 increase in agricultural damages in the 1% AEP fluvial flood event. No increase in agricultural damages in the 0.5% AEP tidal flood event.</p>			
Policy option P5				

Policy unit name/number:	Policy unit 7: Wentlooge Levels		
Policy options	Losses	Gains	Preferred policy option
Environmental	<p>LOW- A 0.3% increase in the area of the Gwent Levels – Rumney and Peterstone SSSI and a 0.1% increase in the area of the Gwent Levels – St. Brides SSSI at risk from a 1% AEP fluvial flood event may negatively affect these sites, particularly if flooding is from low quality water or non-fluvial sources.</p> <p>MEDIUM- Delivery of CFMP policy to reduce current flood risk may reduce the quality and quantity of the BAP habitat and species within the policy unit. Rivers, streams and floodplains, Brown Trout, Allis and Twaite Shad, Otter and Water Vole are likely to be particularly affected.</p> <p>LOW- Less frequent and shorter duration flooding of BAP habitats may adversely affect habitats dependent on waterlogging</p>	<p>LOW+ A 0.3% increase in the area of the Gwent Levels – Rumney and Peterstone SSSI and a 0.1% increase in the area of the Gwent Levels – St. Brides SSSI at risk from a 1% AEP fluvial flood event may benefit the wetland habitats and reens of these sites.</p> <p>LOW+ Less frequent and shorter duration flooding of BAP habitats will benefit BAP habitats intolerant of waterlogging.</p>	<p>Not preferred option – increasing our current level of management is not a sustainable option in this policy unit.</p>
Social	<p>NEUTRAL= No additional people at risk from flooding in the 1% AEP fluvial flood event. No additional people at risk from flooding in the 0.5% AEP tidal flood event.</p> <p>NEUTRAL= No additional people located within flood risk areas where flood depths exceed 0.5 metres in the 1% AEP fluvial flood event. No additional people located within flood risk areas where flood depths exceed 0.5 metres in the 0.5% AEP tidal flood event.</p> <p>NEUTRAL= No additional residential properties at risk from flooding in the 1% AEP fluvial flood event. No additional residential properties at risk from flooding in the 0.5% AEP tidal flood event.</p> <p>NEUTRAL= No change in number of properties not within an existing flood warning area in the 1% AEP fluvial flood event. No change in number of properties not within an existing flood warning area in the 0.5% AEP tidal flood event.</p> <p>NEUTRAL= No additional community assets would be at risk from flooding in the 1% AEP fluvial or 0.5% AEP tidal flood events.</p> <p>LOW- An additional 0.03km² of land where depths exceed 0.5 metres at risk from flooding in the 1% AEP fluvial flood event. There would be no additional land where depths exceed 0.5 metres at risk from flooding in the 0.5% AEP tidal flood event.</p>		
Economic	<p>NEUTRAL= No increase in economic damages to properties in the 1% AEP fluvial flood event. No increase in economic damages to properties in the 0.5% AEP tidal flood event.</p> <p>NEUTRAL= No additional critical assets would be at risk from flooding in the 1% AEP fluvial or 0.5% AEP tidal flood events.</p> <p>NEUTRAL= No increase in agricultural damages in the 1% AEP fluvial flood event. No increase in agricultural damages in the 0.5% AEP tidal flood event.</p>		

Policy unit name/number:		Policy unit 7: Wentlooge Levels		
Policy options		Losses	Gains	Preferred policy option
Policy option P6				
Environmental	There is no scope for carrying out policy six in this policy unit. Increased frequency of flooding to make space for water would result in a very high number of people at risk and very high economic damages. Deliberately promoting flooding through schemes that make space for water would cause large-scale community disruption to the Wentlooge Levels and the Eastern Valleys as a whole.	There is no scope for carrying out policy six in this policy unit. Increased frequency of flooding to make space for water would result in a very high number of people at risk and very high economic damages. Deliberately promoting flooding through schemes that make space for water would cause large-scale community disruption to the Wentlooge Levels and the Eastern Valleys as a whole.	There is no scope for carrying out policy six in this policy unit. Increased frequency of flooding to make space for water would result in a very high number of people at risk and very high economic damages. Deliberately promoting flooding through schemes that make space for water would cause large-scale community disruption to the Wentlooge Levels and the Eastern Valleys as a whole.	Not preferred option – there is no scope for carrying out policy six in this policy unit. There is very limited opportunity for increasing the frequency of flooding as a flood risk management option within this policy unit.
Social				
Economic				

Key

HIGH:	<p>High negative</p> <p>A policy has a 'high negative' effect where it could contribute to a social, economic or environmental objective in a significantly negative way.</p> <p>A 'high negative' effect could be:</p> <ul style="list-style-type: none"> (i) a very large increase in current flood risk; (ii) very large projected increases in flood risk under future conditions, and/or; (iii) significant additional social, economic and/or environmental losses.
MEDIUM:	<p>Medium negative</p> <p>A policy has a 'medium negative' effect where it could contribute to a social, economic or environmental objective in a negative way.</p> <p>A 'medium negative' effect could be:</p> <ul style="list-style-type: none"> (i) an increase in current flood risk; (ii) a projected increase in flood risk under future conditions, and/or; (iii) social, economic and/or environmental losses.
LOW:	<p>Low negative</p> <p>A policy has a 'low negative' effect where it could make a limited contribution to a social, economic or environment objective, but where the overall contribution would be negative.</p> <p>A 'low negative' effect could be:</p> <ul style="list-style-type: none"> (i) an overall increase in current flood risk; (ii) an overall increase in flood risk under future conditions, and/or; (iii) overall social, economic and/or environmental losses.
NEUTRAL:	<p>Neutral</p> <p>A policy has a 'neutral' effect where it makes neither a positive or negative contribution to a social, economic or environmental objective.</p> <p>A 'neutral' effect could be:</p> <ul style="list-style-type: none"> (i) no change in current level of risk. In this instance the current level of risk would have to be low, so that the residual risk after a neutral policy was implemented remained acceptable; (ii) no change in flood risk under future conditions. In this instance projected future risk would need to be low so that the residual risk after a neutral policy was implemented remained acceptable, and/or; (iii) no additional social, economic and/or environmental gains or losses. <p>Policy options may also be 'neutral' where they are not relevant in a particular policy unit, or where it is not feasible for a policy option to contribute to an objective.</p>
HIGH:	<p>High positive</p> <p>A policy has a 'high positive' effect where it could contribute to a social, economic or environmental objective in a significantly positive way.</p> <p>A 'high positive' effect could be:</p> <ul style="list-style-type: none"> (i) a very large reduction in current flood risk; (ii) avoiding/reducing very large projected increases in flood risk under future conditions, and/or; (iii) significant additional social, economic and/or environmental gains.
MEDIUM:	<p>Medium positive</p> <p>A policy has a 'medium positive' effect where it could contribute to a social, economic or environmental objective in a positive way.</p> <p>A 'medium positive' effect could be:</p> <ul style="list-style-type: none"> (i) a reduction in current flood risk; (ii) avoiding/reducing projected increases in flood risk under future conditions, and/or; (iii) additional social, economic and/or environmental gains.
LOW:	<p>Low positive</p> <p>A policy has a 'low positive' effect where it could make a limited contribution to a social, economic or environment objective, but where the overall contribution would be positive.</p> <p>A 'low positive' effect could be:</p> <ul style="list-style-type: none"> (i) an overall reduction in current flood risk; (ii) an overall avoidance/reduction in flood risk under future conditions,

Form 12.8: Summary of the preferred policy

Policy Unit name/number:	Policy Unit 7: Wentlooge Levels The policy unit is located within the coastal plain of the Eastern Valleys CFMP area.
Problem / risk:	<p>There are no main rivers in this policy unit. The fluvial flood risk comes from the reens and drains in the area. There is also a tidal flood risk in this policy unit from the River Ebbw. We currently spend approximately £92,000 per year on maintenance and operations in this policy unit.</p> <p>Current and future fluvial flood risk is low, with no people or properties at flood risk in either scenario or for any event. Tidal flood risk affects areas close to the River Ebbw in the future.</p>
Policy selected	<p>Policy 3 – continue with existing or alternative actions to manage flood risk at the current level</p> <p>We have selected this policy based on the risk posed by inland flooding sources and tidal flooding sources. By selecting this policy we are accepting that flood risk will increase in time from the current level of risk. We consider that the additional risk that will be present in the future can be minimised through influencing and informing.</p> <p>If the risks posed by tidal flooding were removed from the policy appraisal process, preliminary estimates suggest that this policy would remain a P3. This is mainly due to the environmental sensitivity of this area and the lack of knowledge we have of fluvial flooding in the area.</p>
Justification and alternative policies considered	<p>Policy 3 sets a framework where we will continue with existing or alternative actions to manage flood risk at the current level. This policy is appropriate for this policy unit for the following reasons:</p> <ul style="list-style-type: none"> - The current and future levels of fluvial flood risk are low. - The future levels of tidal flood risk will be managed by the implementation of policy four in policy unit six, which will raise the defences that are being overtopped. - There are no critical or community assets at flood risk under current or future scenarios. - The current level of maintenance should be continued or improved as to help improve conveyance, reducing the impacts of flooding and maintaining water levels. - There is a need for better understanding of flood risk from fluvial, tidal and coastal flooding in this policy unit, in order to better inform our future flood risk management measures. This cannot be achieved under policy 2. - The Wentlooge Levels is a sensitive environmental site and reducing the maintenance we undertake now may have negative impacts. Under policy 3, we will be maintaining what we are doing now. <p>The main area of the Wentlooge Levels is situated in the coastal plain of the Eastern Valleys. There are no formal flood defences in this area.</p> <p>The current and future fluvial flood risk in the Wentlooge Levels is low as there are no people or properties at flood risk from any flood event. The agricultural damages are also low because of the small flood extent.</p> <p>The current scale of tidal flood risk in the main area of the Wentlooge Levels is low. The estimated total property damages are low for a 0.5% AEP tidal flood event.</p> <p>In the future, the 0.5% AEP tidal flood event damages for the Wentlooge Levels increase, affecting approximately 716 properties. The majority of these are in Duffryn.</p> <p>Annual average property damages are zero as there are no properties flooded in current or future flood events.</p>

Fluvial flood risk has been calculated from a broad-scale modelling approach as we lack an understanding of the fluvial flooding mechanisms in this policy unit. The maintenance on the reens and drains is likely to have an important control on flood risk, and due to our lack of knowledge, it is prudent to continue the maintenance we are undertaking now until we understand the risk further. The current maintenance regime is also likely to positively affect the environmentally designated sites in the policy unit, reducing this maintenance may have detrimental effects.

