

Cyngor Bwrdeistref Sirol



# Strategic Flood Consequence Assessment of Bridgend County Borough Council

**VOLUME I**  
**User Guide**  
October 2010

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# Issue box

The Bridgend County Borough Council Strategic Flood Consequences Assessment (SFCA) is a "live" document. The current version has been developed using the best information and concepts available at the time.

As new information and concepts become available the document will be updated and so it is the responsibility of the reader to be satisfied that they are using the most up-to-date information and that the SFCA accounts for this information.

All revisions to this summary document are listed in the table below

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# Foreword

Bridgend County Borough Council is required to prepare a Strategic Flood Consequence Assessment (SFCA) to support the production of its Local Development Plan (LDP).

The SFCA creates a strategic framework for the consideration of flood risk when making planning decisions. It has been developed in accordance with Technical Advice Note 15 – Development & Flood Risk (TAN15), as well as additional guidance provided by the Environment Agency.

TAN15 advises a precautionary framework to guide planning decisions specifically aiming to direct new development away from areas thought to be at high risk of flooding. TAN15 promotes action through development plans, specifically the consideration of flooding issues during the preparation of Local Development Plans. Flood risk will therefore be a key consideration when sites are being considered for allocation.

The underlying objective of the approach detailed in TAN15 is to steer development away from areas at risk of flooding – so as to decrease and not increase the risk of flooding to people, businesses, property and the natural environment – and to thereby reduce the reliance on long-term maintenance of built flood defences. In order to develop areas at risk from flooding, developments must be in line with the local authority's development strategy. Furthermore, the risks to the development, including residual risks following any mitigation measures, must satisfy certain acceptability criteria as set out in Section 7 of TAN15. It is also expected that development proposals will contribute to a reduction of flood risk.

A SFCA is essential in enabling a strategic and proactive approach to be applied to flood risk management. The assessment allows us to understand current flood risk on a wide-spatial scale and how this is likely to change in the future in response to climate change.

The main objective of the Bridgend County Borough Council SFCA is to provide flood risk information;

- so that an evidence-based and risk-based, precautionary approach can be adopted when making planning decisions, in line with TAN15;
- that will inform the Sustainability Appraisal/Strategic Environmental Assessment and Habitats Regulations Assessment and ensure flood risk is taken into account when considering sites and land use policies at the local development plan;
- to identify the level of detail required for site specific flood consequence assessments and allow BCBC to determine the acceptability of flood risk in relation to emergency planning capability level;
- to enable BCBC to make informed decisions regarding capacity and flexibility of the 'Regeneration led Spatial Strategy' including application of the TAN15 justification test where necessary for the allocation of strategic development sites;
- to facilitate the production of local 'standing advice'; and
- to identify surface water issues and the suitability of sustainable drainage (SuDS) techniques.

The SFCA is presented in two complementary documents:

- Volume I – User Guide
- Volume II – Technical Report (including flood maps).

# 1. Context

## 1.1 Introduction

- 1.1.1 Strategic Flood Consequence Assessments (SFCAs) can be used to inform a range of activities, including land use planning, emergency planning, development control and the development of specific flood risk management policy. The level of detail included in the SFCA depends on the intended use.
- 1.1.2 The Bridgend SFCA was developed at a Strategic Scale in support of the Local Development Plan (LDP), and thus the scale and detail within the assessment reflects this intended use. A Stage 1 assessment has been completed across Bridgend to assess flood risk across the county, and identify how much planned growth may fall in flood risk areas. A Stage 2 (more detailed) assessment has been completed for the strategic development areas of Maesteg; Porthcawl; Valleys Gateway; Pencoed; and Waterton.
- 1.1.3 Strategic Flood Consequence Assessments (SFCAs) should be used to inform the Sustainability Appraisal and LDP process and to ensure proposed developments are steered towards the lowest possible flood risk zone. Planning Policy Wales (PPW) administers the production of technical advice notes (TAN), of which TAN15: Development and Flood Risk provides guidance in relation to flooding. LPAs should take into account the guidance provided in TAN15 when preparing their LDPs and when assessing individual planning applications.

This volume of the Bridgend Strategic Flood Consequence Assessment is the

### **User Guide**

This decision support document provides comprehensive information on how to interpret the Bridgend SFCA technical results contained within Volume 2. These two volumes of the SFCA are intended to be used together in order to inform land use planning, flood warning, emergency planning and development control decisions.

This document includes the definition and description of flood risk, a description of the strategic approach to evaluating flood risk, and a summary of flood statistics for Bridgend (taken from Volume 2).

This document includes guidance on how to use the technical information in respect to;

- Land use planning (from spatial planning for the LDP to windfall sites)
- Emergency planning
- Development control

This document also includes an overview of the Justification Test and provides guidance on the specification of Flood Consequence Assessments and strategic flood risk management measures.

The document also includes an appraisal of current (August 2010) strategic sites NOT in the adopted Local Plan (note: this appraisal does should not be considered to satisfy the Justification Test).



## 2. How flood risk is assessed

### 2.1 Source-pathway-receptor model

2.1.1 The source-pathway-receptor model can be used when assessing flood risk. This approach is also used when assessing other environmental risks such as land contamination and air pollution. This model requires the identification of:

- **Sources** – where the flood water comes from. There are six sources of flooding (rivers, sea, land (surface water), groundwater, sewers and artificial sources)
- **Pathway** – how the receptor and source come into contact. Pathways for flooding include overland pathways, overtopping of flood defences, breaching of defences and underground barriers causing groundwater levels to rise
- **Receptor** – the people, property and/or environment affected by flooding. For land use planning, the receptors of concern are people and property. TAN15 provides guidance on the vulnerability of different development types to flooding, which includes a consideration of the types of people associated with each property type.

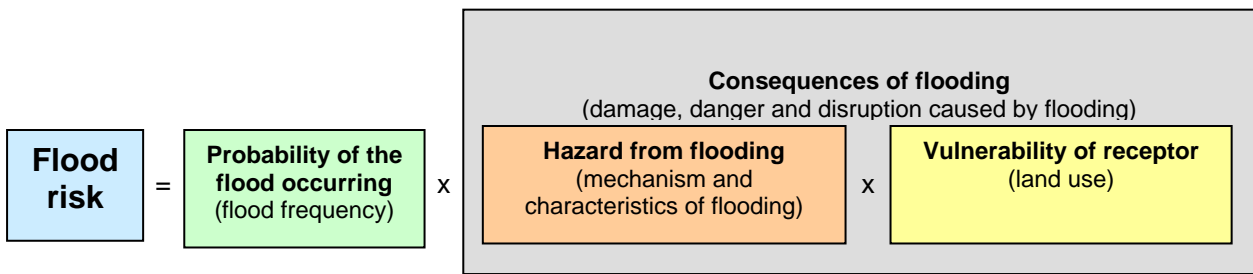
2.1.2 For the purposes of land use planning, it is important to use a precautionary framework in the light of expected changes and events over the lifetime of the proposed developments. The most obvious change relevant to flood risk is likely to be climate change. UKCP09 contains the latest findings in regard to UK climate change. The key findings from UKCP09 are warmer summers, greater rainfall in the winter and sea level rise (greater in the north compared to the south of the UK). However the findings from UKCP09 have not superseded the Defra 2006 guidance which provides guidance on how climate change effects should be included in flood risk assessments. It has not yet been confirmed when this guidance will be updated. The Defra 2006 guidance predicts significant increases in river flows and mean sea levels. The predicted impacts of the climate changes will have a significant impact on existing source-pathway-receptor relationships.

### 2.2 Defining flood risk

2.2.1 The Environment Agency's 'Strategy for Flood Risk Management 2003 - 2008' (Environment Agency 2003), describes flood risk as a combination of two components, the:

- "**chance (or probability)** of a particular flood event and the
- **impact (or consequence)** that the event would cause if it occurred."

2.2.2 By considering both the definition of risk and the "source-pathway-receptor" model, it is beneficial to assess risk in terms of the components shown in Figure 2.1.



**Figure 2-1 Risk Equation**

- 2.2.3 Flood risk from rivers and the sea is defined in association with an annual exceedance probability (AEP). The AEP is the chance (or likelihood) of a flood with a stated magnitude occurring in any single year. Note: it should not be inferred from this definition that if a flood of a given magnitude does occur in a given year that a flood with the same (or greater) magnitude will not occur in the subsequent year.
- 2.2.4 The probability of flooding can be defined using data and statistical analysis. The hazard from flooding can be evaluated by considering the depth of floodwater, the velocity of flow, the speed of inundation of flooding and the rate of rise of floodwater. The vulnerability of flooding can be assessed through analysis of the land use, property or people that would be affected by flooding.
- 2.2.5 It can be seen from the risk equation on the previous page that by reducing the hazard or vulnerability of flooding, it is possible to reduce the risk. It follows that development proposals within Bridgend County Borough should be developed and assessed using a risk-based approach that avoids risk where possible and manages it elsewhere. This approach is promoted in Planning Policy Wales (PPW) and TAN 15, which sets out a precautionary framework to guide planning decisions. The framework aims to:
- Direct new development away from those areas which are at high risk of flooding; and
  - Only allow development which can be justified in high risk areas and where the consequences of flooding can be managed acceptably.
- 2.2.6 There is inherent uncertainty in the estimation of flood probability due to the need to simplify variability in rainfall, storm types, soil types, land cover and antecedent conditions into one designed flood event. By separating flood risk into its three components, it is possible to gauge risk even if the exact probability is uncertain. In this way a precautionary framework can be applied, as flood risk will be higher for floods with significant hazards and consequences, even when the probability of occurrence is uncertain.
- 2.2.7 This information can then be used to inform the precautionary framework. By including consideration of climate change the procedure is precautionary, in accordance with TAN15.
- 2.2.8 The SFCA provides high level information for decisions on land use planning within the Bridgend County Borough area. The strategic approach defined in this document will require that information supporting all planning applications in the study area makes reference to the SFCA and clearly demonstrates adoption of a risk-based sequential approach, within the overarching precautionary framework.

### **Sources of flood risk**

- 2.2.9 Flooding can occur from a range of sources. Rivers are a major source of flooding in Bridgend, and land and sea (tidal) flooding in the Porthcawl area. Ogmore is also at risk of

flooding from the sea (tidal flooding). As highlighted by the 2007 floods, a significant proportion of flooding incidents are from other forms of flooding than rivers and the sea.

- 2.2.10 Flooding can come from rivers, the sea, directly from rainfall, groundwater, highway and sewer drainage systems, and from artificial sources such as canals. The impact of flooding will depend upon its source and the land-use. Further information on flooding from the six sources within Bridgend is detailed in the Technical report.
- 2.2.11 The DAM and Environment Agency Flood Zones only take into account flooding from larger rivers or the sea.
- 2.2.12 The SFCA has refined the Flood Zone information and separate maps have been provided to account for other forms of flooding, which includes information on groundwater, surface water, sewers and artificial sources. This information should be used when preparing appropriate policies for flood risk management and land use allocation.

### Types of flood risk information

- 2.2.13 The SFCA provides a range of information so that the hazard of flooding (flood depth, velocity, rate of rise and speed of inundation of floodwaters), not just the probability of flooding, can be examined. Information on three types of flood risk has been provided.

#### **1. Flood Zones (refer to Map F1 (Overview) & Map FC (Strategic Sites))**

- 2.2.14 DAM (development advice map) zones are defined in Figure 1 of TAN15. There are three DAM Zones (A, B & C). Zone C is further divided to account for existing infrastructure and flood defences. A description of the DAM flood zones are shown in Table 2-1. The descriptions provided in TAN15 (Table 2-1) detail how the DAM zones were first defined, and subsequently updated in 2009. Flood Zones can be refined for SFCAs and Flood Consequence Assessments where more detailed information is available. For the Bridgend SFCA the latest (2009) DAM Zones have been updated and refined using the Environment Agency Flood Zone information and broadscale modelling to provide enhanced information (referred to as the SFCA Flood Zones). As the DAM Zones and Environment Agency Flood Zones may be updated in the future, the user must ensure that they refer to the best available information.

**Table 2-1 TAN15 DAM Zones**

<b>DAM Zone</b>	<b>Description</b>	<b>Use within the Precautionary Framework</b>
A	Considered to be at little or no risk of fluvial or tidal/coastal flooding.	Used to indicate that justification test is not applicable and no need to consider flood risk further.
B	Areas known to have been flooded in the past evidenced by sedimentary deposits.	Used as part of a precautionary approach to indicate where site levels should be checked against the extreme (0.1%) flood level. If site levels are greater than the flood levels used to define adjacent extreme flood outline there is no need to consider flood risk further.
C	Based on Environment Agency extreme flood outline, equal to or greater than 0.1% (river, tidal or coastal)	Used to indicate that flooding issues should be considered as an integral part of decision making by the application of the justification test including assessment of consequences.
C1	Areas of the floodplain which are developed and served by significant infrastructure, including flood defences.	Used to indicate that development can take place subject to application of justification test, including acceptability of consequences.