Gains and losses under preferred policy (policy three)

Social

Policy three gives three medium losses, one low loss, with two neutral, against our social CFMP objectives and indicators. Flood risk would be managed sufficiently under this policy as current fluvial risk is minimal, and the tidal risk will be managed under the P4 in policy unit six.

Economic

Policy three gives one medium and one low loss, and one neutral, against our economic CFMP objectives and indicators. Flood risk would be managed sufficiently under this policy as current fluvial risk is minimal, and the tidal risk will be managed under the P4 in policy unit six.

Environmental

Policy three, 3 low losses and 2 low gains against our environmental CFMP objectives and indicators. Rivers in policy unit seven are already maintained; therefore we would not expect the natural environment to be significantly affected if we took further action to reduce risk to society and the economy. We do not expect that an increase in flooding will have a significant negative impact on environmental sites.

Alternative policies considered

Policy one – *No active intervention*. The increased risk to people (+710), properties (+220) and the economy (+£8.6m) would be high in terms of tidal flood risk and there would be significant and high increases in risks in the future.

Policy two – *Reduce current levels of flood risk management*. The increased risk to people, properties and the economy would be high in terms of tidal flood risk and there would be significant and high increases in risks in the future.

Policy four – *Take further action to sustain the current level of flood risk into the future*. In comparison to risk and consequences as a result of flooding across other areas of the Eastern Valleys, flood risk is comparatively low, and further investment towards a structural response is considered not to be justified.

Policy five – *Take further action to reduce flood risk (now and/or into the future)* In comparison to risk and consequences as a result of flooding across other areas of the Eastern Valleys, flood risk is comparatively low, and further investment towards a structural response is considered not to be justified.

Policy six – *Take action with others to store water or manage run-off in locations that provide overall flood risk reduction or environmental benefits, locally or elsewhere in the catchment*. There is no scope for carrying out policy six in this policy unit. There is very limited opportunity for increasing the frequency of flooding as a flood risk management option within this policy unit.

Catchment-wide opportunities & constraints	<p>There may be opportunities to use alternative maintenance activities throughout the policy unit to enable gradual enhancement of channel habitats.</p> <p>There are few opportunities within this policy unit to reconnect the reens and drains with their floodplains as the reens and drains already flood regularly in the Wentlooge Levels.</p>
Actions	<ul style="list-style-type: none"> • To undertake a detailed modelling study of the reens and drainage system to fully understand the fluvial flood risks in the policy unit. • In partnership with Cardiff and Newport Local Authorities, we should enforce stringent building controls on new development within flood risk areas. Suitable land allocations for new development should first be sought outside of flood risk areas. • SUDs and building regulations (resilience) should be incorporated, where appropriate, into all new developments.
Risks, uncertainties & dependencies	<p>The damages to the Wentlooge Levels policy unit from flooding are estimates that are considered sufficiently accurate to justify the cost of further investigations into the appropriate intervention to reduce flood risk. More detailed assessments will be required to identify the actual level of investment that can be justified and its relative priority with other flood risk reduction work.</p> <p>We will be accepting some flood risk by selecting policy three, where risks to people and property remain, investment will be focused on influencing and informing, to reduce the consequences if flooding occurs.</p> <p>There were no existing models of the reens system available for use in this policy unit, therefore, a broadscale modeling approach was used. There is more uncertainty with the broadscale modeling than areas with existing models.</p> <p>For this policy to be successful, appropriate policies and actions must be implemented throughout the Eastern Valleys.</p>

Form 12.9: Requirements for further policy development and appraisal

Is there a need for further policy development?	No
If yes, then mark Policy Options for more detailed development. Some complex policies may require more detailed development, probably at Strategy Plan level.	
Is there a need for further more detailed appraisal?	No
If yes, take forward to Strategy study.	

Form 12.10: Indicators for monitoring, review and evaluation

Set out the indicators that need to be included in the policy implementation plan, for policy monitoring, drawing on the residual risks and likely impacts identified above. This will allow better review and evaluation of the policy when implemented.	
Monitoring	Significance/impact
Hydrometric monitoring of river flows and levels, sea level, rainfall and groundwater levels throughout the catchment in order to monitor changes in climate	<ul style="list-style-type: none"> Additional data may change our assessment of current or future conditions
Scientific advancements in flood risk management	<ul style="list-style-type: none"> Improved sea level rise predictions Improved predictions in changes to river flows
Land use change monitored using satellite imagery	<ul style="list-style-type: none"> Further information on land use change may change future predictions of flood risk
Actual development rates	<ul style="list-style-type: none"> Need to check if urbanisation predictions made are realistic in light of current and future development undertaken
Designation and condition of environmental sites	<ul style="list-style-type: none"> May change the chosen policy if additional sites are designated. Monitoring of site condition will confirm that chosen CFMP policies have not adversely affect designated sites
Designation and condition of historic environmental assets	<ul style="list-style-type: none"> May change the chosen policy if additional sites are designated. Monitoring of site condition will confirm that chosen CFMP policies have not adversely affect designated sites
Detrimental impacts of flood risk management projects on BAP habitats and species	<ul style="list-style-type: none"> To ensure that specific flood risk management projects do not adversely affect BAP habitats and species
Level of uptake of flood warning services	<ul style="list-style-type: none"> Monitor whether the community are aware of the flood risks
Condition of flood defences	<ul style="list-style-type: none"> Need to maintain defences in line with the policy chosen
Actual expenditure on maintenance activities by policy unit, subdivided into activities.	<ul style="list-style-type: none"> Ensure that money is being targeted according to policy chosen
Actual expenditure on capital works to reduce flood risk	<ul style="list-style-type: none"> Need to ensure that these actions are in keeping with the policy chosen
Improved documentation of actual flood events: <ul style="list-style-type: none"> Number of properties/assets/ environmental sites/historic environment assets flooded Source of flooding Cause of flooding Whether due to defence failure 	<ul style="list-style-type: none"> Information on actual flood events needs to be better recorded in order to understand the relative importance of the various sources of flooding
Construction of critical infrastructure	<ul style="list-style-type: none"> May change the chosen policy if additional critical infrastructure is constructed within the floodplain

At this level of plan, the mitigation and enhancement measures are integral to the policy appraisal. Where we have the potential to enhance the environment we have included this potential within the appraisal objectives. Mitigation measures at this level are generally included as part of the policy options, so that a less detrimental impact will tend to be an alternative policy option. We therefore can not identify any further specific mitigation measures at the policy level. At a lower level in our planning hierarchy, when we are investigating the details of how we will implement flood risk management measures, we will be undertaking an appropriate level of environmental assessment which will, in turn, identify more relevant mitigation measures to the impacts arising.

A summary of the findings of appropriate assessment, detailing the proposed mitigation measures, are given in Table B6 below. An appropriate assessment was required for in-combination impacts only on the Severn Estuary cSAC, SPA and Ramsar sites. It was determined that there would be no likely significant effect on the Aberbargoed Grassland SAC and Usk Bat Sites SAC, and the Severn Estuary cSAC, SPA and Ramsar sites from the Eastern Valleys CFMP alone.

Table B6: Summary of Appropriate Assessment requirements for Natura 2000 sites

Policy Unit and sites at risk	Findings of the Appropriate Assessment undertaken	Justification for pursuit of option and commitment to mitigation and compensation
Severn Estuary cSAC, SPA and Ramsar Site: Policy units 1, 3 and 6	No significant adverse in-combination effects with other plans and projects were identified.	None required.

B.4.3 Cumulative environmental effects

SEA requires assessment of cumulative and synergistic effects. This section sets out the significant environmental effects of the plan as a whole, which have been considered in relation to each of the environmental objectives. The cumulative impacts of the CFMP are determined from analysis of the results of the policy appraisal process, which is detailed in forms 12.6 and 12.7. The same scale of assessment as used in form 12.7 of the policy appraisal is used to assess the cumulative impact. The key below shows this scale of assessment.

Key

HIGH:	<p>High negative</p> <p>A policy has a 'high negative' effect where it could contribute to a social, economic or environmental objective in a significantly negative way.</p> <p>A 'high negative' effect could be:</p> <ul style="list-style-type: none"> (i) a very large increase in current flood risk; (ii) very large projected increases in flood risk under future conditions, and/or; (iii) significant additional social, economic and/or environmental losses.
MEDIUM:	<p>Medium negative</p> <p>A policy has a 'medium negative' effect where it could contribute to a social, economic or environmental objective in a negative way.</p> <p>A 'medium negative' effect could be:</p> <ul style="list-style-type: none"> (i) an increase in current flood risk; (ii) a projected increase in flood risk under future conditions, and/or; (iii) social, economic and/or environmental losses.
LOW:	<p>Low negative</p> <p>A policy has a 'low negative' effect where it could make a limited contribution to a social, economic or environment objective, but where the overall contribution would be negative.</p> <p>A 'low negative' effect could be:</p> <ul style="list-style-type: none"> (i) an overall increase in current flood risk; (ii) an overall increase in flood risk under future conditions, and/or; (iii) overall social, economic and/or environmental losses.
NEUTRAL:	<p>Neutral</p> <p>A policy has a 'neutral' effect where it makes neither a positive or negative contribution to a social, economic or environmental objective.</p> <p>A 'neutral' effect could be:</p> <ul style="list-style-type: none"> (i) no change in current level of risk. In this instance the current level of risk would have to be low, so that the residual risk after a neutral policy was implemented remained acceptable; (ii) no change in flood risk under future conditions. In this instance projected future risk would need to be low so that the residual risk after a neutral policy was implemented remained acceptable, and/or; (iii) no additional social, economic and/or environmental gains or losses. <p>Policy options may also be 'neutral' where they are not relevant in a particular policy unit, or where it is not feasible for a policy option to contribute to an objective.</p>
HIGH:	<p>High positive</p> <p>A policy has a 'high positive' effect where it could contribute to a social, economic or environmental objective in a significantly positive way.</p> <p>A 'high positive' effect could be:</p> <ul style="list-style-type: none"> (i) a very large reduction in current flood risk; (ii) avoiding/reducing very large projected increases in flood risk under future conditions, and/or; (iii) significant additional social, economic and/or environmental gains.
MEDIUM:	<p>Medium positive</p> <p>A policy has a 'medium positive' effect where it could contribute to a social, economic or environmental objective in a positive way.</p> <p>A 'medium positive' effect could be:</p> <ul style="list-style-type: none"> (i) a reduction in current flood risk; (ii) avoiding/reducing projected increases in flood risk under future conditions, and/or; (iii) additional social, economic and/or environmental gains.
LOW:	<p>Low positive</p> <p>A policy has a 'low positive' effect where it could make a limited contribution to a social, economic or environment objective, but where the overall contribution would be positive.</p> <p>A 'low positive' effect could be:</p> <ul style="list-style-type: none"> (i) an overall reduction in current flood risk; (ii) an overall avoidance/reduction in flood risk under future conditions,

The cumulative impacts are determined from the impacts identified in the losses and gains table (12.7) of the policy appraisal. The overall cumulative impact of the chosen CFMP policy is then determined by assessing the cumulative impact on a catchment level. This is done in relation to each environmental objective. The cumulative impact assessment is undertaken in relation to the current and future baseline.