DAM Zone	Description	Use within the Precautionary Framework
C2	Areas of the floodplain without significant flood defence infrastructure.	Used to indicate that only less vulnerable development should be considered subject to application of justification test, including acceptability of consequences. Emergency services and highly vulnerable development should not be considered.

2.2.15 TAN15 requires that all sources of flooding be examined. Flood Zones are a good starting point for this assessment as they show areas at risk of flooding from rivers (catchment area >3km<sup>2</sup>) and the sea, which cause the most damage across Wales. However other sources and types of flooding must be examined, even if a proposed development lies within a low probability Flood Zone. Thus the actual and residual risks must be examined as well.

## 2. Actual risk (refer to Overview maps and Strategic Site maps AR1 to AR5)

2.2.16 Actual risk provides information on flooding when the impact of existing flood defences is considered (assuming that they operate as they are supposed to). The actual risk of river and tidal flooding has been assessed for the SFCA. The maps provide a range of information: flood extent; maximum flood depth; maximum flood velocity; the speed of inundation; and the rate of rise of floodwaters. These maps can be used to determine if a development is likely to meet the acceptability criteria as detailed in TAN15, Appendix 1. Further guidance on using the SFCA to inform site assessment is provided in Section 6 of this report.

2.2.17 Actual risk of flooding from other sources (surface water, groundwater, sewers and artificial sources) can be assessed using a range of analyses. However, for the level of assessment required in an SFCA, these sources are usually assessed via a review of historic flood incidents records and a qualitative analysis of catchment characteristics.

## 3. Residual risk (breach and/or failure of flood defences and flood management infrastructure) (refer to Strategic Site Map RR)

2.2.18 This involves the assessment of breach or failure of flood defences or other features, which may act as a defence. Such scenarios may include collapse of a flood defence wall, blockage of a culvert or structural failure of a canal or reservoir embankment. Whilst the probability of a breach or failure may be low (dependent on the integrity and maintenance of the structure), the consequences of an event are often very high.

## 2.3 Climate change (refer to Overview Map F2 & Strategic Site maps FF)

2.3.1 Projections of future climate change indicate that more frequent short-duration, high intensity rainfall and more frequent periods of long duration rainfall could be expected. Winters are expected to become wetter with summers and autumn becoming much drier than at present. Global sea level rise is also expected to continue. These kinds of changes will have implications for all forms of flooding.

2.3.2 Changes in the extent of inundation as a result of climate change are likely to be negligible in well-defined floodplains but may be dramatic in low-lying and flat areas. It is expected that climate change will lead to a reduction in the standard of protection provided by defences constructed in the past. Changes in the depth of flooding may reduce the return period of a given flood and as a result the flood zone classification within which certain areas fall.

- 2.3.3 The Bridgend SFCA contains information on flood probability in the future based on a time horizon representing 100 years into the future (2110). Government guidance states that an increase of 20% on present day river flows should be applied to any forecast of river flows between 2025 and 2115 (i.e. Map FF in this SFCA contains information for present day river flows + 20% contingency for future climate change – this is not a cumulative year on year value). To account for sea level rise, estimated tide levels have been increased by 1035 mm in accordance with the Defra guidance. The impacts of climate change on wind speed and wave heights should also be considered for sites near to the sea.
- 2.3.4 In the UK the implications of climate change are assessed by the UK Climate Impacts Programme and latest government guidance on allowing for the impacts of climate change on flooding is provided in FCDPAG3 Economic Appraisal: Supplementary Note to Operating Authorities – Climate Change Impacts, October 2006.
- 2.3.5 It is imperative that allowances for climate change are based on the latest predictions and up to date guidance. There is a more recent study, UKCP09 that looks at probabilistic projection on the likely changes to the UK climate under a range of greenhouse gas emission scenarios. The findings of this recent study has not superseded the Defra climate change guidance therefore this new guidance has not been used for the SFCA. At the time of writing, Defra had not yet confirmed when new guidance will be available. Further research and updates are expected in the future.
- 2.3.6 The user must ensure that the most recent climate change guidance is considered over an appropriate time horizon when using the SFCA to inform decision making.

## 2.4 Strategic flood risk evaluation procedure

- 2.4.1 The SFCA has identified and analysed the three different types of flood risk information, including future flood zones and six sources of flooding using the strategic risk evaluation procedure (SREP).
- 2.4.2 It is important to note that there is no implied priority given to any of these specific types of risk and flooding. By considering climate change, the procedure is precautionary, in accordance with TAN15.
- 2.4.3 It is possible to reduce risk by reducing the hazard associated with the flooding or the vulnerability of the receptor at risk. It follows that development proposals should be developed and assessed using a risk-based search sequence avoiding risk where possible and managing it elsewhere.
- 2.4.4 The SFCA should be used to provide high level flood risk information for decisions on land use planning. This can be done on an 'as required' basis, matching the needs of phased submission of applications. The SREP is shown diagrammatically in Figure 2.2.

## 2.5 Staged approach to risk assessment

- 2.5.1 Flood risk can be assessed in various degrees of detail, which should be proportionate to its nature and complexity. More specifically, the level of assessment will depend on;
- the relative area affected by flooding
  - the severity of the consequences of the flooding
  - the receptors affected by the flooding
  - the certainty of information.

- 2.5.2 SFCAs are encouraged to be carried out as part of the development plan stage, to ensure that flood risk is taken into account when considering future land allocations and development control policies. The level of SFCA required varies from a Stage 1 to 3. The three stages are discussed in Operational Instruction 303 \_09 provided by the Environment Agency Wales.
- 2.5.3 There are potentially three stages in the production of an SFCA. The number of stages is dependent on the level detailed required, the level of detail progressively increases for each stage.

**Table 2-2 Stages of the production of the SFCA**

	<b>Description</b>	<b>Purpose</b>	<b>Activity</b>
Stage 1	Compile existing information of flooding	Inform policy production and site selection	Compile existing information on flooding to see how much growth falls in flood risk areas.
Stage 2	Inform policy production and site selection	Inform policy production and site selection	Refine information to narrow site options
Stage 3	Test site suitability	To test site suitability	Apply information to show that consequences of all forms of flooding can be acceptably managed.

- 2.5.4 For SFCAs, the quality and quantity of information used in the assessment depends on the extent and severity of flood risk within the administrative boundary, the vulnerability of the development and the certainty of information. A less detailed assessment is recommended where the relative area of flood risk is small, and all development can be allocated in low probability Flood Zones. However a more detailed assessment is required where development cannot be placed in low probability Flood Zones. The Bridgend SFCA comprises a Stage 1 assessment across the whole county, and a Stage 2 assessment for the identified strategic development areas (Maesteg, Valleys Gateway, Porthcawl, Pencoed & Waterton).

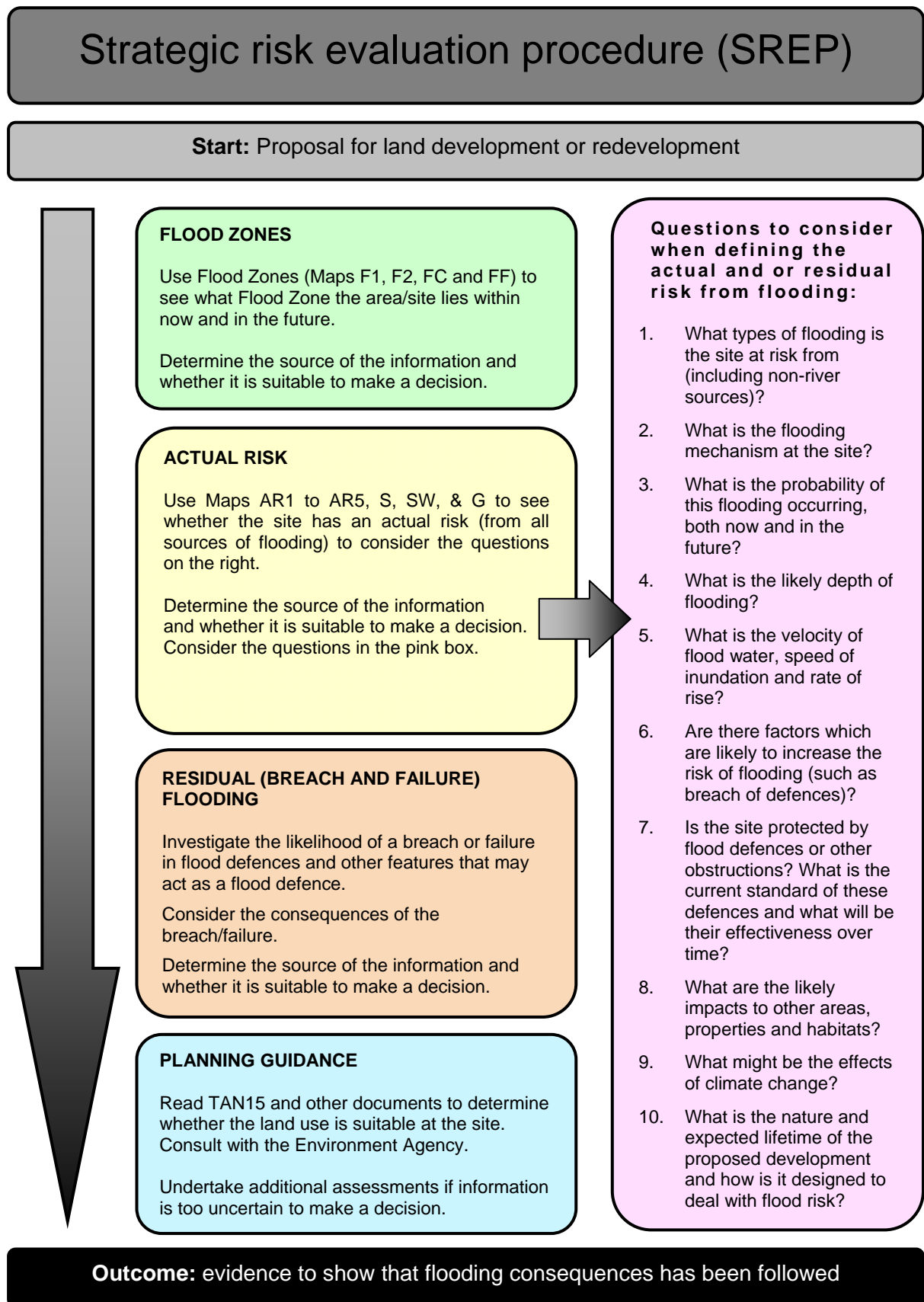


Figure 2-2 Strategic flood risk evaluation procedure

## Stage 1 SFCA

2.5.5 A Stage 1 SFCA provides information so that the Sequential Approach, detailed in TAN15 (Paragraph 6.2) can be applied. Stage 1 information should be used to direct development to Zone A, then Zone B and only Zone C where there is no other suitable site available. For the Bridgend SFCA, maps providing information on all sources of flooding have been prepared so these can be considered alongside flooding from rivers and the sea. The Stage 1 SFCA provides information so that BCBC can:

- identify potential allocations at risk of flooding;
- identify locations where climate change may have a significant impact;
- identify locations where additional development may significantly increase flood risk elsewhere, which will inform the LDP strategic options;
- identify areas that flood from sources other than rivers and sea;
- identify the location of any flood risk management measures, including infrastructure and flood warning systems;
- provide guidance on which SuDS techniques would be appropriate for managing surface water run-off at key development sites; and
- prepare appropriate policy statements, informed by the above.

## Stage 2 SFCA

2.5.6 A Stage 2 SFCA assessment is required if:

- the Stage 1 assessment indicates that potential allocation sites need to be considered in flood risk areas;
- the Stage 1 assessment indicates that the developments may create or exacerbate flooding elsewhere;
- the receptors of flooding are sufficiently vulnerable to warrant a more detailed assessment.

2.5.7 It is not uncommon for development to be proposed in areas of higher probability flooding due to:

- non-flood related factors limiting development opportunities in lower probability areas;
- location specific factors requiring development in these areas; and
- higher probability flood risk areas covering much of the administrative boundary.

2.5.8 Stage 2 assessments should assess the impacts of climate change on flood risk. The Stage 2 information will be used to inform the allocation of sites and application of the Justification Test and so must include indication of;

- variation in flood risk (flood probability, depth, velocity, rate of rise and speed of inundation, accounting for the influence of flood defences and other infrastructure;



- residual flood risk (overtopping and breach failure hazards) including an appropriate allowance for climate change;
- appropriate flood policies for different areas within the boundary;
- appraisal of the current condition of the flood defence infrastructure where relevant to new development and the long-term maintenance policy; and
- guidance on appropriate measures to manage flood risk to acceptable levels.

### **Stage 3 SFCA**

2.5.9 A Stage 3 SFCA is required if following Stage 2 it is still envisaged that development is required in flood risk areas. The purpose of Stage 3 is to confirm that flood risk to any candidate site(s) or prospective development site (s) can be managed to an acceptable level and that the development itself will not exacerbate flooding elsewhere over its lifetime. LPAs should satisfy themselves that flood risk management measures associated with a potential allocation are feasible and practicable. Stage 3 assessments should also reduce the time and resources required for any subsequent FCAs carried out at the planning application stage.

## **2.6 Flooding in Bridgend**

2.6.1 Information concerning the six types of flooding has been collated and analysed for the whole of the study area. The assessment has aimed to characterise flood risk today and also into the future. A 100 year time horizon has been assessed and is considered appropriate for land use planning, based upon the maximum application of the current government guidance on climate change.

2.6.2 The Environment Agency and other key stakeholders have been contacted throughout the SFCA process in an attempt to gather as much information as possible from Bridgend Borough County Council, Environment Agency Wales and Welsh Water.

2.6.3 The methodology used for the SFCA was based on the best use of available information and involved minimal new analyses and limited hydraulic modelling across the study area. Each dataset was reviewed with regard to its accuracy and the most appropriate datasets were used to define flood risk across Bridgend under varying conditions. Broad-scale (2D TUFLOW) modelling was completed for the five strategic development areas to provide more detailed information for the Stage 2 SFCA assessment. Details of the SFCA modelling are provided in Volume 2 (Technical Report).

2.6.4 An amalgamation of the current DAM zones, EA Flood Zones and the TUFLOW (broad-scale) models produced as part of the SFCA were used in defining current and future SFCA flood zones. TUFLOW is a two-dimensional hydrodynamic modelling package commonly used for flood modelling applications in the UK and elsewhere. It is important that the source of flood data is considered whenever using it to inform a land use planning decision.

2.6.5 Bridgend CBC and the Environment Agency will need to manage the update of the SFCA datasets in the future, as more detailed flood risk information becomes available. The management protocols are outlined in Section 8 of this document.

## 2.7 Stage 1 Assessment for Bridgend

### Summary of flood risk in Bridgend

- 2.7.1 The dominant flooding source affecting the BCBC district is flooding from rivers. The principal watercourses are the River Ogmore, the River Llynfi and the River Ewenny. Flooding from the sea is not currently a significant problem, however it may become more significant in the future as sea level rises. Although incidents of surface water flooding and sewer flooding are potentially significant, there is less certainty in assessing these risks at a strategic level. Flooding from artificial sources is also important due to the potential severity of consequences.
- 2.7.2 The areas most at risk of flooding are:
- Abergarw - at risk of flooding from rivers, sewers, surface water and groundwater.
  - Maesteg - at risk of flooding from rivers, surface water, sewers and groundwater.
  - Bridgend – at risk of flooding from rivers, surface water, sewers and groundwater.
  - Pencoed – at risk of flooding from rivers, surface water, groundwater and artificial sources.
  - Waterton - at risk of flooding from rivers, surface water and groundwater.
  - Pyle – at risk of flooding from rivers, surface water, groundwater and sewers.
  - Porthcawl / Newton at risk of flooding from tidal, surface water and sewers.
- 2.7.3 Climate change research predicts an increase in the severity and frequency of rainfall events. Flooding from rivers, sewers and surface water is therefore likely to increase throughout BCBC in the future. BCBC is also expected to become increasingly vulnerable to tidal flooding as sea levels rise.
- 2.7.4 Areas likely to have notable increases in flood risk in the future are:
- Abergarw / Brynmenyn - increased flooding from rivers, sewers and surface water.
  - Maesteg - increased flooding from rivers, sewers and surface water.
  - Waterton - increased flooding from rivers, sewers and surface water.
  - Porthcawl/Newton - increased flooding from the sea, sewers and surface water.

### Flood risk statistics in Bridgend

- 2.7.5 The Stage 1 SFCA has been undertaken over the whole of BCB administrative boundary so that the Council can make a comparative assessment of flood risk. This allows consideration of flood consequences and the vulnerability of developments in accordance with the principles of TAN15 when allocating land for development and making decisions on the acceptability of planning applications. Table 2-3 provides a summary of the key flood risk statistics across BCBC.

Table 2-3 Key flood risk statistics for BCBC

	Approximate area or number	Percentage of total area or number
<b>BCBC statistics (Map O)</b>		
BCBC district area	255 km <sup>2</sup>	100%
Existing urban areas	38 km <sup>2</sup>	15%
<b>Flood statistics</b>		
<b>Flooding from rivers and sea (Maps F1 and F2)</b>		
Area of BCBC within SFCA Zone B	3km <sup>2</sup>	1%
Area of BCBC within SFCA Zone C1	1km <sup>2</sup>	0.4%
Area of BCBC within SFCA Zone C2	19 km <sup>2</sup>	7.5%
Area within BCBC covered by a flood warning service	6.7 km <sup>2</sup>	2.6%

## Regeneration-Led Spatial Strategy

2.7.6 The Preferred Strategy for BCBC, in order to achieve the Vision and Objectives of the LDP, is the implementation of a Regeneration-Led Spatial Strategy. Four Key Strategic Regeneration Growth Areas will be brought forward that will deliver a range of mixed-use developments and facilities at: -

- Porthcawl
- Maesteg and the Upper Llynfi Valley
- The Valleys Gateway;
- Bridgend.

2.7.7 In addition, Four Strategic Employment Sites have been identified at:

- Broscastle, Waterton
- Island Farm, Bridgend
- Pencoed Technology Park
- Ty Draw Farm, North Conelly

2.7.8 From these Strategic Development Areas, BCBC have identified five for specific consideration as part of this SFCA:

- Maesteg
- Porthcawl
- The Valleys Gateway
- Waterton
- Pencoed

2.7.9 These development areas are shown on Map O in Annex A; further information & guidance for these development areas is provided in later sections of this report.

## 2.8 Uncertainty

2.8.1 Flood risk can be assessed using a number of techniques and also to various degrees of detail. It is important to be confident that the methods used for estimation produce results that are sufficiently robust for land use planning decisions to be based upon.

- 2.8.2 Uncertainty in flood estimation arises from the;
- complexity of the flooding
  - quality of the input data
  - the potential impact of climate change.
- 2.8.3 When using the SFCA to inform land use planning the following questions must be answered;
- Is the assessment suitable for the type of flooding and the scenarios being considered (fit for purpose)?
  - Is the study appropriate for the level of detail required for the proposed land use (vulnerability)?
  - Are the limitations of the method clearly understood and reported?
  - Are the studies appropriately verified?
  - Are the key assumptions identified and stated?
  - Is the key input data justified and appropriate for the level of assessment (fit for purpose)?
  - Have sensitivity analyses<sup>1</sup> been carried out?
  - Have all relevant uncertainties (ie. climate change) been identified and appropriately addressed?
  - Is the information up to date?
- 2.8.4 Where there is high certainty in flood estimation there may be no need for further analyses. Conversely low certainty requires more detailed assessment.
- 2.8.5 The potential impacts of climate change are an important aspect of uncertainty relevant to flood risk estimation. Government guidance suggests that the impacts of climate change can be managed by either monitoring change in risk and adapting in the future as the need arises (Managed Adaptive Approach) or acting now to manage the eventuality (Precautionary Approach).
- 2.8.6 Adopting a "Managed Adaptive Approach" to land use planning is not advised. Future adaptation to the impacts of climate change may not be feasible in the long-term or practical in intervening periods and the requirement to review and take action can be managed more effectively through individual planning applications rather than by Bridgend CB within the LDP process.
- 2.8.7 Climate change information within the SFCA has been based therefore on a precautionary approach to ensure that planning led decisions are made on a "no-regret" basis.

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<sup>1</sup> An assessment of the sensitivity of flood model results (water levels, extents, depths) to input parameters e.g. flow, roughness, structure energy loss coefficients etc.

## 2.9 Currency of information

- 2.9.1 It is imperative to ensure that the latest information is used when assessing flood risk. The source and currency of the flood risk information should be checked before using any information. Management protocols are included in Section 8.

## 3. How to use the SFCA in land use planning (site allocations)

### 3.1 Introduction

- 3.1.1 This chapter describes the application of the precautionary approach for the guidance for development of key areas in the formulation of the Local Development Plan.
- 3.1.2 Guidance on development and flood risk is given in Technical Advice Notes (TAN 15) and Planning Policy Wales. These documents require that flood risk be considered through the application of the precautionary framework, which guides development away from areas of high risk of flooding.
- 3.1.3 It must be noted that the guidance provided in this document does not supersede guidance provided in TAN15 or other plans or policies. The information and procedures are simply provided as an interpretation of this guidance for the preparation of the Local Development Plan (LDP).

### 3.2 Objectives

- 3.2.1 Bridgend County Borough Council is responsible for carrying out spatial planning and developing the LDP. SFCAs are undertaken to inform the spatial planning process at the local scale.
- 3.2.2 Within the LDP there is;
- A strategy based on a vision (including aims and objectives, key policies, broad locations for development and spatial interpretation of the strategy);
  - Area wide policies for all development and/or development types;
  - Allocations of land and related sites (founded on a robust and credible assessment of suitability);
  - Specific policies and proposals for key areas of change or protection;
  - Reasoned justification for policies; and
  - A proposals map on a geographical base.
- 3.2.3 The SFCAs will inform the development of the vision, policies and allocation of land during the production of the strategy. A SFCA undertaken to an appropriate level of detail ensures that the Strategy is robust and able to underpin the production of LDPs in accordance with statutory requirements.
- 3.2.4 The SFCA will form a key part of the evidence base for Bridgend County Borough Council. The SFCA will aid in determining appropriate development policies and land allocations that avoid or minimise flood risk from all sources and to assess any future development proposals in line with the precautionary framework in PPW and TAN 15. The SFCA provides the necessary information for planners to be able to take the strategic decisions that identify where development may be permitted, and will reduce objections to development, saving time and costs.

- 3.2.5 Flood risk can be assessed to various degrees of detail, which should be proportionate to the nature and complexity of the flood risk within the administrative boundary. To ensure that an appropriate assessment is completed guidance in the FRM: SFCA for Wales (Operational instruction 303\_09) recommends three levels of detail;
- Stage 1 (initial assessment) – The purpose of this stage is to determine how much growth falls in the flood risk areas. The study should be carried out for all of the administrative area. The assessment should enable the LPA to apply the sequential approach, that is to direct development into Flood Zone A and away from Flood Zone C.
  - Stage 2 (more detailed assessment) - where the result of the Stage 1 assessment indicates that there is an issue of flood risk, then it is necessary to undertake a more detailed assessment of flood risk. The impacts of climate change will need to be considered. LPAs need to guide development to areas where risk can be managed with minimum reliance on raised defences (existing or proposed).
  - Stage 3 (Test site suitability) – to confirm that the flood risk to any of the candidate sites or prospective allocations can be managed to an acceptable level and that the allocation site does not exacerbate flooding elsewhere. This stage allows for a reduction in the time and resources required for any future FCAs.
- 3.2.6 Bridgend County Borough Council SFCA has undertaken a Stage 1 assessment for the whole administrative area and a Stage 2 assessment providing more detail for the Strategic Development Areas. Stage 3 assessments are required for those candidate sites or prospective allocations where flood risk needs to be considered in more detail and will be completed as these sites come forward. They are outside the scope of this SFCA. The Council can use the SFCA to;
- prepare appropriate policies for the management of flood risk within the County Borough;
  - inform the sustainability appraisal so that flood risk is taken account of when considering options and the preparation of strategic land use policies;
  - enable them to determine the acceptability of flood risk in relation to emergency planning capability (see Section 4);
  - identify the level of detail of required FCAs (see Section 5); and
  - identify potential strategic flood risk management measures for each of the strategic development areas (Section 6).

### 3.3 Decision support guidance

- 3.3.1 This user guide provides tools for interpreting the technical information contained in Volume II, maps and data for use in land use planning. These tools are intended to support the application of the Precautionary Framework as described in the following sections.