The cumulative impact assessment then goes on to consider the environmental effects of potential interactions between the CFMP and relevant plans and programmes within the catchment. These plans and programmes are summarised in Table B3. The findings of the assessment of cumulative environmental impacts are summarised in Table B7. The economic objectives have not been considered.

Table B7: Summary of cumulative issues

Catchment Objective	Cumulative effects across the whole plan area							Sum of policy unit impacts	Interaction of CFMP with relevant Plans and Programmes
	PU1	PU2	PU3	PU4	PU5	PU6	PU7		
	P5	P3	P5	P2	P4	P4	P3		
Reduce the risk of harm to life from flooding.	MEDIUM +	MEDIUM -	HIGH +	NEUTRAL	LOW -	MEDIUM -	MEDIUM -	MEDIUM +	<u>Land use Planning (various)</u> <ul style="list-style-type: none"> Negative interaction where promotion of economic growth encourages development in areas where CFMP policies will increase flood risk. Positive interaction as Unitary and Local Plans, working with the CFMP, should ensure that future development is acceptable in terms of flood risk, and is located away from flood risk areas and functional flood plains. <u>Flood Risk Management Plans and Policies (various)</u> <ul style="list-style-type: none"> The CFMP will complement flood risk management plans and policies which aim to manage flood risks to people and property, and deliver environmental, economic and social benefits. Positive interactions to develop sustainable flood risk management planning.
	<p><u>Summary of effects on sensitive receptors:</u></p> <ul style="list-style-type: none"> Under the current baseline conditions a total of 1315 people are at risk from a 1% AEP fluvial flood event, where depths exceed 0.5m, rising to 7175 under future baseline conditions. As a result of the chosen policies, the number of people at risk will be 1189. This represents a decrease from the current baseline (-126), and a significant decrease from the future baseline (-5986). Under the current baseline conditions a total of 915 properties are at risk from a 1% AEP fluvial flood event, in areas without existing flood warning, rising to 2323 under future baseline conditions. As a result of the chosen policies, the number of properties at risk will be 538, a significant reduction from the baseline scenarios. Under current baseline conditions a total of 173 people are at risk from a 0.5% AEP tidally influenced flood event, where depths exceed 0.5m, rising to 2502 under future baseline conditions. As a result of the chosen policies, the number of people at risk from a 0.5% AEP tidal flood event will increase in comparison to the current baseline (+630), but decrease in relation to the future baseline (-1520). Under the current baseline conditions a total of 99 properties, in areas without existing flood warning, are at risk from a 0.5% AEP tidally influenced flood event, rising to 1389 under future baseline conditions. As a result of the chosen policies, the number of properties at risk will reduce to 31. <p>Overall the cumulative impact has been assessed as a medium gain as the risk to people and property from fluvial flooding decreases. A significant decrease (-5986) in the number of people at risk from fluvial flooding occurs as a result of the chosen policies, in comparison with the future baseline. However, the increases in the number of people at risk from tidal flooding (+630) results in the gains being limited to medium on the catchment level.</p>								

Catchment Objective	Cumulative effects across the whole plan area							Sum of policy unit impacts	Interaction of CFMP with relevant Plans and Programmes
	PU1	PU2	PU3	PU4	PU5	PU6	PU7		
	P5	P3	P5	P2	P4	P4	P3		
Reduce community disruption caused by flooding.	MEDIUM +	MEDIUM -	HIGH +	LOW -	LOW -	LOW -	LOW -	MEDIUM +	<p><u>Land use Planning (various)</u></p> <ul style="list-style-type: none"> Negative interaction where promotion of economic growth encourages development in areas where CFMP policies will increase flood risk. Positive interaction as Unitary and Local Plans, working with the CFMP, should ensure that future development is acceptable in terms of flood risk, and is located away from flood risk areas and functional flood plains. <p><u>Flood Risk Management Plans and Policies (various)</u></p> <ul style="list-style-type: none"> The CFMP will complement these plans and policies which aim to manage flood risks to people and property, and deliver environmental, economic and social benefits.
	<p><u>Summary of effects on sensitive receptors:</u></p> <ul style="list-style-type: none"> As a result of the chosen policies, the number of residential properties at risk from a 1% AEP fluvial flood event will be 1099. This represents a decrease (-378) from the current baseline, and a significant decrease (-3867) from future baseline conditions. A range of community assets are currently at risk from a 1% AEP fluvial flood. The number of assets increases under the future baseline conditions. As a result of the chosen policies, and in comparison to the current baseline, 71 fewer retail buildings and 2 less schools would be at risk. However, an additional 5 community centres would be at risk. Under the current baseline conditions a total of 192 residential properties are at risk from a 0.5% AEP tidally influenced flood event, rising to 1768 under future baseline conditions. As a result of the chosen policies, the number of residential properties at risk from tidal flooding will be 310. This is an increase (+118) from the current baseline and decrease (-1458) from the future baseline. A range of community assets are currently at risk from a 0.5% AEP tidally influenced flood event, with the number increases under the future baseline conditions. As a result of the chosen policies all community assets currently at risk from tidal flooding will benefit from reduced flood risk, and will be no longer at risk from a 0.5% AEP tidal flood event. <p>Overall the cumulative impact has been assessed as a medium gain as the number of residential properties and community assets at risk from fluvial flooding decreases (with the exception of community centres), with significant decreases in the number of residential properties occurring in relation to the future baseline (-3867). The increases in the number of residential properties at risk from tidally influenced flooding, in relation to the current baseline, limits the overall gain to medium at a catchment level.</p>								
Catchment Objective	Cumulative effects across the whole plan area								Interaction of CFMP with relevant Plans

	PU1	PU2	PU3	PU4	PU5	PU6	PU7	Sum of policy unit impacts	and Programmes
	P5	P3	P5	P2	P4	P4	P3		
Reduce risk to critical transport routes and critical assets from flooding.	HIGH +	LOW -	LOW +	NEUTRAL	NEUTRAL	LOW -	NEUTRAL	MEDIUM +	<u>Land use Planning (various)</u> <ul style="list-style-type: none"> Negative interaction where promotion of economic growth encourages development in areas where CFMP policies will increase flood risk. Positive interaction as Unitary and Local Plans, working with the CFMP, should ensure that future development is acceptable in terms of flood risk, and is located away from flood risk areas and functional flood plains. <u>Flood Risk Management Plans and Policies (various)</u> <ul style="list-style-type: none"> The CFMP will complement these plans and policies which aim to manage flood risks to critical infrastructure, and deliver environmental, economic and social benefits.
	<p><u>Summary of effects on sensitive receptors:</u></p> <ul style="list-style-type: none"> As a result of the chosen policies, the number of critical assets at risk from a 1% AEP fluvial flood event will be 9 electricity stations, 0.8km of railway line and 2.1km of critical transport route. This is an increase of 1 electricity station and 0.8km of railway line from the current baseline, but a decrease of 0.4km of critical transport route. However, in comparison to the future baseline, the chosen CFMP policies will result in significantly fewer critical assets being at risk from a 1% AEP fluvial flood event. The CFMP policies will result increased protection to 14 electricity stations, 5.8km of critical transport route, 3 police stations, 1 fire station, 0.7km of railway line, 1 ambulance station and 1 COMAH site. These sites would be at risk from a 1% AEP fluvial flood event under the future baseline scenario, but would not be at risk as a result of the chosen CFMP policies. As a result of the chosen policies, the number of critical assets at risk from a 0.5% AEP tidally influenced flood event will only be 1 landfill site. This represents a significant reduction in the number of critical assets at risk, in comparison with the current baseline. Currently, 4 electricity stations, 0.9km of critical transport route, 1 police station, 1 fire station and 1 landfill site are at risk. The chosen CFMP policies would increase protection to all these assets, with the exception of one landfill site. In comparison to the future baseline, the chosen CFMP policies will result in significantly fewer critical assets being at risk from a 0.5% AEP tidal flood event. <p>Overall the cumulative impact has been assessed as a medium gain due to the increased protection provided to a significant number of critical assets within the catchment, particularly from tidal flooding. However, as a result of the chosen CFMP 9 electricity stations, 0.8km of railway line and 2.1km of critical transport route will be at risk from a 1% AEP fluvial flood event and 1 landfill site will be at risk from a 0.5% AEP tidal flood event, limiting the gains.</p>								
Catchment Objective	Cumulative effects across the whole plan area								Interaction of CFMP with relevant Plans and Programmes
	PU1	PU2	PU3	PU4	PU5	PU6	PU7	Sum of	