#### Application of the Precautionary Framework

- 3.3.2 Section 3 of TAN15 describes the application of the Precautionary Framework in determining the appropriate location for development. The operation of the precautionary framework is governed by the Development Advice Maps (DAM) and the vulnerability of different land uses. The framework is an aid for forward planning and development control purposes.
- 3.3.3 The aim of the precautionary framework is to direct new development away from areas with high flood risk. Where development has to be considered in high risk areas, the precautionary framework requires that development is justified in that location, and is tested to ensure that flood consequences can be acceptably managed.

- 3.3.4 The operation of the precautionary framework is governed by:-
- Development Advice Maps (DAM) which contain three zones (described in Table 2-1). These zones are used to trigger the appropriate planning test, refer to Figure 1 in TAN 15. The SFCA used the DAM zones as a starting point and built on these to provide refined flood zones for the SFCA.
  - Definition of vulnerability of the development to flooding; developments are divided into three development categories (emergency services, highly vulnerable development and less vulnerable development), detailed in Figure 2 of TAN 15.
- 3.3.5 The precautionary framework will indicate the planning tests that are required for each of the developments and will identify the vulnerability of different land uses to flooding. All developments will not fall into predefined development categories.
- 3.3.6 Each of the SFCA tools is more suited to a different land use planning decisions that must be made. They are:

#### **(1) Information to direct development away from high flood risk areas**

- 3.3.7 In accordance with the precautionary framework development should be directed preferentially towards Flood Zone A, considering the impact of climate change for the lifetime of development, and areas with a low risk of flooding from other sources. Where this is not possible, a sequential approach directing development towards Zone B, then Zone C1 and C2 (considering climate change and other sources of flooding) should be adopted.
- 3.3.8 The SFCA provides refined Flood Zones and information on all sources of flooding to provide decision support guidance when seeking an appropriate location for development. These maps expand on the DAM and TAN15 guidance, and are:
- Map F1 (county wide) /FC (strategic development areas) and Map F2 / FF: Current flood zones and future flood zones;
  - Map S: Flooding from sewers and drains;
  - Map SW: Flooding from surface water;
  - Map G: Flooding from groundwater; and
  - Map A: Flooding from artificial sources.

#### **(2) Information on which land uses are considered appropriate in different locations**

- 3.3.9 Table 3.1 provides generic decision support in relation to the six sources of flooding and potential land uses for the LDP. This table provides guidance on when the Justification Test is required and expands upon the table in TAN15 Section 9 by providing additional guidance on the likely criteria for development. Section 3.5 describes the application of the Table 3-1 and the justification test.

#### **(3) Guidance on the application of the Justification Test & assessment of flood consequences**

- 3.3.10 Development in Wales is currently located along rivers and in the coastal plain, therefore it is difficult to avoid flood risk areas. There is existing development that is vulnerable to flooding and falls within Flood Zone C. Consequently it is recognised that flood risk information must be considered alongside other spatial planning issues. Allocations are thus “tested” on the basis of their flood risk attributes and the outcome used to inform decisions



include other spatial planning issues. This is the Justification Test. Further information is provided below.

### **Information on which land uses are considered appropriate in different locations**

- 3.3.11 Table 3-1 and the table in Section 9 of TAN15 provide generic decision support in relation to the six sources of flooding and potential land uses for the LDP. The table also provides guidance as to when the Justification Test is required.
- 3.3.12 Figure 2 in TAN15 defines three development vulnerability classifications: Emergency Services, Highly vulnerable and Less vulnerable. The Emergency Services category describes facilities which need to remain operational in times of flood. Highly vulnerable development includes those where occupiers have limited ability to manage the consequences of flooding or decide whether they wish to accept the associated risks. It also includes facilities where there is a risk to the public and water environment should the site be inundated. Less vulnerable development includes land uses where the ability of occupants to decide on whether a risk is acceptable and manage the consequences of flooding is greater. Other development types, including boatyards and marinas, have not been classified as above as by their nature are required in fluvial, tidal or coastal locations.
- 3.3.13 If the proposed development is a mixed use development, it would be appropriate to classify the development according to what is considered as more vulnerable, for example if the development is a public building with offices it would be classified as highly vulnerable development (refer to Figure 2 TAN15).

Table 3-1 SFCA planning guidance summary table (to be used in conjunction with table in Section 9 of TAN15).

		<b>Emergency Services</b> Hospitals, ambulance, fire stations, police stations, coastguard stations, command centres, emergency depots and buildings used to provide emergency shelter in time of flood	<b>High Vulnerable Development</b> All residential premises (including hotels and caravan parks), public buildings (e.g. schools, libraries, leisure centres), especially vulnerable industrial development (e.g. power stations, chemical plants, incinerators), and waste disposal sites	<b>Less Vulnerable Development</b> General industrial, employment, commercial and retail development, transport and utilities infrastructure, car parks, mineral extraction sites and associated processing facilities, excluding waste disposal sites	<b>Other</b> Boatyards, marinas, essential works required at mooring basins, and development associated with canals
<b>Current SFCA Flood Zones Map F1 / FC (rivers &amp; sea)</b>	<b>Zone A</b>	Development is appropriate. No constraints on development, other than managing surface water runoff and avoid increasing risk elsewhere in the catchment (check Maps FC, FF, A, S, SW, &G). Refer to Maps SS1 and SS2 for SuDS suitability.			
	<b>Zone B</b>	Development is appropriate if site levels are greater than extreme flood level (0.1%). In other cases assessment required to demonstrate consequences can be managed in an acceptable manner. Flood resistant design should be considered. There should be no additional flooding in the catchment. Management of surface water runoff. Check other sources of flooding. Unlikely to be major constraints on development.	Development is appropriate if site levels are greater than extreme flood level (0.1%). In other cases assessment required to demonstrate consequences can be managed in an acceptable manner. Flood resistant design should be considered. There should be no additional flooding in the catchment. Management of surface water runoff. Check other sources of flooding. Unlikely to be major constraints on development.	Development is appropriate if site levels are greater than extreme flood level (0.1%). Occupiers should be aware of flood risk and there should be no increase flood risk in catchment. Management of surface water runoff. Unlikely to be major constraints on development.	Development is appropriate. Management of surface water required.
	<b>Zone C1</b>	Development should be avoided. Application of the Justification Test is required. If development in that location is justified full assessment of flood consequences required. Consequences should be acceptable for nature of use (refer to TAN15, Appendix 1 and Maps AR1 – AR5). Flood defences should be adequate and agreement for construction & maintenance costs secured. Safe evacuations and flood resistant design should be considered. There should be no additional flooding in the catchment. Management of surface water runoff.			Assessment of flood consequences required. Consequences should be acceptable for nature of use. Occupiers should be aware of flood risk and effective flood warning and evacuation procedures considered. No increase in flooding elsewhere. Management of surface water runoff.
	<b>Zone C2</b>	Development should not be permitted.		Development should be avoided. Application of the Justification Test is required. If development in that location is justified full assessment of flood consequences required. Consequences should be acceptable for nature of use (refer to TAN15, Appendix 1 and Maps AR1 – AR5). Flood defences should be adequate and agreement for construction & maintenance costs secured. Safe evacuations and flood resistant design should be considered. There should be no additional flooding in the catchment. Management of surface water runoff.	Assessment of flood consequences required. Consequences should be acceptable for nature of use. Occupiers should be aware of flood risk and effective flood warning provided. Flood resistant design should be considered. No increase in flooding elsewhere. Management of surface water runoff.
<b>Future SFCA Flood Zones Map F2 / FF (rivers &amp; sea)</b>	<b>Future Zone C1</b>	Development may not be appropriate. Consequence assessments should consider the impact of climate change on flood risk for the lifetime of the development to demonstrate that flood risk can be appropriately managed. Planning requirements as above.			Consequence assessments should consider the impact of climate change on flood risk for the lifetime of the development to demonstrate that flood risk can be appropriately managed. Planning requirements as above.
	<b>Future Zone C2</b>	Development may not be appropriate. Consequence assessments should consider the impact of climate change on flood risk for the lifetime of the development to demonstrate that flood risk can be appropriately managed. Planning requirements as above.			
<b>Map AR1 to AR5</b>	<b>Actual Risk</b>	Flood consequences should be assessed for the lifetime of the development. Refer to indicative guidance in Section 3.3 and TAN15 Appendix 1. Development should be flood free for 0.1% AEP flood event (tidal and fluvial).	Flood consequences should be assessed for the lifetime of the development. Refer to indicative guidance in Section 3.3 and TAN15 Appendix 1. Development should be flood free for 0.5% AEP flood event (tidal ) and 1% AEP event (fluvial).	Flood consequences should be assessed for the lifetime of the development. Refer to indicative guidance in Section 3.3 and TAN15 Appendix 1. Development should be flood free for 0.5% AEP flood event (tidal ) and 1% AEP event (fluvial).	Consequences should be acceptable for nature of use.
<b>Map RR</b>	<b>Residual Risk</b>	Flood Consequence assessments should consider the maintenance of flood management infrastructure and consequences of failure. Development may not be appropriate where consequences of flooding cannot be acceptably managed. Further breach analysis is required for proposed development considering the 0.1% AEP flood event. TAN15 Appendix 1 indicates that a suitable buffer zone should be adopted surrounding flooding caused by the breach, where no development should be allowed.			
<b>Map SW</b>	<b>Surface water flooding</b>	Consider potential effect of extreme events, particularly in relation to locations identified as being at 'high risk'. Assessments should consider strategic solutions or careful design of individual built form on a case by case basis in relation to a detailed assessment of risk. Consultation required with Highway authorities, Land Drainage Authorities, and Sewerage Undertakers to identify localised risk of flooding.			
<b>Map G</b>	<b>Groundwater flooding</b>	Consider potential effect of extreme events, particularly in relation to locations identified as being at 'high risk'. Assessments should consider strategic solutions or careful design of individual built form on a case by case basis in relation to a detailed assessment of risk.			
<b>Map S</b>	<b>Sewer flooding</b>	Consultation with water companies or operating authorities should be sought to confirm localised risk of flooding and any ongoing mitigation.			

Notes:

- i. This Matrix is designed to provide planning guidance to Bridgend Local Planning Authority in accordance with the Strategic Flood Consequence Assessment, and it does not in any way supersede or replace TAN15.
- ii. The Precautionary Framework should be applied before considering the application of the Justification test or determining whether a particular location is appropriate for the development vulnerability defined.
- iii. For potential solutions affected by flood risk full consideration shall be given to the management, maintenance and operation of any necessary measures (be they strategic or site specific). Failure to be able to demonstrate commitment to the long term operation, management and maintenance of such measures for the lifetime of development will deliver development that cannot be sustained.
- iv. This Matrix is based on the principles of TAN15
- v. Further details of the justification test and acceptability consequences and criteria can be found in TAN15 and the Strategic Flood Consequence Assessment. Any proposed development requiring a justification test, or development where the actual risk is reduced due to the presence of defences should utilise the velocity and depth data provided in the Strategic Flood Consequence Assessment and allocate reduced vulnerability land uses appropriately.
- vi. Where development is proposed that relies on a reduced level of flood risk due to flood defences, the FCA must include a full assessment of the impact of the failure of flood defence infrastructure (ie. Overtopping, breaching, blockage etc).
- vii. Third party infrastructure may act as a Flood Defence, although it must never be assumed that this infrastructure IS a flood defence (ie. It may not be constructed of suitable materials, or not be maintained as a flood defence).
- viii. Flood consequence assessments should include consideration of flooding from all sources identified in the SFCA, a qualitative methodology has been used to assess risk of flooding from Surface Water, Sewer and Groundwater in order to predict relatively problematic areas. However the scale of the risk has not been assessed quantitatively, hence the scale of the response in planning or development terms must be considered on a site by site basis and always in consultation with the appropriate responsible body, namely the Environment Agency, Welsh Water, the Highways Authority (with respect to Surface Water drainage from road network) and Bridgend BC departments as appropriate

## The Justification Test

- 3.3.14 The Justification Test should be applied by Bridgend Borough County Council when allocating land for development in Zone C during the production of the Local Development Plan (LDP). TAN15 outlines that ideally development should be directed away from flood zone C, however recognises that this is not always feasible. Development will only be permitted in zone C1 and C2 if it can be demonstrated that:
1. The location of the development is necessary to aid or be part of the local authority regeneration initiative of a local authority strategy required to sustain existing development; **OR**
  2. The location of the development is necessary to contribute to key employment objectives supported by local authority and other key partners, to sustain an existing settlement or region.
- AND**
3. It concurs with the aims of PPW and meets the definition of previously developed land (PPW figure 2.1); **and**
  4. The potential consequences of a flooding event for the particular types of development have been considered and meet the acceptability criteria for flooding consequences (Section 5 & 7, and Appendix 1 in TAN 15)
- 3.3.15 TAN15 indicates that the Justification Test does not apply to development classified as highly vulnerable or Emergency Services located within zone C2. These land uses should not be permitted in Zone C2.
- 3.3.16 PPW indicates that government resources will focus on protection (flood and coastal defence) of existing developments and will not be available from the protection of anticipated development. The PPW expresses the need to have a sustainable approach to flooding which will involve; avoiding high flood risk areas, and where possible or practical the encouragement of managed retreat, the creation of wash-lands and flood plain restoration. Therefore new development should not be proposed in areas where new defences are required, and should be concentrated where there are existing defences or within Flood Zones A or B.
- 3.3.17 PPW indicates that development in the floodplains that are currently unobstructed should be limited to exceptional and limited essential transport and utilities infrastructure. This infrastructure should be able to function at all times, even during times of flooding, and not result in loss of floodplain storage or impede flood flows, and not increase flood risk elsewhere. The LPA will need to recognise that there are some developments, schools, hospitals, residential development and emergency services which should not be located in high flood risk areas.
- 3.3.18 The guidance provided should ideally be agreed by the Environment Agency and Bridgend County Borough Council. It is important that the decision maker engage key stakeholders early in the decision making process. It is also important to consider uncertainty of information when making land use planning decisions.
- 3.3.19 If parts 1, 2 and 3 of the Justification Test are satisfied, an assessment will be needed to determine whether the consequences of flooding can be managed appropriately, and that they are acceptable for the nature of the development, as described below.

## Assessing flood consequences

- 3.3.20 Table 3-1 of the SFCA and the table in Section 9 of TAN15 indicate the planning requirements for different type of developments, and detail whether a flood consequence assessment is required. The assessment will need to examine the likely mechanisms that cause flooding (addressing all sources of flooding) and the impact of the development on flooding. Detailed advice is provided in Appendix 1 of TAN15. Section 5.2 of the SFCA provides guidance for preparing a FCA.
- 3.3.21 The SFCA provides information on all sources of flooding, both now and in the future, to assist in determining the scope of flood consequence assessments (Maps F1, F2, A, S, SW & G). More detailed information on flood consequences has been provided for the strategic development areas (Maps AR1 – AR5).

## Acceptability criteria

- 3.3.22 Appendix 1 of TAN15 provides indicative guidance for determining whether the consequences of flooding are acceptable and flood risk can be appropriately managed.
- 3.3.23 If the development has been justified the consequence assessment will need to establish whether suitable mitigation measures can be incorporated within the design of the development to ensure there is minimal risk to life; disruption to people living and working in the area; potential damage to property; impact of the proposed development on flood risk generally; and disruption to natural heritage.
- 3.3.24 For most developments located in Flood Zone C there will be additional flood risks, the LPA will need to determine with assistances from the Environment Agency whether this risk is acceptable. TAN15 Appendix 1 indicates a development should only be considered where the following conditions can be satisfied:
- Flood defences must be shown by the developer to be structurally adequate particularly under extreme overtopping conditions (i.e. that flood with a probability of occurrence of 0.1%);
  - the cost of future maintenance for all new/approved flood mitigation measures, including defences must be accepted by the developer and agreed with the Environment Agency;
  - the developer must ensure that future occupiers of development are aware of the flooding risks and consequences;
  - effective flood warnings are provided at the site;
  - escape/evacuation routes are shown by the developer to be operational under all conditions;
  - flood emergency plans and procedures produced by the developer must be in place;
  - the development is designed by the developer to allow the occupier the facility for rapid movement of goods/possessions to areas away from the floodwaters;
  - development is designed to minimise structural damage during a flooding event and is flood proofed to enable it to be returned to its prime use quickly in the aftermath of the flood; and

- no flooding elsewhere

As well as the guidance provided above, TAN15 provides indicative guidance for different types of development, for the probability of flood risk when the development should be flood free, refer to Table 3-2. The lifetime of the development should be considered when referring to the indicative guidance, and appropriate climate change allowances applied if necessary.

**Table 3-2 Acceptable threshold frequency (TAN 15, Appendix 1)**

Type of Development	Annual Probability (AEP), %	
	Fluvial	Tidal
Residential	1	0.5
Commercial / Retail	1	0.5
Industrial	1	0.5
Emergency Services	0.1	0.1
General Infrastructure	1	0.5

3.3.25 Beyond the threshold frequency it is expected that the development would be flooded during extreme conditions. However there are acceptable criteria in regards to flood depth, velocity, rate of rise and speed of inundation, which are detailed below. It is important to know that these figures are only indicative and are not definitive. Maps AR1 to AR5 in the SFCA provide indicative maximum flood depth and velocity, the rate of rise of floodwaters and speed of inundation for the Strategic areas.

3.3.26 These maps should be used to guide development away from areas that do not meet the acceptability criteria. The maps should be used in conjunction with the indicative acceptability criteria provided in TAN15 and outlined below. These are based on broadscale modelling and are appropriate for considering site allocations in the LDP. More detailed assessments will be required as these sites are taken forward.

**Table 3-3 Acceptability Criteria for extreme events (TAN 15 Appendix 1)**

Type of development		Maximum depth of flooding (mm)	Maximum rate of rise floodwaters (m/hr)	Maximum speed of inundation of flood risk area (hrs)	Maximum velocity of floodwaters (metres/sec)
Residential (habitable rooms)	Property	600	0.1	4	0.15
	Access	600			0.3
Commercial & Retail	Property	600	0.3	2	0.15
	Access	600			0.3
Industrial	Property	1000	0.3	2	0.3
	Access	1000			0.45
Emergency Services	Property	450	0.1	4	0.15
	Access	600			0.3
General Infrastructure	Property	600	0.3	2	0.3
	Access	600			0.3

## Planning Summary Guidance

- 3.3.27 TAN15, PPW, the DAM Maps and the SFCA provide guidance to aid in the allocation of development within Bridgend County Borough Council area. The following generic steps should be undertaken when considering land-use allocation proposals;
1. Seek to direct development away from high flood risk areas;
  2. Assess the suitability of development and planning requirement with reference to Table 3.1 and Volume II of the SFRA;
  3. Identify the source of information and so certainty of the level of flood risk;
  4. Consult with the Environment Agency;
  5. Determine where necessary the requirement for more detailed studies based on areas of high risk (where receptors must be located in higher probability flood zones) and where information is too uncertain for an effective land use planning decision to be made;
  6. Consult with the Environment Agency;
  7. Where land use is planned in areas of higher probability flood risk, use the SFCA to test the proposed application against the Acceptability Criteria (see TAN15, Appendix 1);
  8. Consult with the Environment Agency; and
  9. Undertake detailed flood consequence assessments as necessary.

### **3.4 Windfall sites**

- 3.4.1 Any currently allocated sites that have not been assessed by the LPA, together with any new (windfall) sites that developers bring forward may need to be justified by the developer. In all cases, the assessment must be performed in an open and transparent manner. The LPA, along with the Environment Agency, will be responsible for overseeing the process, and for evaluating the submission by the developer.

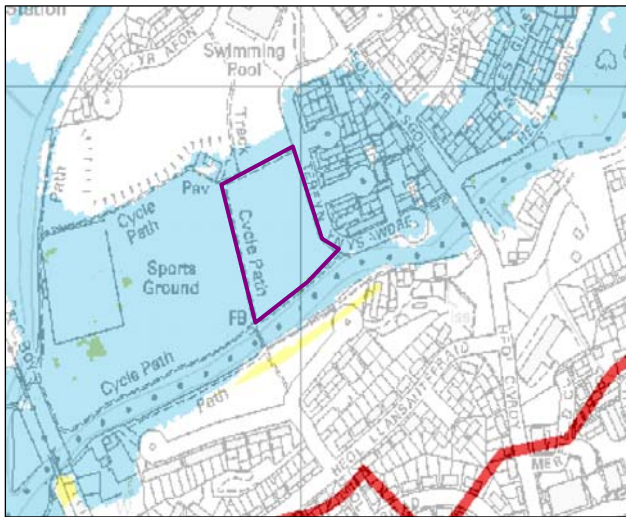
### **3.5 Example application of TAN15**

- 3.5.1 The purpose of this section is to provide illustrative examples within the BCBC area to demonstrate the implementation of the SFCA and TAN15. The examples provided in this section are **not** proposed development sites, they have been created for example purposes.

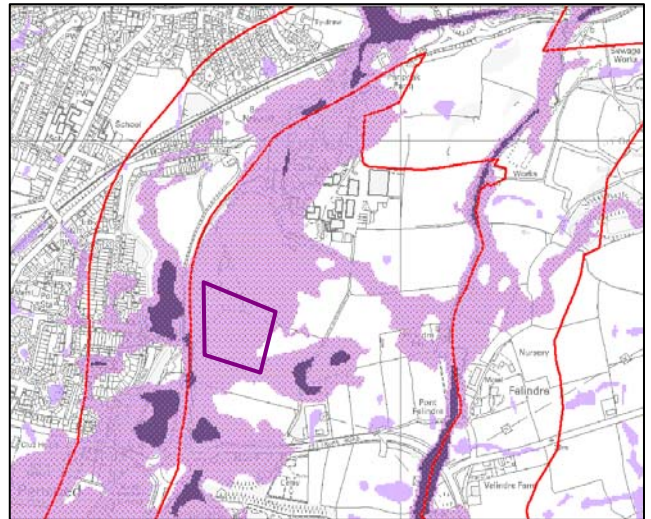
## Using the SFCA to locate development

- 3.5.2 When the LPA is selecting locations for proposed development the precautionary framework, detailed in the SFCA and TAN15, indicate that development should be directed away from high flood risk areas. This is applicable for all types of development. The following steps are suggested:
1. Use Map F1 / FC to identify whether potential sites are located in Flood Zones. Where possible, steer new development towards Zone A, then Zone B, C1 & C2 preferentially.
  2. Use Map F2 / FF to assess whether potential sites are likely to be within future flood zones. Where possible, steer new development away from future Flood Zone C.

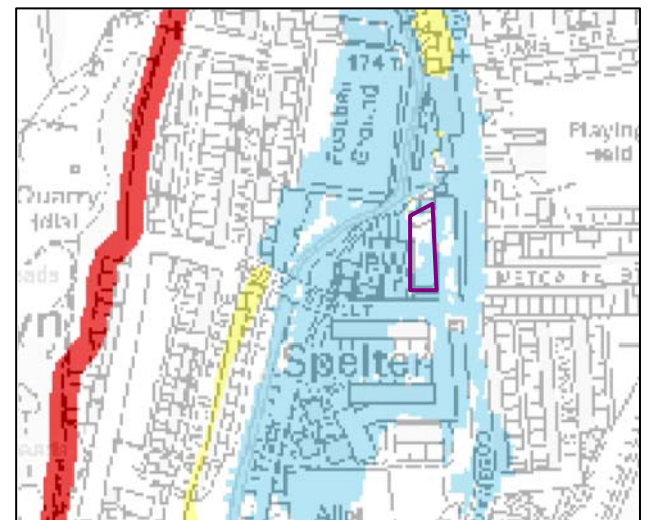
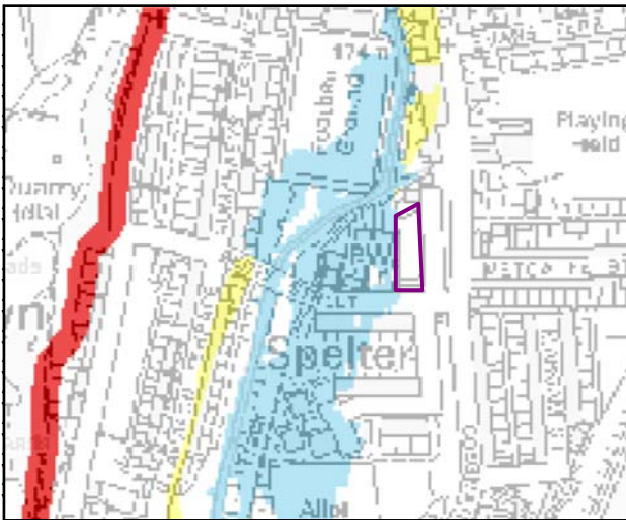
3. Use Maps A, S, SW & G to assess whether potential sites are likely to be affected by other sources of flooding. Where possible steer development towards low or medium risk areas.
- 3.5.3 At all steps the certainty of information should be considered and the Environment Agency consulted as necessary.
- 3.5.4 To illustrate these steps, four potential development sites for a police station within BCB have been considered (note this is **not** a proposed development).
- 3.5.5 TAN15 Figure 2 indicates that a police station is assigned a development category of Emergency Services. Table 3-1 in the SFCA and the table in Section 9 of TAN15 indicate that for Emergency Services development should not be located with in Flood Zone C.
  1. **Check current flood zones:** suggests Site 1 should be discounted, refer to Map FC.
  2. **Check future flood zones:** suggests Site 3 should be discounted, refer to Map FF
  3. **Check other sources of flooding:** suggests Site 2 should be discounted due to surface water flood risk, refer to Map SW. Similar checks should be made for the other sources of flooding shown on Maps A, S & G.
- 3.5.6 In accordance with the Precautionary Framework Site 4 would be the most appropriate site for development. There may be a requirement for further consultation with the Highway authorities, Land Drainage Authorities, and Sewerage Undertakers to identify localised risk of surface water flooding to development.