	P5	P3	P5	P2	P4	P4	P3	policy unit impacts	
Ensure no deterioration of designated international and national nature conservation sites	NEUTRAL	NEUTRAL	NEUTRAL	NEUTRAL	NEUTRAL	NEUTRAL	NEUTRAL	NEUTRAL	<p><u>Land Use Planning (various)</u></p> <ul style="list-style-type: none"> Positive interactions between Unitary and Local Plans, and the CFMP through the protection and enhancement of sites of nature conservation importance. <p><u>Caldicot and Wentlooge Levels IDB Water Level Management Plan (WLMP)</u></p> <ul style="list-style-type: none"> Together the CFMP and WLMP will influence water level management in Policy Unit 7 (Wentlooge Levels) for the benefit for nature conservation. <p><u>Rural Land Management Planning (various)</u></p> <ul style="list-style-type: none"> Positive interactions between rural land use plans and the CFMP through the conservation of the natural environment and designated nature conservation sites. <p><u>Welsh Assembly Government Environment Strategy</u></p> <ul style="list-style-type: none"> One of the outcomes of this strategy is that sites of international, Welsh and local importance are in favourable condition to support the species and habitats for which they have been identified. The CFMP objectives are compatible with this aim, and the CFMP may provide opportunity to meet this aim
	<p><u>Summary of effects on sensitive receptors:</u></p> <ul style="list-style-type: none"> As a result of the chosen CFMP policies no international or European sites will be at risk from fluvial or tidally influenced flooding. As a result of the chosen CFMP policies no nationally designated nature conservation sites will be at risk from tidally influenced flooding. Currently an area of 32.2 ha, within two SSSIs (the Gwent Levels – Rumney and Peterstone and Gwent Levels – St Brides), is at risk from a 1% AEP fluvial flood event. In the future, one additional SSSI (Plas Machen Wood) will be at risk from a 1% AEP fluvial flood event. In the future, a total of 62.8 ha of SSSI would be at risk from a 1% AEP fluvial flood event. As a result of the chosen CFMP policies these three SSSI will remain at risk from fluvial flooding. In relation to the current baseline the area of SSSI at risk will increase by 5.7 ha, but in relation to the future baseline the area will decrease by 24.9 ha. The impact on the Plas Machen Wood SSSI is likely to be neutral due to the nature of the site and the limited extent of flooding. The two SSSI in the Gwent Levels may be negatively or positively affected. Increased flooding may benefit wetland habitats and reens of these sites, however, some features may be negatively affected by flooding, particularly if flooding is from low quality water or non-fluvial sources. <p>Overall the cumulative impact on designated sites has been assessed as neutral. This is because only a small proportion of the three sites at risk will be affected by fluvial flooding, and due to the nature of the site the impacts are likely to be neutral, or a combination of positive or negative impacts.</p>								
Catchment Objective	Cumulative effects across the whole plan area								Interaction of CFMP with relevant Plans and Programmes
	PU1	PU2	PU3	PU4	PU5	PU6	PU7	Sum of policy unit impacts	

	P5	P3	P5	P2	P4	P4	P3	
Protect and improve habitats and species diversity, particularly BAP habitats and those relying on freshwater	NEUTRAL	NEUTRAL	NEUTRAL	NEUTRAL	LOW -	LOW -	NEUTRAL	NEUTRAL
<p><u>Summary of effects on sensitive receptors:</u></p> <ul style="list-style-type: none"> • Flooding may have positive or negative impacts on BAP habitats and species. Water-dependent habitats may benefit from inundation, whereas habitats intolerant of waterlogging may be negatively affected. Impacts will be particularly severe if inundation is from low quality water. • In those areas of the catchment where delivery of the CFMP policies will reduce or sustain current levels of flood risk (e.g. Cardiff, Rhymney Corridor, Upper Ebbw and the Ebbw Corridor) the impact on BAP habitats and species is likely to be negative. In particular the BAP habitat of Rivers, streams and floodplains is likely to be adversely affected, along with BAP species such as Otter, Water Vole and Brown Trout. • In those areas of the catchment where the delivery of CFMP policies will reduce the current level of flood risk management (e.g. Upper and Mid Reaches) BAP habitats and species may benefit, for example through reduced disturbance. <p>Overall the cumulative impact on BAP habitats and species has been assessed as neutral. This is because both flooding and actions arising from the chosen CFMP policies can have both positive and negative impacts on a catchment level. The lack of information on the exact number and location of BAP habitats and species prevents a quantitative assessment being undertaken.</p>								
<p><u>Water Management Planning (various)</u></p> <ul style="list-style-type: none"> • Positive interactions through the potential to restore rivers to a more natural functioning watercourse. <p><u>Caldicot and Wentlooge Levels IDB WLMP</u></p> <ul style="list-style-type: none"> • Any changes in water levels as a result of the CFMP policies in the Wentlooge Levels must consider all adequate safeguards in relation to biodiversity. <p><u>Rural Land Management Planning (various)</u></p> <ul style="list-style-type: none"> • Rural land use management plans (e.g. agri-environment schemes, Rural Development Plan, Farming for the Future) could interact with the CFMP to influence rural land management for the benefit of wildlife and biodiversity. <p><u>CCW Plans (various)</u></p> <ul style="list-style-type: none"> • Positive interactions through the delivery of CFMP policies which may help CCW restore urban parklands (e.g. Roath Park in Cardiff) and increase the area of BAP priority habitat by 2%. <p><u>Welsh Assembly Government Environment Strategy</u></p> <ul style="list-style-type: none"> • Positive interactions through compatible aims to protect and improve biodiversity in Wales. <p><u>UK and Local BAPs</u></p> <ul style="list-style-type: none"> • Positive interaction with opportunities for habitats creation and protection. • Potential for the outcome of the CFMP to be incorporated into future revisions of BAPs. 								

Catchment Objective	Cumulative effects across the whole plan area							Sum of policy unit impacts	Interaction of CFMP with relevant Plans and Programmes
	PU1	PU2	PU3	PU4	PU5	PU6	PU7		
	P5	P3	P5	P2	P4	P4	P3		
Manage flood risk to listed buildings and ensure sites which are currently 'safe' do not become at risk of flooding	NEUTRAL	LOW -	LOW +	NEUTRAL	LOW -	LOW +	NEUTRAL	LOW +	<p><u>Land Use Planning (various)</u></p> <ul style="list-style-type: none"> Positive interaction through the protection and enhancement of sites of historic and landscape importance. All relevant Unitary and Local Plans within the CFMP area have policies to protect historic environment assets. <p><u>Strategy for the Severn Estuary</u></p> <ul style="list-style-type: none"> Positive interaction as features of archaeological/heritage interest must be taken into full account in flood risk management planning. <p><u>Welsh Assembly Government Environment Strategy</u></p> <ul style="list-style-type: none"> Positive interactions through encouraging the maintenance and enhancement of historic environment. <p><u>Rural Land Management Planning (Various)</u></p> <ul style="list-style-type: none"> Rural land management plans (e.g. agri-environment schemes, Local Authority Strategies, Rural Development Plan) will interact positively with the CFMP through ensuring the protection of cultural landscapes and historic and archaeological features.
<p><u>Summary of effects on sensitive receptors:</u></p> <ul style="list-style-type: none"> Under current catchment conditions there are currently 40 listed buildings at risk from a 1% AEP fluvial flood event. This increases by 9 to 49 under future baseline conditions. As a result of the preferred CFMP policies the number of listed buildings at risk from a 1% AEP fluvial flood event, in comparison to the current baseline, will decrease by 5 to 35. Fourteen additional listed buildings will be protected from fluvial flooding in comparison to the future baseline. Under current catchment conditions there is currently 1 listed building at risk from a 0.5% AEP tidal flood event. This increases to 18 under the future baseline. As a result of the preferred CFMP policies the number of listed buildings at risk from a 0.5% AEP tidal flood event will remain at 1. A considerable number of listed buildings will therefore be protected as a result of the chosen CFMP policies, in comparison with the future baseline. <p>Overall the cumulative impact on listed buildings has been assessed as a low gain. This is because the chosen CFMP policies will reduce the number of listed buildings at risk from fluvial and tidal flooding, in relation to both the current and future baselines. In particular, the chosen CFMP policies will result increased protection from tidal flooding to 17 listed buildings, in comparison to the future baseline.</p>									

B.4.4 Mitigation and Enhancement

At this level of policy making, where we are setting the direction for future actions, the mitigation and enhancement measures are integral to the policy appraisal. Where we have the potential to enhance the environment we have included this potential within the appraisal as opportunities. Mitigation measures at this level are generally included as part of the policy options, so that a less detrimental impact will tend to be implicit within an alternative policy option. At a lower level in our planning hierarchy, when we are investigating the details of how we will implement flood risk management measures, we will be undertaking an appropriate level of environmental assessment and consultation which will, in turn, identify more relevant mitigation measures to the impacts arising. We will use the assessment of impacts undertaken at this level to help focus our lower levels of decision making, ensuring that relevant mitigation and enhancement measures are explored fully.

Where Table B7 identifies potential benefits / impacts between the CFMP and other plans / programmes operating within the catchment we will take this into account when developing further proposals, as set out above.

B.4.5 Monitoring

SEA requires significant environmental effects related to the implementation of the plan to be monitored. Monitoring will also ensure that the impacts on SEA receptors are the same as predicted. More information on the monitoring requirements related to the implementation of the CFMP is included in the appraisal tables.

A monitoring plan should be included as part of the policy implementation plan to ensure that the significant environmental effects of the CFMP are monitored. In summary, the monitoring of the significant effects of the plan in relation to the SEA, will include:

- Actual development rates to check if urbanisation predictions made are realistic in light of current and future development undertaken. This will help monitor the number of people at risk of flooding;
- Designation and condition of environmental sites. Designation of new sites may change the chosen policy and monitoring of the condition of environmental sites will confirm that chosen CFMP policies have not adversely affected the sites;
- Designation and condition of historic environment assets. Designation of new sites may change the chosen policy and monitoring the condition of historic environment assets will confirm that chosen CFMP policies have not adversely affected the sites;
- Detrimental impacts of flood risk management projects on BAP habitats and species will be monitored to ensure that specific flood risk management projects do not have adverse impacts;
- Level of uptake of flood warning services to monitor whether the community are aware of the flood risks;
- Improved documentation of actual flood events:
 - Number of properties/assets/environmental sites/historic environment assets flooded
 - Source of flooding
 - Cause of flooding
 - Whether due to defence failure
- Construction of critical infrastructure to monitor if additional critical infrastructure is constructed within the floodplain.