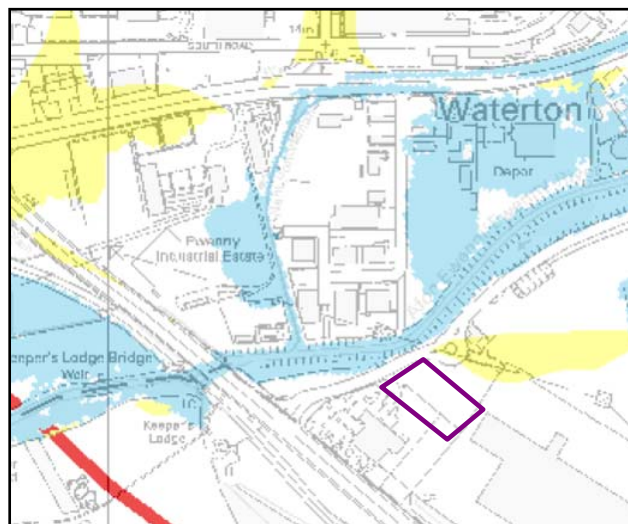
Site 1: Located in Flood Zone C (Map FC)



Site 2: Located outside Flood Zone C in area of surface water flooding (Map SW)



Site 3: Outside Flood Zone C (Map FC - left) but within future Flood Zone C (Map FF - right)



Site 4: Outside Flood Zone C (Map FC) and surface water flooding (Map SW)

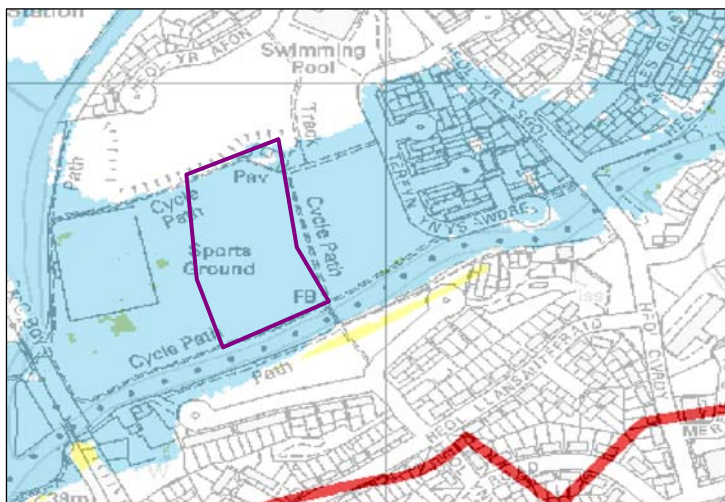


### Using the SFCA to identify suitable development for a site

- 3.5.23 Table 3-1 in the SFCA can be used to identify suitable development for a particular site. The following steps are suggested:
1. Use Map F1 / FC to identify whether the site is located within a Flood Zone.
  2. Use the information in Table 3-1 to identify suitable development vulnerability categories for the site and planning requirements.
  3. If necessary, consider whether proposed development would pass parts 1, 2 and 3 of the Justification Test (refer to paragraph 3.3.14, p27). If proposed development does not pass the test TAN15 suggests that the site should not be developed.
  4. Use Maps F2 /FF, SW, A, S & G, to assess future Flood Zones and flood risk from other sources and identify planning requirements and the need to apply the Justification Test.
  5. Use the SFCA information (Maps AR1 – AR5) to decide whether flood consequences can be acceptably managed and the scope of detailed assessments.
- 3.5.24 At all steps the certainty of information should be considered and the Environment Agency consulted as necessary. An illustration of this process is provided below.

### Applying Part 4 of the Justification Test

- 3.5.25 Table 3-1 and Section 9 of TAN15 provide guidance on when the Justification Test is required. Only when it is necessary to locate development in high flood risk areas, as demonstrated through Parts 1, 2 and 3 of the Justification Test should the acceptability of flood consequences be assessed (Part 4 of the Test). The following example illustrates how the SFCA information can be used to assist in the assessment to inform site allocation in the LDP.
- 3.5.26 A proposed development site in Valleys Gateway has been identified (note this is **not** an actual proposed development site). Although the site is located within Flood Zone C, it is decided that the site must be developed to support the local regeneration led development strategy.
- 3.5.27 The location of the development is shown in Figure 3-1. There are different land use planning decisions that will require slightly different approaches, the following steps are generic.



**Figure 3-1 Example Proposed Development Site**

- 3.5.28 These are the following steps that will need to be undertaken to ensure that the development meets the acceptability criteria:
- 3.5.29 **Step 1. Precautionary Framework:** The first step is to apply the precautionary framework which involves determining the flood zone the proposed development site is located within (Map FC and FF, Volume II). *For this situation the proposed development is located within Flood Zone C2.*
- 3.5.30 **Step 2. Information on which land uses are considered appropriate in different locations:** The next step is to use Figure 1 of TAN15 and Table 3-1 to determine the appropriate planning test for the type of development. For development within Zone C2, only less vulnerable and 'Other' development should be considered. On this basis development such as employment, retail and commercial premises may be appropriate, subject to passing the Justification Test and if flood consequences can be managed appropriately. With reference to Table 3-1, a full flood consequence assessment will be required. *For the remainder of this example it is assumed that a retail development has been selected*
- 3.5.31 **Step 3. Applying the Justification Test.** The next step is to determine if the proposed development is permissible according to the Justification Test, refer to Section 6 in TAN15 and Section 3.3 of the SFCA. TAN15 acknowledges that there needs to be some flexibility to enable flood risk to be addressed and recognises the negative economic and social consequences if policy were to preclude investment in existing urban areas and the benefits of reusing previously developed land. *If the retail development in this area was part of a regeneration initiative or a strategy, or contributes to key employment objectives, and is on previously developed land the development may pass the first three parts of the justification test.*
- 3.5.32 **Step 4. Assessing flood consequences:** If Parts 1 to 3 of the Justification Test have been met, the potential consequences of flooding should be assessed to determine if the development meets the acceptability criteria detailed in TAN15 (Part 4 of the Test). The detail of the assessment required will be reflected in the scale and potential significance of the development. The Environment Agency should be consulted about the level of assessment required and the objectives of the assessment.
- 3.5.33 TAN15 Appendix 1, Section E and Section 5.2 of the SFCA provides guidance of the information that is required as part of the assessment. The assessment will need to demonstrate how the development provides a safe and secure living and/or working environment throughout its life.

- 3.5.34 The assessment should also detail how the development meets the general criteria detailed in Appendix 1 of the TAN15 and Section 3.3 of the SFCA. The acceptability criteria for different types of development are provided in Appendix 1 of TAN15 and Table 3-3 of the SFCA, these values are indicative they are not prescriptive.
- 3.5.35 Information for the assessment and acceptability criteria can be obtained from the maps produced as part of Volume II of the SFCA, Maps FC, FF, AR1 to AR2, SW, S, A & G. The SFCA can be used to determine the sources of flooding and the certainty of the current information, and whether it is appropriate for use in the decision making process. The Environment Agency and other key stakeholders could be consulted to determine if there is additional information available.
- 3.5.36 The Environment Agency and other key stakeholders will also need to be consulted to determine the currency of the information. Particular attention should be paid to latest Government guidance, findings of strategy studies and current condition of flood defences. From assessing the currency of the information, it can be determined if a more detailed study is required, this will be necessary if the proposed development is located in an area of high risk (where receptors must be located in higher probability flood zones) or where information is too uncertain for an effective land use planning decision to be made.
- 3.5.37 *Using the information provided in the SFCA, the following information can be obtained to judge whether the development is likely to meet the acceptability criteria and is therefore suitable for allocation in the LDP:*
- The retail development is located within Flood Zone C2, the flooding mechanism is from the River Ogmore reaching full capacity and inundating the floodplain. Flooding is exacerbated in this area due to the railway embankment further downstream which restricts the volume of water able to flow downstream.*
  - The flood depth (for the 0.1% AEP flood event, 2110) for half of the site is fairly shallow flooding between 0.00 and 0.03m, the remaining half of the site is between 0.03 and 1.00 m. Refer to Map AR3. Only part of the site meets the requirements of the acceptability criteria in TAN15, there is a small part of the site to the east of the site where flooding is particularly deep.*
  - The flood velocity (for the 0.1% AEP flood event, 2110) is between 0.15 and 0.60 m/s, there are some locations where the velocity reaches 1.00 to 2.00 m/s. Refer to Map AR2. These values do not meet the requirements of the acceptability criteria in TAN15.*
  - The rate of rise is between 0.00 and 0.10 m/h (for the 0.1% AEP flood event, 2110), there are small areas where the value is higher, between 0.10 and 0.30 m/h. Refer to Map AR4. These values meet the requirements of the acceptability criteria in TAN15 as long as the access to the development is 0.30 m/hr or below.*
  - The speed of inundation is between 2.00 and 4.00 hours (for the 0.1% AEP flood event, 2110) with some areas being between 0.00 and 2.00 hours. Refer to Map AR5. These values do not meet the requirements of the acceptability criteria in TAN15.*
  - There is a low susceptibility of surface water flooding, refer to Map SW.*
  - There is a medium/high relative susceptibility of ground water flooding, refer to Map G.*
  - There is a low historical flooding risk of sewer flooding refer to Map S.*

- 3.5.38 *This shows that the proposed development does not meet the requirements of TAN15 due to the high flood velocities and depths. The impact of the high velocity would need to be considered and discussion would need to be held with the Environment Agency as to whether these could be managed. If these high velocities and depths are not acceptable appropriate flood mitigation measures would need to be implemented. A more detailed study would be required to ensure that this does not have further impact upstream or downstream. This site may be appropriate development, subject to a detailed flood consequence assessment demonstrating that the requirements of TAN15 can be met. The flood consequence assessment would need to provide details of any flood mitigation measures. The impact of these measurements will need to be assessed. It is important that the flood mitigation measure does not cause further risk to the development or the surrounding area.*

## 4. How to use the SFCA in flood warning and emergency planning

- 4.1.1 Government recognises that it is not possible to protect everyone, everywhere against every flooding eventuality. Extreme or unpredictable events can happen. While physical defences may provide a level of protection, they may be breached or overtopped. A necessary component of flood defence is flood warning, backed up by civil protection measures. In this context, the Environment Agency is the authority responsible for issuing forewarning of possible events to the public, local authorities and emergency services.
- 4.1.2 Structures and procedures for civil protection drawn up under the Civil Contingencies Act came into force in November 2004. The Act formalises the duties on Category 1 responders to emergencies by requiring risk assessment and contingency planning to deal with emergencies, and the giving of advice and information to the public about actual or likely emergencies.
- 4.1.3 Under the Act, risk assessment and planning is arranged through Local and Regional Resilience Forums. The Forums, which are led by the Regional Resilience Teams in the Government Offices of the Regions, seek to draw in all those bodies, which may be exposed to risk or be required to respond to events, including flooding. This includes production of an emergency flood management plan, which may then be incorporated into a local emergency plan or major incident plan as judged appropriate. The Teams also assist local authorities and emergency services in responding to and recovering from events.
- 4.1.4 The SFCA provides information on the spatial distribution of flood hazard, which can inform the production of emergency flood management plans. Emergency flood management plans should minimise risks to life and property, through, for example, ensuring that evacuation procedures are adequate to the kinds of risks that a major flooding event may create.
- 4.1.5 Information held within the SFCA can be used to:
- identify and develop emergency plans for parts of Bridgend County Borough Council which respond quickly to rainfall and produce hazardous flows (rapid response catchments);
  - identify and develop emergency plans for rapid inundation of properties due to flood events or failure of raised sections of defences and structures;
  - identify essential infrastructure at higher risk of flooding, such as power stations and public buildings;
  - identify major transportation linkages at higher risk of flooding; and
  - improve flood warning through further analysis of antecedent conditions and seasonality of flooding.

## 5. Using the SFCA for development control

### 5.1 Introduction

- 5.1.1 SFCAs set the context within which any planning application should be considered, by establishing;
- the category of Flood Zone within which the proposed development site is located in;
  - the flood risk constraints in accordance with guidance in TAN15;
  - the basis of the policies of Bridgend regarding proposed development in each Flood zone.
- 5.1.2 The SFCA should be used to provide high level flood risk information for decisions on land use planning. This can be done on an “as required” basis, matching the needs of phased submission of applications.
- 5.1.3 Developers should be referred to the SFCA at the start of any pre-application consultation with the LPA. Where developers promote development outside of the allocated areas identified in the LDP and within flood risk areas defined by the SFCA they are responsible for;
- demonstrating compliance with TAN15 notably the Justification Test if required.
  - providing an assessment of the impact of flooding on the development and of the development on flood risk elsewhere
  - satisfying the LPA that flood risk to the development and the impact of the development on flood risk elsewhere will be appropriately managed.
- 5.1.4 This will require the preparation of site-specific Flood Consequences Assessments (FCAs). The SFCA provides advice on the likely scope of FCAs, and developers should demonstrate that these have been considered prior to consulting further with the LPA and Environment Agency.
- 5.1.5 The level of information in FCAs should be proportionate to the degree of flood risk and the scale, nature and location of the proposed development. The SFCA provides information already available which should be considered in the production of site-specific FCAs. In these instances the SFCA allows the LPA to identify the level of detail required for site-specific FCAs in particular locations.
- 5.1.6 The SFCA should also be used to set planning constraints within development areas designated in the LDPs and where relevant in the case of windfall planning applications.

### 5.2 Guidance for developers

- 5.2.1 It is the responsibility of developers to consider flood risk issues at a site as early as possible and to consult with the Environment Agency prior to undertaking any FCA. Key points include the responsibility of landowners for safeguarding land and other property against hazards. It is the responsibility of property owners and users to manage the drainage of their land, as far as possible to prevent adverse impacts on neighbouring land.
- 5.2.2 Developers are advised to make independent checks regarding flood risk before purchasing a site. The developer should apply the precautionary framework to determine the appropriate land uses across the site with respect to any flood risk within the site.

- 5.2.3 The scope of any FCA should be agreed with the Local Planning Authority and the Environment Agency, and it should be agreed who the developer needs to consult. For example the developer may need to consult Sewerage undertakers, Highways Authorities, Reservoir Undertakers, British Waterways etc. The developer is responsible for demonstrating the development is consistent with the requirements of TAN15, PPW and those on flood risk in the LDP.
- 5.2.4 SFCAs should be used as the starting point as FCAs may be relatively minor in nature. For example the development may be small, on a low risk site and have minimal secondary effects on flood risk. FCAs should be proportional to the size and type of development and risk of flooding.
- 5.2.5 LDPs may provide specific guidance on, or criteria for, allocating development sites. Where sites have been allocated by the LPA, the SFCA may provide more detailed background information. A key requirement for FCAs is that they consider all sources of flooding and consider the consequence of flood risk at the development.

### 5.3 Guidance for site specific flood consequence assessments

- 5.3.1 The outcomes of the SFCA do not replace the requirement for an appropriate FCA to be undertaken at the planning application stage. Flood Consequence Assessments may be standalone documents submitted by the developer to accompany a planning application, or where an environmental statement is required, the developer should ensure that the FCA is incorporated into the study.
- 5.3.2 The topography of Bridgend varies from low lying, fairly flat coastal areas to the west of Bridgend and steep valleys to the north of Bridgend. The geology of Bridgend is quite varied therefore the catchment response is varied. Existing development across Bridgend tends to be located in the floodplain. The main source of flooding is fluvial, there are three main rivers running through Bridgend CB area, River Ogmore, River Llynfi and River Ewenny. A small area within Bridgend CB, Porthcawl area and land alongside the tidal Ogmore, is at risk of tidal flooding. The other sources of flooding in Bridgend CB area are land (surface water), groundwater and sewers.
- 5.3.3 Flood Consequence Assessments should consider all sources of flooding and provide suitable mitigation measures that can be incorporated into the design to ensure that the development has minimal risk to the property and people. Where risk of flooding from sources other than the sea or rivers has been identified such as groundwater or surface water flooding the FCA needs to consider the risk of flooding at the site. The SFCA provided maps for the risk from other sources. FCAs should also consider the impact of the development on flood risk elsewhere.
- 5.3.4 The FCA will be required to demonstrate that flood risk to the development and from the development can be managed now and in the future, to acceptable criteria for the type of development. The requirement for site-specific flood consequences assessments is detailed in TAN15. Planning applications for development proposals located in Flood Zone B where the site level is below the extreme (0.1%) flood level and all proposals for development located in Flood Zone C (including C1 and C2) require a FCA. The appropriate planning test according to TAN15 is triggered by using the precautionary framework, detailed in Section 3 (of TAN15).
- 5.3.5 TAN15 indicates that the developer will need to consult with the Environment Agency concerning the objectives of the assessment. TAN15 provides details of the objectives of the FCA:
- Develop a full understanding and appreciation of the consequences of flooding on the development;

- Develop a full understanding and appreciation of the consequences (i.e. the overall impacts) of the development on flood risk elsewhere within the catchment for a range of potential flooding scenarios up to that flooding a probability of 0.1% flood event;
- Establish whether appropriate mitigation measures can be incorporated within the design of the development to ensure that development minimises risk to life, damage to property and disruption to people living and working on site or elsewhere in the floodplain.

5.3.6 TAN15 provides guidance on the information required in the Flood Consequence Assessment, in addition the Environment Agency will need to be consulted concerning the requirements of the development. As part of the FCA the developers will need to provide information to demonstrate that their proposal satisfies the test contain in TAN15. In addition the FCA should provide a clear and simple description of the following key requirements:

- The likely sources of flooding;
- The likely mechanisms of flooding and overland flow routes;
- A description of the development and the planning context;
- The depths of flooding throughout the site;
- The speed of inundation throughout the site;
- The rate of rise of floodwaters throughout the site;
- Velocities of floodwaters across the site;
- probability of flooding and the impact of climate change on flood risk;
- The effect on access and egress and infrastructure, for example public sewer outfalls, combined sewer overflows, surface water sewers and effluent discharge from waste water treatment works;
- The impacts of the development on natural heritage;
- The impact of the development in terms of flood risk on neighbouring properties and elsewhere on the floodplain;
- surface water drainage;
- flood risk management measures including the application of SuDS;
- Consideration of the possibility of a blockage and the flood risk of the blockage to the development; and
- Consideration of the adequacy of the defences, and the flood risk due to overtopping and breaching of the defences;

5.3.7 Any new developments will generally result in additional flood risk, the FCA will need to demonstrate that the development can effectively manage the flood risk. TAN15 provides general guidance of the criteria that the development needs to satisfy, this includes:



- Flood defences must be shown by the developer to be structurally adequate particularly under extreme overtopping conditions (i.e. that flood with a probability of occurrence of 0.1%)
- The cost of future maintenance for all new/approved flood mitigation measures, including defences must be accepted by the developer and agreed with the Environment Agency.
- The developer must ensure that future occupiers of development are aware of the flooding risks and consequences
- Effective flood warnings are provided at the site. It is important to consider that the Environment Agency will not automatically provide or extend a flooding warning service.
- Escape/evacuation routes are shown by the developer to be operational under all conditions
- Flood emergency plans and procedures produced by the developer must be in place
- The development is designed by the developer to allow the occupier the facility for rapid movement of goods/possessions to areas away from the floodwaters
- Development is designed to minimise structural damage during a flooding event and is flood proofed to enable it to be returned to its prime use quickly in the aftermath of the flood.
- No flooding elsewhere

5.3.8 Appendix 1 of TAN15 and Section 3.3 of the SFCA provides particular guidance of flooding consequences that may be considered acceptable for different types of development. These criteria are only guidance and are not prescriptive.

## 5.4 Guidance for Strategic Areas

5.4.1 This section provides guidance to Bridgend County Borough Council for key items to consider in future flood consequence assessments in each of the Strategic Development areas.

### Porthcawl

5.4.2 If new development is proposed for the Strategic Development Area of Porthcawl, it is important that a number of aspects are addressed further. It has been highlighted by the Environment Agency that wave overtopping is a key mechanism. For this area future FCAs will need to consider the impacts of wave overtopping.

5.4.3 The information in Volume II (Technical Report) of the SFCA highlighted that Porthcawl was susceptible to surface water flooding, therefore for future development proposals the FCA would need to provide further details about the impact of surface water flooding on the development and appropriate surface water management.

### Pencoed

5.4.4 The Flood Zones (Maps FC and FF) and the flood depth maps (Map AR3) indicate the M4 road and railway embankment in Pencoed have a significant impact on flooding. For this

area further investigations would need to be undertaken as part of FCA. These investigations would involve identifying flow paths in the floodplain, particularly those through embankment for example culvert openings. The results from the investigations should feed back into the definition of the Flood Zones.

- 5.4.5 The information in Volume II (Technical Report) of the SFCA highlighted that Pencoed was susceptible to surface water flooding, therefore for future development proposals the FCA would need to provide further details about the impact of surface water flooding on the development and appropriate surface water management.

### Waterton

- 5.4.6 In addition to fluvial flood risk, the information in Volume II (Technical Report) of the SFCA highlighted that Waterton was susceptible to surface water flooding, therefore for future development proposals the FCA would need to provide further details about the impact of surface water flooding on the development and appropriate surface water management as well as fluvial flood risk management measures.

### Valleys Gateway

- 5.4.7 The Flood Zones (Maps FC and FF) and the flood depth map (Map AR3) indicate the B4281 road and railway embankment (specifically in the downstream area of the Strategic Development area) have a significant impact on flooding in the vicinity of Pandy Road and the sports ground further upstream. For this area further investigation would need to be undertaken as part of FCA. These investigations would involve identifying flow paths in the floodplain, particularly those through embankment for example culvert openings. The results from the investigations would feedback into the definition of the Flood Zones.

### Maesteg

- 5.4.8 The Flood Zones (Maps FC and FF) and the flood depth map (Map AR3) indicate that the topography of Maesteg has a significant impact on the flooding mechanism. In a number of areas there is deep flooding due to the restriction in the channel and floodplain, caused by structures and road embankments. For this area further investigation would need to be undertaken as part of an FCA. These investigations would include all the appropriate structures for that development, and any important flow paths in the floodplain, particularly culvert openings under embankments. The results from the investigations should feedback into the definition of the Flood Zones.
- 5.4.9 The information in Volume II (Technical Report) of the SFCA commented that a number of defences were not included in the models as they would have limited impact. For future FCAs the impact of these defences would need to be further investigated. The crest level of these defences would need to be surveyed or further information sought from the Environment Agency.

## 6. Recommendations for possible flood risk management measures

### 6.1 Introduction

- 6.1.1 In Section 3.5 of this document illustrated examples have been provided to demonstrate how the SFCA maps and the guidance within TAN15 are applied.
- 6.1.2 Five strategic development areas have already been identified where flooding will need to be considered. A more detailed Stage 2 SFCA has been completed for these sites to provide information on the level of flood risk, now and in the future, and identify possible flood risk management measures that could be employed to manage flood risk to acceptable levels. The following sections provide a brief review of the flooding mechanisms, flooding constraints and possible strategic flood risk management measures that could be considered for further assessment.
- 6.1.3 There are a number of options available to manage flood risk at proposed developments in order to meet the requirements of TAN15. Alleviation of flooding can be approached in three different ways, detailed below are methods to alleviate flooding from all different sources of flooding in Bridgend County Borough:
1. Avoidance – developing outside flood risk areas.
  2. Prevention –
    - a. walls and embankments used to exclude water from a site,
    - b. new and improved channel conveyance, drainage systems (including drains, dams and embankments)
    - c. improve conveyance of floodwater through and away from flood prone areas
    - d. pumping or flood storage areas used to attenuate/retain peak flows upstream
    - e. development zoning including the use of green space and planting to manage runoff
    - f. raising ground or flood levels
    - g. implementing flood gates along main flow paths
    - h. upgrading of the sewer system.
  3. Management –
    - a. flood resilient design, flood proofing properties (such as tanking or sealing of building basements)
    - b. flood warning
    - c. evacuation and emergency planning
    - d. management of development runoff (such as the inclusion of SuDS)
    - e. flood awareness
    - f. replacement and renewal of leaking sewers, drains and water supply reservoirs. Water companies have a programme to address leakage from infrastructure, so there is clear ownership of the potential source.
- 6.1.4 The following sections provide details of the potential strategic prevention and management options that could be considered for each Strategic Development area. These options should be considered in conjunction with any of the options detailed above.