Appendix C

Links to Wales Environment Strategy and Water Framework Directive

Table C1: Contribution of CFMPs to the delivery of Welsh Assembly Government Environment Strategy outcomes (2006)

Environment Strategy Outcome Number	Summary of Outcome	Contribution of CFMP (Delivered through CFMP process and/or resultant Flood risk management policy or actions)
1	The Assembly Government provides clear leadership on environmental issues through its policies, programmes and the way the it conducts its business	<p>CFMPs are promoted and funded by Welsh Assembly Government. They seek to identify and address a wide range of environmental issues associated with flood risk management.</p> <p>Good example of Welsh Assembly Government providing clear strategic leadership through its commitment to this process.</p>
2	Wales demonstrates the contribution that a small nation can make to global sustainable development and environmental improvement	<p>The CFMP process is challenging and 'ground breaking'. The Euro Floods Directive will require other European states to produce Flood Risk Management Plans. These will build upon the recognised good example of CFMPs. CFMPs will make a significant contribution to the sustainable development and environmental improvement of Wales and thereby contribute to global outcomes.</p>
3	Environmental considerations are integrated in all policies, programmes and service delivery and that high level quality and consistent environmental evidence is available to inform the decision making process	<p>The CFMPs are informed by an integrated Strategic Environmental Assessment. This ensures that the wider environment is fully considered within the plan process and strategic environmental issues are identified at the highest strategic level of flood risk management planning.</p>
4	The roles and responsibilities of organisations are understood, leading to better integration for the delivery of environmental protection and enhancement	<p>The CFMP development process has involved a wide range of organisations. The roles and responsibilities of these organisations and their contribution to sustainable flood risk management has informed the choice of policy options. In particular, the CFMP process has helped to communicate to professional partners the need for all organisations to work together in an integrated manner in order to respond to climate change.</p> <p>The CFMP Action plan identifies the responsibilities of all parties and their role in contributing to sustainable flood risk management in Wales.</p> <p>The periodic review of the CFMPs will ensure that partnership working and environmental outcomes are achieved.</p>
5	Appropriate education about our environmental impacts is in place and good quality information is available at the point where people make decisions.	<p>CFMPs are the first documents in Wales to consider flood risk management at a catchment scale and over a long time horizon, i.e. 100 years.</p> <p>They contribute to the reservoir of information used by strategic decision makers They</p>

Environment Strategy Outcome Number	Summary of Outcome	Contribution of CFMP (Delivered through CFMP process and/or resultant Flood risk management policy or actions)
		<p>will inform the identification and recognition of our environmental impacts and will improve the timeliness and quality of strategic decision making.</p> <p>Improved strategic decisions will significantly contribute to Wales's adaptation to climate change. In particular these will increase the resilience of the people, communities and critical infrastructure of Wales to increasing flood risks resulting from climate change.</p>
6	Individuals understand and are enabled to take responsibility for their environmental impact; changes in behaviour are apparent that help reduce negative environmental impacts	CFMPs contribute to our knowledge of flood risk both now and in the long term. This will enable individuals to understand their flood risks and the actions that they can take to reduce these risks in both their personal and professional lives.
8	Wales has improved resilience to the impacts of climate change. A clear flexible programme of measure is in place to enable Wales to respond and adapt to climate change.	<p>CFMPs are about flood risk managements adaptation to climate change and increasing our nation's resilience to flooding.</p> <p>CFMPs provide the information, policy direction and strategic framework of actions to deliver improved resilience.</p>
19	The loss of biodiversity has been halted and we can see a definite recovery in the number, range and genetic diversity of species, including those species that need very specific conditions to survive.	CFMPs as strategic documents at a catchment scale will have an important role in the conservation, protection and enhancement of important and valuable wildlife species and habitats.
20	The wider environment is more favourable to biodiversity through appropriate management, reduced habitat fragmentation and increased extent and interconnectivity of habitats	The CFMPs will identify opportunities for improved land use management and habitat improvement and creation which will benefit the interconnectivity of habitats and reduce habitat fragmentation.
21	Sites of international, Welsh and local importance are in favourable condition to support species and habitats for which they have been identified	The CFMPs will make a significant contribution to the improvement of strategically important wildlife habitats by identifying sites detrimentally or positively affected by flooding and improving the flood regime experienced by these areas.
23	The quality and diversity of the natural and historic character of our landscape and seascape is maintained and enhanced	<p>CFMPs provide information on the impacts of future flooding on the character of our natural and historic landscape.</p> <p>This will enable appropriate strategic decisions to be taken to maintain and enhance the quality of these features.</p>

Environment Strategy Outcome Number	Summary of Outcome	Contribution of CFMP (Delivered through CFMP process and/or resultant Flood risk management policy or actions)
24	The built environment is high quality and vibrant, reflecting local distinctiveness and supporting strong communities, which are actively engaged in the management of their local environment	<p>A high quality and vibrant built environment is founded on structural and community resilience to flooding risks.</p> <p>Communities understand and are informed of their risks and understand the actions that they can undertake themselves to compliment actions undertaken by public bodies.</p> <p>The CFMP process and resultant action plan will help to deliver this local community resilience.</p>
25	New buildings in Wales meet high environmental quality standards and the environmental quality standards of existing building stock is improving	<p>CFMP action plans will encourage incorporation of flood resistance and resilience measures into new buildings through the planning and development control process.</p> <p>Where appropriate CFMPs will also encourage and outline a process to deliver retro fitting of measures to increase resistance and resilience of the existing building stock</p>
26	The historic building stock and character is maintained to a high standard	<p>CFMPs provide information on potential long term flood risks to the historic building stock and will identify sustainable flood risk management options to protect and improve these areas.</p> <p>CFMPs will enable better informed decisions by those responsible for management of the historic building stock.</p>
31	Appropriate measures are in place to manage risk of flooding from rivers and the sea and help adapt to climate change impacts	<p>CFMPs are about flood risk managements adaptation to climate change and increasing our nation's resilience to flooding.</p> <p>CFMPs provide the information, policy direction and strategic framework of actions to deliver improved resilience.</p> <p>Action plans will identify who does what and when, i.e. will identify the measures to manage flood risk</p>
32	Everyone who lives in a flood risk area understands the flood risk they are subject to, the consequences of that risk and how to live with that risk	<p>CFMPs provide information on present and future flood risk and the actions to be taken by public and professional bodies.</p> <p>CFMPs and the action plans will be used as a catalyst to stimulate a debate at a community level. They will require communities to consider how they will respond to changing risk and risk management in the future.</p>

Water Framework Directive, River Basin Management Plans and Catchment Flood Management Plans

C1. Context

Flood Risk Management activities are, like any other activities, subject to European Directives and transposing UK legislation. 'Flood protection' is recognised in the Water Framework Directive (WFD) as one of the activities that may mean that the default target of Good Ecological Status (GES) may not be achieved.

The water body may be designated a 'Heavily Modified Water Body' (HMWB) and so the aim is instead to achieve Good Ecological Potential. The legacy of human intervention can often be great so that the necessary actions to achieve GES would be technically unfeasible or disproportionately costly to deliver. In that case, less stringent objectives may be set. In addition where more stringent objectives already apply, for example in 'Protected Areas' under other legislation such as Habitats and Birds Directives, these will need to be met.

FRM proposals will in future be subject to tests for WFD compliance to demonstrate that our activities meet with the requirements of the Directive. At present there are many ongoing areas of WFD work that will set the standards by which the condition of the water environment will be measured, identify the status of water bodies, and identify action needed to improve or prevent deterioration of water bodies in good ecological status. In addition economic tests and appraisal mechanisms are being examined and developed in light of the WFD.

This section provides an initial assessment of the WFD compliance of Catchment Flood Management Plans. This is based on the high level assessments undertaken to support the plan appraisal, and our present understanding of, and therefore capability to satisfy, the tests of the WFD which relate primarily to Article 4 of the directive. When the Project Appraisal Guidance (PAG) for flood and coastal erosion risk management projects is revised, it will take account of the WFD and other changes in legislation, along with changes in government policy. However, in advance of more detailed assessment and appraisal of subsequent plans and projects emanating from the CFMP, this compliance check is provided in order to demonstrate good practice and support the case for adoption of the CFMP.

The CFMP will be regularly reviewed, and further plans and individual schemes will be developed using latest available guidance, so ensuring flexibility is maintained in implementing compliance options in future.

C2. Water Framework Directive and Catchment Flood Management Plans

One of the aims of the CFMPs is to help deliver the objectives of the WFD. However, we began preparing the CFMPs in 2004, when preparation to implement the WFD was in its infancy. As our CFMPs have been progressed our understanding of the requirements of the WFD, and the role of River Basin Management Plans, has evolved. We are planning to release our draft RBMPs for consultation in December 2008: at the same time our preparation of CFMPs will be drawing to a close. The completed RBMPs, with the agreed objectives for each water body will be published in December 2009.

Our CFMPs set long-term policies for sustainable flood risk management, but these plans started framing their catchment objectives a number of years ago, and prior to the WFD environmental standards being fully developed. We recognise the need for our review of the CFMPs to take more account of the WFD objectives, drawing from our suite of published RBMPs. Nonetheless, our CFMPs have been developed mindful of the need to work with

nature, as far as possible, and contribute to environmental improvement. Moreover, as we progress the implementation of our CFMPs, we can draw from the water body objectives established within the RBMPs, during our subsequent more detailed assessments and appraisals, in order to ensure our delivery contributes to achieving the overall aims of the WFD.

Figure 1 shows this CFMP in relation to the River Basin Districts described under the Water Framework Directive.

C3. Water Framework Directive Compliance check

In advance of any specific guidance being issued by the Environment Agency, an assessment of the likely tests for compliance that will need to be met in future has been made. The assessment of compliance with these tests is made acknowledging that this is in advance of water body objectives being defined, the draft RBMPs being written and any agreement on the approach to be taken to controlling new modifications.

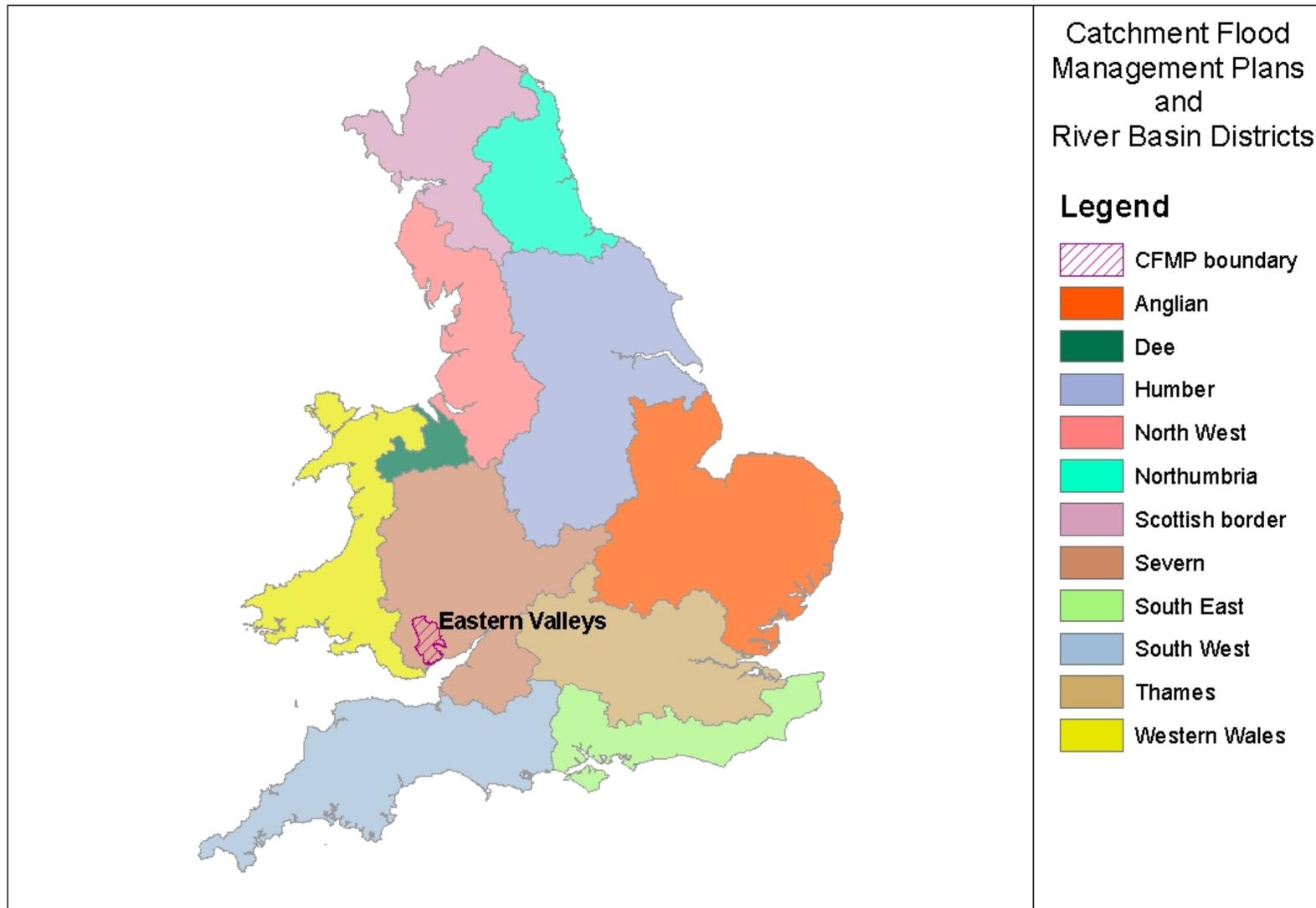
Furthermore, the consideration of further plans and actions emanating from the CFMP may involve specific local issues that have not been covered in the CFMP and so will need their own assessments during the detailed design stage. At that time they will be subject to any existing guidance on WFD compliance. The subsequent stages of CFMP implementation, and the CFMP review process will allow flexibility for this.

The tables contained in section 5.0 detail, for each relevant part of the WFD in order, the nature of the issue with regards the CFMP and our view on the evidence provided and way ahead for ensuring compliance.

C4. Conclusions

The examination of the current state of understanding of the WFD and the nature of the CFMP suggests that the plan is compliant with the requirements of the Directive. It does raise some issues which will require examination at future stages of scheme development and appraisal, which should be addressed by good practice in detailed appraisal. Appraisal guidance will evolve to take into account specific requirements of the WFD as these are understood and standards and objectives are established. The CFMP provides a sufficiently flexible approach to ensure that this is achieved.

Figure C1. This CFMP in relation to the River Basin Districts



C5. Compliance assessment

Article	Explanation	Evidence
4.1.a(i)	This article requires implementation of necessary measures to prevent deterioration of status of all surface water bodies	The CFMP presents policies for the long-term management of flood risk and operates at the highest level within our planning hierarchy. Prior to works being undertaken to implement the CFMP, further assessment and appraisal will consider the implication on achieving GES or GEP and on preventing deterioration. The actions within the CFMP need to be considered against national priorities and available funding before commitment is given to resource those actions.
4.1.a(ii)	This article requires protection, enhancement and restoration of all surface water bodies other artificial and heavily modified water bodies with the aim of achieving good ecological status	Presence of flood defences, or other flood risk management activities, may result in continued or increased deterioration in ecological status, or the modification of water bodies. Conversely, flood risk management activities may result in the protection, enhancement and restoration of the ecological status of water bodies through, for example, enabling greater floodplain connectivity, reducing detrimental erosion and sedimentation, and reducing polluted run-off from land. This will need to be reviewed when the RBMPs are published and the CFMP actions are progressed. The impact of individual schemes on achieving good ecological status will need to be reviewed on a case-by-case basis.
4.1. a(iii)	This article requires protection and enhancement of artificial and heavily modified water bodies with aim of achieving good ecological potential (GEP) and good surface water status.	Presence of flood defences may exacerbate erosion resulting from increases in flow and sea level rise as a result of climate change, and if eroded sediments contain any priority or hazardous substances, implementing the CFMP could affect the ability to meet the standards for these substances. This will need to be reviewed when the RBMPs are published and the CFMP actions are progressed. The impact of individual schemes on erosion, and the possible consequences, will need to be reviewed on a case-by-case basis. The costs of moving defences in order to reduce erosion would be very significant; this would have wider consequences and its effectiveness could be challenged.
4.1a(iv)	This article requires the implementation of measures to reduce pollution from priority substances and ceasing or phasing out emissions, discharges and losses of priority hazardous substances. FRM works should not compromise delivery of these.	The CFMP could deliver improvements in our ability to meet the standards for priority or priority hazardous substances through creation of areas which act as sinks for pollutants. Any impact on the standard of protection provided to the floodplain has potential to adversely affect quantities of these substances (through flooding of potentially contaminated land and industrial plant) and this will need to be reviewed when the RBMPs are published.
Article	Explanation	Evidence

4.1.b(i)	This article requires the implementation of measures to prevent or limit inputs of pollutants to groundwater, and to prevent the deterioration of status of groundwater bodies. FRM works should not compromise delivery of these.	The CFMP will not generally have a direct effect on groundwater or the input of pollutants to groundwater. It may have an indirect effect, however, where defence standards are reduced or defences are realigned so that land that was protected is open to regular or increased inundation. These impacts will routinely be assessed on a case-by-case basis.
Article	Explanation	Evidence
4.1(c) 4.2	Protected areas shall achieve compliance with the WFD objectives by 2015, unless otherwise specified in other legislation such as Habitats and Birds Directives. Where more than one set of objectives under different legislation applies to a water body, the most stringent applies.	For areas designated under Habitats and Birds Directives, the CFMP and has satisfied the tests of those through mitigation and subsequent further assessment as more detailed proposals emerge. The Habitats and Birds Directive requirements are likely to be more stringent than those objectives set for WFD. Any future works will be subject to more detailed assessment as discussed. At that point tests under article 4(4) may be relevant – where extended deadlines may need to be set for reasons of technical feasibility or disproportionate cost.
Article	Explanation	Evidence
4.4	This article allows for an extension of deadlines to achieve objectives, subject to conditions (relating to technical feasibility, cost and natural conditions).	If GEP is defined by the sum total of improvement likely to be gained by delivering mitigation measures, then the CFMP could help deliver those measures through habitat management and ongoing implementation of good practice in construction and maintenance activities. If GEP is defined by slight deviation from Maximum Ecological Potential (MEP), which is in turn seen as deviation from GES only in as much as the physical pressures dictate it, then the CFMP could provide the justification for not achieving GEP for reasons of disproportionate cost, and in many urban areas for reasons of technical feasibility. Any further works will be subject to more detailed assessment and appraisal, so that the implementation of this CFMP is sufficiently flexible to adapt to either of these scenarios.
Article	Explanation	Evidence
4.5	This article allows for water bodies to be set less stringent environmental objectives where human activity requires it for reasons relating to technical feasibility and cost. There are conditions and a requirement to ensure that the benefits brought by the human activity can not be achieved by any other means that are not disproportionately	The CFMP itself does not increase the risk as it is not leading to major increases in morphological pressure and neither is it compromising delivery of expected mitigation measures which may be used to define GEP. Any further works emanating from the CFMP will be subject to more detailed assessment and appraisal, at which time the technical feasibility and cost of those proposals will be considered, alongside the need to achieve the environmental objectives set in the RBMPs.

	costly. The reasons for requiring less stringent objectives needs to be included in the RBMP	
Article	Explanation	Evidence
4.6	Temporary deterioration in the status of water bodies shall not be a breach of requirements of the WFD if this is the result of natural causes or force majeure which are exceptional and could not reasonably have been foreseen, such as extreme floods and prolonged droughts, are permitted. Conditions include the need to take practical steps to prevent further damage, to state in the RBMP the criteria for defining these circumstances, to outline the measures to be taken in these events.	The effects of flooding on the environment (for example resulting from flooding of normally dry land or, in extreme events, industrial premises leading to contamination of water) will be minimised where possible by provision of warnings, and actions of our emergency response local teams. At present there is no definition of an extreme flood. This CFMP establishes the policy intent for long term management of flood risk which will see decreased risk in some areas and increases over time in others as we progressively prioritise resources and the need for and impact of our activities. Where we actively plan to increase regular flooding of land, such as at realignment and flood storage sites, we will assess the environmental impact of this at design stage – it is not felt this is relevant to article 4(6) as it will be reasonably foreseen. Emergency works may be seen as force majeure and the need for these should reduce over time as the CFMP progresses through subsequent stages of implementation – with the exception of any required after an extreme flood. Any emergency works are already undertaken with regard for their impact and these may be reassessed once the WFD objectives are agreed.
Article	Explanation	Evidence
4.7	Failure to achieve GES/GEP is not a breach of the WFD if it is the result of new modifications to physical characteristics of the water body and the following conditions are met: <ul style="list-style-type: none"> • All practical mitigation is undertaken • Reasons for modifications are set out in RBMPs • There is overriding public interest and/or the benefits for human health or safety or for sustainable human development outweigh the benefits to the environment and society of achieving WFD objectives • The beneficial objectives served by the modifications – in this case flood risk management – can not for reasons of 	The CFMP present policies for the long-term management of flood risk and operates at the highest level within our planning hierarchy. Prior to works being undertaken to implement the CFMP, further assessment and appraisal will consider the implication on achieving GES/GEP. The actions within the CFMP need to be considered against national priorities and available funding before commitment is given to resource those actions. As a consequence, the CFMP actions, as such, will not be included within the RBMP as potential modification, but any agreed programmes of actions will be included in the final RBMPs. At a local level it is possible that individual schemes could affect the physico-chemical and hydromorphological status of a water body. This will need to be assessed on a case-by-case basis as further details of schemes are developed and appraised. The appraisal techniques used will be sufficiently robust to ensure the human health and societal benefits in providing flood risk management are balanced with the impacts on the environment, and that alternative approaches are also considered. The CFMP is sufficiently flexible to adapt to future requirements. NB: flood risk management activity can lead to increased development of land and

	<p>technical feasibility or disproportionate cost be achieved in a more environmentally sensitive way.</p> <p>Are the new modifications likely to result from this CFMP justified in these terms? Is adequate mitigation planned? Will the reasons for modifications be in RBMPs? Are there more environmentally sensitive approaches that could be justified?</p>	<p>should that occur the developer may be expected to prove the case for sustainable human development if that could affect other water bodies.</p>
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Appendix D

CFMP Consultation Response

D1 Introduction

Catchment Flood Management Plans are an essential component of future flood risk management. The plans are key to delivering the flood risk management outcomes of Welsh Assembly Government (WAG) and Defra. A Catchment Flood Management Plan is a high level strategic planning tool, setting out the policies we will adopt to manage flood risk for the next 50 to 100 years. The plans include actions we, and others, need to take now and in the future to ensure we all respond and adapt to the challenge of increasing and changing flood risk.

Catchment Flood Management Plans have been developed for the whole of Wales and England. Each plan covers a single large catchment or a combined number of smaller catchments, with boundaries aligned to catchment boundaries. The plans consider all types of flooding and are based on a standard approach to ensure they provide a consistent assessment of flood risk. They also cover tidally influenced flooding from rivers and estuaries but not direct flooding from the sea, which is covered by Shoreline Management Plans.

Figure D1 shows the location of the Catchment Flood Management Plans produced by Environment Agency Wales. For further details of these, please refer to each individual Final Plan.

Figure D1: The location of the CFMPs produced by Environment Agency Wales



D2 Purpose of this Appendix

The Environment Agency Wales consultation process for all nine Catchment Flood Management Plans was managed in a co-ordinated manner and as a single exercise. A number of the consultees received more than one Catchment Flood Management Plan.

This Appendix describes the overall consultation process for Environment Agency Wales and highlights the specific issues of relevance to this Catchment Flood Management Plan.

D3 Purpose of consultation

The Catchment Flood Management Plans are large, technical and strategic documents, therefore, the consultation process was targeted primarily at co-deliverers of flood risk management, wider interest groups and community representatives (see below for details)

The purpose of the wider consultation was both to raise awareness of the Catchment Flood Management Plan process and to seek support from co-deliverers of flood risk management and wider interest groups.

The draft plans were available to the general public, but the consultation process was not specifically targeted at them. It is anticipated that more specific and local public engagement will take place as appropriate, during the Catchment Flood Management Plan implementation process.

D4 Consultation groups

For the purpose of planning and managing the consultation process we identified three distinct groups. These are outlined below.

D4.1 Primary Contacts (including Catchment Flood Management Plan Steering Group members)

The Primary Contacts are a broad group of organisations, who, through their own actions and operations or via working with us, can deliver flood risk management changes.

A list of the Primary contacts is included as Table D2.

D4.2 Wider Consultation Group

The wider Consultation Group includes organisations that have an interest in flooding and flood risk management actions.

A list of the wider consultation group contacts is included as Table D3.

D4.3 Community Representatives

Those who represent the interests of the wider community were identified as Assembly Members (AMs), Members of Parliament (MPs), Members of European Parliament (MEPs) and Local Authority Chief Executives and Council leaders.

D5 Consultation Process

The Draft Plans were released for consultation in a phased manner between 12th September 2008 to 4th November 2008. All plans had a minimum 3 months consultation period which ended on 31st January 2009. Table D1 outlines the specific consultation dates for each Catchment Flood Management Plan. We were flexible and where possible provided extra time for consultation responses to be submitted where requested.

Table D1: CFMP Draft Plan consultation dates

CFMP	Consultation start date	Consultation end date
Eastern Valleys	12-Sep-08	12-Dec-08
Taff and Ely	19-Sep-08	12-Dec-08
Wye and Usk	04-Nov-08	31-Jan-09
Ogmore to Tawe	02-Oct-08	28-Dec-08
Loughor to Taf	02-Oct-08	30-Dec-08
Pembrokeshire and Ceredigion Rivers	09-Oct-08	31-Dec-08
North West Wales	02-Oct-08	29-Dec-08
Conwy and Clwyd	23-Oct-08	31-Dec-08
River Dee	09-Oct-08	29-Dec-08

The consultation groups were involved in the Draft Plan consultation in different ways:

D5.1 Primary Contacts

According to their remit, each organisation was assigned the appropriate Draft Plans to receive for consultation. The organisations were asked to confirm if the Draft Plans assigned to them were correct, if not, which they wanted to receive and who was to receive it. Follow-up requests were issued to unresponsive organisations.

The organisations were made aware a nil response assumed the correct Draft Plans had been assigned to the organisation and would be sent to them. As a result of this the organisations outlined in Table D2, were sent the Draft Plans.

D5.2 Wider consultation group

The organisations were asked to confirm if they wished to be included in the Catchment Flood Management Plan, Draft Plans consultation, if so, which Draft Plans they wanted to receive and who was to receive it. Follow-up requests were issued to unresponsive organisations.

The organisations were made aware a nil response assumed the organisation did not want to be involved in the Draft Plans consultation and they would not receive copies of the Draft Plans. As a result of this the organisations outlined in Table D3, were sent the Draft Plans.

D5.3 Community Representatives

Those who represent the interests of the wider community were sent letters by the relevant Environment Agency Wales Area Manager by Friday 24th October 2008.

AMs, MPs and MEPs were offered the opportunity to contact us to receive copies of the relevant Draft Plans and/or arrange a meeting to discuss them.

Local Authority Chief Executives within the Environment Agency Wales boundary were informed colleagues from their Authority had been helping us throughout the development of the Catchment Flood Management Plans and these representatives had been contacted directly and had appropriate Draft Plans sent to them. All Local Authority Chief Executives with an interest in our Catchment Flood Management Plans were offered the opportunity to contact us to receive copies of the relevant Draft Plans and/or arrange a meeting to discuss them.

Local Authority Council leaders were offered the opportunity to contact us to find out more about Catchment Flood Management Plans.

The consultation was open to community representatives until 23rd January 2009.

D6 Responses received

In total 16 Consultation responses were received from the following organisations;

Blaenau Gwent County Borough Council
Cadw
Caerphilly County Borough Council
Caldicott and Wentloog Levels IDB
Cardiff County Council
Country Land and Business Association
Countryside Council for Wales
CWM Environmental
Dwr Cymru - Welsh Water¹
Forestry Commission
Glamorgan Gwent Archaeological Trust
Institution of Civil Engineers
National Trust
Newport City Council²
Powys County Council
Welsh Canoeing Association

Note 1: Dwr Cymru- Welsh Water did not formally respond to the consultation but separate discussions have taken place a part of the Periodic review of pricing, (PR09). Discussions have concerned surface water management issues and infrastructure resilience to flooding.

Note 2: Newport City Council response to Wye and Usk Catchment Flood Management Plan included comment on the importance of interaction of Catchment Flood Management Plan and Shoreline Management Plans. Comment also of general relevance.

D7 Organisations sent Draft Plans

Table D2: CFMP Draft Plans sent to the Primary Contacts

Organisation	CFMP Draft Plans sent for consultation								
	Wye and Usk	Eastern Valleys	Taff and Ely	Ogmore to Tawe (inc Thaw and Cadoxton)	Loughor to Taf	Pembrokeshire and Ceredigion Rivers	North West Wales	Conwy and Clwyd	River Dee
Blaenau Gwent CBC		✓							
Brecon Beacons National Park	✓	✓	✓	✓	✓				
Bridgend CBC				✓					
British Waterways	✓	✓						✓	✓
Cadw	✓	✓	✓	✓	✓	✓	✓	✓	✓
Caerphilly CBC		✓							
Caldicot and Wentlooge IDB	✓	✓							
Cardiff Council		✓	✓						
Cardigan Bay Coastal Group						✓	✓		✓
Carmarthenshire CC					✓	✓			
CCW	✓	✓	✓	✓	✓	✓	✓	✓	✓
Ceredigion CC						✓	✓		
Cheshire CC									✓
Chester City Council									✓
City & County of Swansea				✓	✓				
Conwy CC							✓	✓	✓
Country Land & Business Association	✓	✓	✓	✓	✓	✓	✓	✓	✓
Dee Valley Group									✓
Denbighshire CC								✓	✓
Dŵr Cymru Welsh Water	✓	✓	✓	✓	✓	✓	✓	✓	✓
English Heritage	✓								✓
Farmers Union Wales (FUW)	✓	✓	✓	✓	✓	✓	✓	✓	✓
Flintshire CC								✓	✓
Forestry Commission ¹									
Forestry Commission Wales	✓	✓	✓	✓	✓	✓	✓	✓	✓
Gwynedd CC							✓		✓
Herefordshire Council	✓								
Isle of Anglesey CC							✓		
Liverpool Bay Coastal Group								✓	✓
Merthyr Tydfil CBC			✓						
Monmouthshire CC	✓								
National Farmers Union	✓								
National Farmers Union Cymru	✓	✓	✓	✓	✓	✓	✓	✓	✓
National Farmers Union West Midlands	✓								
National Trust	✓				✓	✓	✓	✓	
Natural England	✓	✓	✓	✓					✓
Neath Port Talbot CC				✓	✓				
Newport City Council	✓	✓							
Pembrokeshire Coast National Park Authority					✓	✓			
Pembrokeshire CC					✓	✓	✓	✓	
Powys CC	✓		✓	✓	✓	✓	✓		

Organisation	CFMP Draft Plans sent for consultation									
	Wye and Usk	Eastern Valleys	Taff and Ely	Ogmore to Tawe (inc Thaw and Cadoxton)	Loughor to Taf	Pembrokeshire and Ceredigion Rivers	North West Wales	Conwy and Clwyd	River Dee	
Rhondda Cynon Taff CBC			✓	✓						
Severn Estuary Coastal Group	✓	✓	✓							
Severn Trent Water Ltd	✓									
Snowdonia National Park Authority							✓	✓	✓	
Swansea and Carmarthen Bay Coastal Group				✓	✓	✓				
Tidal Dee Users Group										✓
Torfaen CBC	✓									
Vale of Glamorgan Council			✓	✓						
Welsh Assembly Government	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Welsh Local Government Association	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Wrexham CBC										✓
Ynys Enlli to Llandudno Coastal Group							✓	✓		

Note¹: Organisations opted out of the consultation, therefore were not sent copies of the Draft Plans.

Table D3: CFMP Draft Plans sent to the wider consultation group members

Organisation	CFMP Draft Plans sent for consultation								
	Wye and Usk	Eastern Valleys	Taff and Ely	Ogmore to Tawe (inc Thaw and Cadoxton)	Loughor to Taf	Pembrokeshire and Ceredigion Rivers	North West Wales	Conwy and Clwyd	River Dee
ADAS Wales ¹									
Advantage West Midlands	✓								✓
Associated British Ports	✓		✓	✓					
Association of British Insurers	✓	✓	✓	✓	✓	✓	✓	✓	✓
Association of National Parks Authorities			✓						
Barton Willmore		✓	✓	✓	✓	✓			
British Canoe Union ¹									
British Hydrological Society ¹									
British Organic Farmers ¹									
British Outdoor Professional Association ¹									
British Trout Association	✓	✓	✓	✓	✓	✓	✓	✓	✓
BTCV Cymru									
Business in the Community Wales ¹									
Campaign for the Protection of Rural England ¹									
Campaign for the Protection of Rural Wales	✓	✓	✓	✓	✓	✓	✓	✓	✓
Campaign to Protect Rural England ¹									
Cardiff County Council Harbour Authority			✓						
Cardiff Harbour Authority ¹									
Carmarthenshire Fisherman's Federation					✓	✓			
Carmarthenshire Rivers Trust					✓	✓			
CBI Cymru ¹									
CBI Wales ¹									
CEH Bangor	✓						✓	✓	
Centre for Ecology and Hydrology ¹									
Chartered Insurance Institute ¹									
Chartered Institution of Water and Environmental Management ¹									
Clwyd and Powys Archaeological Trust ¹									
Coal Authority ¹									
Coed Cymru ¹									
Confederation of Forest Industries	✓	✓	✓	✓	✓	✓	✓	✓	✓
Conservation and Countryside Section ¹									
Consumer Council for Water ¹									
Consumer Council for Water Wales						✓			
Dee Valley Group									✓
Dee Valley Water Plc ¹									
Denbighshire Biodiversity Partnership								✓	✓

Organisation	CFMP Draft Plans sent for consultation								
	Wye and Usk	Eastern Valleys	Taff and Ely	Ogmore to Tawe (inc Thaw and Cadoxton)	Loughor to Taf	Pembrokeshire and Ceredigion Rivers	North West Wales	Conwy and Clwyd	River Dee
Denbighshire Countryside Service ¹									
Department for the Economy and Transport	✓		✓	✓	✓	✓	✓		✓
Dow Corning				✓					
Dyfed Archaeological Trust					✓	✓			
Ellesmere Port and Neston Borough Council									
EPAC	✓			✓				✓	✓
Farming and Wildlife Advisory Group ¹									
Farming and Wildlife Advisory Group Cymru ¹									
Federation of Small Businesses ¹									
FERAC	✓	✓	✓	✓	✓	✓	✓	✓	✓
Flood Forum ¹									
Forest of Dean District Council	✓								
Forestry & Timber Association - Wales ¹									
Forestry Commission ¹									
Friends of the Earth ¹									
Friends of the Earth Cymru ¹									
FUW County Offices	✓	✓	✓	✓	✓	✓	✓	✓	✓
Glamorgan Gwent Archaeological Trust	✓	✓	✓	✓	✓				
Gloucestershire County Council ¹									
Government Offices West Midlands	✓								✓
Greenpeace ¹									
Groundwork UK ¹									
Groundwork Wales ¹									
Gwynedd Archaeological Trust							✓	✓	✓
Halcrow					✓				
Herefordshire Nature Trust	✓								
Herefordshire NFU ¹									
Highways Agency	✓								✓
Homebuilders Federation	✓	✓	✓	✓	✓	✓	✓	✓	✓
ICE Wales	✓	✓	✓	✓	✓	✓	✓	✓	✓
Inland Water Association South Wales ¹									
Inland Waterways Association ¹									
Institute of Biological, Environmental and Rural Sciences ¹¹									
Institute of Welsh Affairs									
Institution of Civil Engineers ¹									
Joint Nature Conservation Committee ¹									
Llyn Fishermen's Association							✓		
Lower Severn IDB ¹									
Lower Wye IDB ¹									
Malvern Hills District Council ¹									
Media Wales	✓	✓	✓	✓	✓	✓	✓	✓	✓

Environment Agency Wales

Organisation	CFMP Draft Plans sent for consultation								
	Wye and Usk	Eastern Valleys	Taff and Ely	Ogmore to Tawe (inc Thaw and Cadoxton)	Loughor to Taf	Pembrokeshire and Ceredigion Rivers	North West Wales	Conwy and Clwyd	River Dee
Merthyr Tydfil Angling Association ¹									
Midlands Fisheries Consultative Council ¹									
Milford Haven Port Authority						✓			
MOD ¹									
Monmouth Flood Forum	✓								
National Grid ¹									
National Soil Resources Institute (NSRI) Cymru ¹									
Network Rail ¹									
Newport & Gwent Chamber of Commerce & Industry ¹									
Newport Unlimited ¹									
North East Wales Wildlife ¹									
North Shropshire District Council									✓
North West Development Agency									✓
North West Regional Assembly									✓
One Voice Wales	✓	✓	✓	✓	✓	✓	✓	✓	✓
Oswestry Borough Council ¹									
Pembrokeshire Rivers Trust ¹									
Ramblers Association ¹									
River Lugg IDB	✓								
Riverfly Partnership		✓							
Royal Commission on the Ancient and Historical Monuments of Wales ¹									
Royal Institution of Chartered Surveyors ¹									
Royal Welsh Agricultural Society	✓								
RSPB	✓								✓
RSPB Cymru	✓	✓	✓	✓	✓	✓	✓	✓	✓
RTPI (Royal Town Planning Institute) Cymru ¹									
Salmon and Trout Association ¹									
Scott Wilson			✓						
Senior Policy Analyst ¹									
Severn Estuary Partnership ¹									
Severn Trent Water Ltd	✓								
Severn Vyrnwy Project (Land Management Initiative) ¹									
Shrewsbury and Newport Canals Trust ¹									
Shropshire County Council ¹									
Soil Association ¹									
Soil Survey and Land Research Centre ¹									
South East Area Environment Group	✓	✓							
South Wales Traffic Management Centre ¹									

Organisation	CFMP Draft Plans sent for consultation								
	Wye and Usk	Eastern Valleys	Taff and Ely	Ogmore to Tawe (inc Thaw and Cadoxton)	Loughor to Taf	Pembrokeshire and Ceredigion Rivers	North West Wales	Conwy and Clwyd	River Dee
South Wales Valleys Rivers Trust			✓						
South West Area Environment Group				✓		✓			
South West Regional Assembly ¹									
Sport England ¹									
Sustainable Development Commission Wales ¹									
Teifi Rivers Trust ¹									
Tenant Farmers Association	✓	✓	✓	✓	✓	✓	✓	✓	✓
The Pembrokeshire Biodiversity Partnership ¹									
The Woodland Trust ¹									
The Wye & Usk Foundation	✓								
TraCC ¹									
United Utilities ¹									
WAG ¹									
WAG - Department for the Economy and Transport	✓		✓	✓	✓	✓	✓		✓
Wales Biodiversity Partnership ¹									
Wales Environment Link - Cymdeithas Eryri Snowdonia Society							✓	✓	✓
Welsh Amateur Rowing Association ¹									
Welsh Canoeing Association	✓	✓	✓	✓	✓	✓	✓	✓	✓
Welsh Environmental Services Association ¹									
Welsh Salmon and Trout Association	✓	✓	✓	✓	✓	✓	✓	✓	✓
Wentloog Wildfowling & Conservation Association ¹									
West Midlands Business Council	✓								✓
West Midlands Regional Assembly	✓								
West Midlands Rural Network ¹									
West Wales Chamber of Commerce ¹									
Wildfowl and Wetland Trust ¹									
Wildlife Trusts	✓	✓	✓	✓	✓	✓	✓	✓	✓
Wirral Borough Council ¹									
Worcestershire County Council	✓								
WWF ¹									
WWF Cymru ¹									
Wye Navigation Advisory Committee ¹									
Wye Salmon Fisheries Owners Association	✓								
Wye Valley AONB	✓								

Note¹: Organisations provided a nil response or opted out of the consultation, therefore were not sent copies of the Draft Plans.

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