- 6.1.5 Prior to implementation of the proposed flood mitigation measures further investigations would be required. The investigations would need to provide details of the impacts of the measure upstream and downstream of the proposed location that would affect flood risk to 3<sup>rd</sup> parties, in particular determining if there is any loss of active floodplain that would affect areas upstream and downstream.

## 6.2 Porthcawl

### Description of Flooding

- 6.2.1 The Strategic Area of Porthcawl is located along the coastal extent of Bridgend CB consequently the main influence is from tidal flooding and wave overtopping. There is a seawall and a rip rap flood bank located along the south east coast, adjacent to the caravan park and residential housing. This flood defence is maintained by the Environment Agency. The flood defence provides limited protection to the residential housing and caravan park. The area behind the defences is located in Flood Zone C2. The future Flood Zones (Map FF) show an increase in the flood extent, especially to the east in Newton Burrows where there are no flood defences.
- 6.2.2 TAN15 (Appendix 1) and the SFCA (Table 3-2) provide details of the recommended threshold frequency of flooding. Any type of development (excluding Emergency Services) should be flood free for the 0.5% AEP tidal event. According to this guidance development may not be appropriate along Beach Road (to the east of the Strategic Area) or in the car park area between The Portway and Eastern Promenade (to the west of the Strategic Area), refer to Map AR1. Development would be appropriate in other areas if it is shown to be flood free for this event.
- 6.2.3 Behind the defences on the east coast of the Strategic Area, the maximum flood depth (future 0.1% AEP event) is between 1 and 2 m and the maximum flood velocity is between 0 and 0.15 m<sup>3</sup>/s. The rate of rise (Map AR4) in this area varies and tends to be greater than 0.3 m/hr and reaches a maximum of 1 m/hr behind the flood defence. The speed of inundation (Map AR5) in this area is between 0 and 2 hours. According to TAN 15, all development within Zone C2 must pass the Justification Test. In addition Emergency Services and Highly Vulnerable development is not considered appropriate. This would place constraints on development in the Beach Road and caravan park areas.
- 6.2.4 For the current flood zones (refer to Map FC) the remaining strategic area is not impacted by tidal flooding, however for the future flood event (refer to Map FF) the areas in the east and west of the strategic area is located within flood Zone C2. The LPA should consider the increase in flood extent due to climate change. Flooding from other sources and ordinary watercourses should also be considered.
- 6.2.5 In the area to the west Map AR3 indicates that the maximum flood depths (future 0.1% AEP event) north of the A4106 roundabout are relatively shallow, below 300 mm, and the maximum flood velocity tends to be below 0.3 m/s (there are some higher velocities experienced in some locations). The rate of rise of floodwaters is between 0 and 0.10 m/hr. The speed of inundation is generally less than 2 hours, although it is significantly slower in some locations with speeds of inundation greater than 10 hours (along the roads). According to the TAN15 acceptability criteria, all development may not be suitable in most of the area to the west due to the short time to inundation, however due to the shallow flood depths development may be permissible with appropriate flood mitigation measures.
- 6.2.6 In the car park along Eastern Promenade, the flood depths are generally between 1 and 2 m, although a small section adjacent to the Eastern Promenade has flood depths above 2 m. The maximum flood velocity is fairly slow, between 0 and 0.15 m/hr. The rate of rise of floodwater ranges from 0 to 1 m/hour, closer to the sea the rate of rise is between 0.3 and 1.0 (approximately half of the car park), the remaining area is below 0.3 m/hr. The speed of inundation is between 0 and 2 hours. According to the TAN15 acceptability criteria development would not be suitable in this area due the flood depths, rate of rise and speed

of inundation of the floodwaters, without appropriate mitigation measures to reduce the consequences of flooding.

6.2.7 The SFCA Map SW shows that parts of Porthcawl are susceptible to surface water flooding, especially to the north of the Strategic area. This is due to the topography of Porthcawl - low lying areas that are surrounded by higher ground. Map S shows that flooding from sewers within Porthcawl is low to high. Recorded events generally occurred in the western part of the strategic site. If development is planned within these areas it is recommended that further investigations and appropriate management measures would be needed.

### Flood Risk Management Measures

6.2.8 The main flood risk in Porthcawl is tidal and through wave overtopping. Surface water and sewer flood risk is considered a minor risk in comparison. Development should ideally be focussed away from the coast due to the vulnerability of the coastal areas to flood risk. The current flood zone extents and anticipated flood consequences are likely to place significant constraints on development in the area of Beach Road (in the eastern part of the Strategic Area) and in western Newton (the western part of the Strategic Area) – refer to Map FC showing the SFCA Flood Zones.

6.2.9 In accordance with the precautionary framework, the overarching flood risk management measure within the Strategic Area should be to allocate proposed development away from Flood Zone C, where possible. However, if development is required in areas at risk of flooding, for wider sustainability or regeneration reasons appropriate flood risk management measures would need to be implemented to reduce the extent and consequences of flooding to acceptable levels. This will only be acceptable if development is justified (refer to Section 3.3). Potential strategic mitigation measures to reduce the constraints on development have been reviewed and are detailed in Table 6-1.

**Table 6-1 Proposed flood risk management measures – Porthcawl**

<b>Flood Risk Management Measure / Indicative Cost (£)</b>	<b>Benefit provided</b>	<b>Impact of management measure on development constraints</b>
Upgrade existing flood defences adjacent to the caravan park to provide protection for a 0.5% AEP tidal flood event (2110). <b>£1,000,000</b>	May reduce extent on Flood Zone C2 (area may be designated Zone C1). Actual flood consequences (flood frequency, depth, flood velocities, speed of inundation and rate of rise of flood waters) reduced. Defences provided to specifically reduce flood risk at the caravan park and residential properties (along Beach and Bay View Road)	Possible reduction in Flood Zone C2 reduces constraints on highly vulnerable development and Emergency Services. Development would still be subject to the Justification Test. FCAs would need to consider residual risk from possible failure or exceedance of flood defences.
Localised land raising and / or flood resilience measures for properties in shallow flood depth areas, specifically in the western part of the strategic area. <b>£5000 to £10,000/property</b>	Provides protection to properties to manage consequences of flooding. More likely to be suitable in areas with reasonably shallow depths of flooding.	No impact on the Flood Zones, therefore all development within Flood Zone C will be subject to the Justification Test. Emergency Services and Highly vulnerable may not be permitted.

6.2.10 Prior to the implementation of any flood risk management measures (and proposed development) there is a need to determine the impact of water overtopping along Porthcawl. The Environment Agency provided details of areas of the Porthcawl coastline at risk from wave overtopping (see Figure 6-1). Flood risk strategies should also consider the relevant Shoreline Management Policies. At the time of writing the SMP was in review, however the

information available suggests the policy for Porthcawl will be to Hold or possibly Advance the Line. An upgrade to existing defences would be in line with these policies.



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**Figure 6-1 Wave Overtopping Locations - Porthcawl**

## 6.3 Pencoed

### Description of Flooding

- 6.3.1 The Strategic Area of Pencoed covers the industrial and residential area of Pencoed. The current and future Flood Zone maps (refer to Map FF and FC) show that the area on the western edge of the boundary is within Flood Zone C2. The future SFCA flood zone map (Map FF) shows that there is a small increase in Flood Zone C2 in the vicinity of the factory along the western side of the A473 and residential area at school and properties on Heol Croesty and Hafod Las. A large portion of the Strategic Development area is open farm land which is currently within Flood Zone C2, this area would possibly have future development pressures.
- 6.3.2 TAN15 (Appendix 1) and the SFCA (Table 3-2) provides details of the recommended threshold frequency of flooding. Any type of development (excluding Emergency Services, which should be flood free for the 0.1% AEP event) should be flood free for the 1% AEP fluvial event. Map AR1 indicates that there is not a large difference between the 1% and 0.1% AEP flood extent.
- 6.3.3 Map SW shows that approximately 50% of Pencoed is shown as being susceptible to surface water flooding. There is a large area shown as 'intermediate' and 'less' susceptible

away from river channels or drains. Within this area it is presumed that free drainage of surface runoff to the Ewenny River is restricted by the presence of a raised highway, the A473. Further detailed investigations into the risk of surface water flooding is recommended.

- 6.3.4 Map G shows that the majority of Pencoed has not been highlighted as being susceptible to groundwater flooding. There are small areas of high and low susceptibility at the edges of the strategic site.
- 6.3.5 Fluvial flooding in Pencoed is split into two parts, flooding to the east is due to the Ewenni Fach and to the west is due to the Ewenny River. The floodplains are split by a high road embankment, the A473. The nant Heol-y-Geifr also influences flooding to the west of Pencoed. Future FCAs should include a further investigation of this embankment and identify any flow paths between the floodplains.
- 6.3.6 Along the Ewenny River the maps show that a number of residential properties, a school, playing fields and a football ground are within Flood Zone C2 (Map FF and FC). The maximum flood depth (future 0.1% AEP event) tends to be quite shallow, below 0.3 m. Water ponds on the eastern bank of the River Ewenny adjacent to the road embankment and upstream of the road embankment, for example upstream of the M4 the flood depths reach 2 m and beside the A473 the flood depths reach 1 m (Map AR3). The flood velocities vary through this area, tending to be between 0.45 and 0.60 m/s on the floodplain; in the channel and along the road they reach up to 2.00 m/s (Map AR2). The speed of inundation also varies, closer to the river and along the roads it is between 2.00 and 4.00 hours, however further into the floodplain the values are longer, approximately 6.00 to 10.00 hours. The rate of rise is between 0.00 and 0.01 m/hr (there are some isolated locations where the flood waters rise faster 0.10 to 0.30 m/hr). There are fast flood velocities across the area which does not satisfy the acceptability guidance provided in TAN15.
- 6.3.7 Flooding for the Ewenni Fach causes high flood depths in some locations reaching up to 1 m in some areas (refer to Map AR3), for the future 0.1% AEP event. The flood depths are particularly high north of Felindre Road, reaching between 2 and 3 m on the right bank floodplain. Downstream of the road they decrease to below 600 mm. The flood velocities in the floodplain tend to be between 0.45 and 0.6 m/s, there are some locations where the flood velocities are below 0.3 m/s, further away from the river. There are also some locations where they reach 2 m/s (Map AR3). In the areas surrounding the factories the speed of inundation is generally between 2 and 4 hours and longer in some areas. The rate of rise is between 0 and 0.10 m/hr, there are some locations where floodwaters rise faster at 0.10 to 0.30 m/hr. It is recommended that the LPA should concentrate development further away from the river and downstream of the Felindre Road bridge, in order to meet the acceptability criteria in TAN 15.

### **Flood Risk Management Measures**

- 6.3.8 The main flood risk to Pencoed is fluvial due to the bank of the River Ewenni, Ewenni Fach and Nant Heol-y-Geifr overtopping. Other sources of flooding affecting the area are surface water and ground water. In accordance with the precautionary framework, the overarching flood risk management measure within the Strategic Area should be to allocate proposed development away from Flood Zone C, where possible
- 6.3.9 However, if development is required in areas at risk of flooding, for wider sustainability or regeneration reasons appropriate flood risk management measures would need to be implemented to reduce the extent and consequences of flooding to acceptable levels. This will only be acceptable if development is justified (refer to Section 3.3). If development was required within Zone C it would need to meet the acceptability requirements detailed in TAN15 (table in Appendix 1) and will need to be justified (refer to Section 3.3). Potential strategic mitigation measures to reduce the constraints on development have been reviewed and are detailed in Table 6-2. Any proposed mitigation options for Pencoed would have to

take in account the impact of flood risk further downstream in Waterton, as the Strategic Areas are so close.

- 6.3.10 For this area further investigations are required to ensure that all the flow paths have been identified in the floodplain, particularly those through the road embankments. This investigation may improve the representation of the Flood Zone C2.

**Table 6-2 Proposed Flood Risk Management Measures – Pencoed**

<b>Flood Risk Management Measure / Indicative Cost (£)</b>	<b>Benefit provided</b>	<b>Impact of management measure on development constraints</b>
Flood storage unit upstream of Felindre Road. <b>£850,000</b>	Possible reduced extent of flood zone C2. Actual flood consequences reduced (frequency and flood hazard). Alleviation of flooding in the factory area. The full benefits would depend on the capacity of the flood basin.	Possible reduction in Zone C2 may reduce constraints on highly vulnerable and Emergency Services Development. Development would still be subject to the Justification Test although consequences of flooding may be reduced to acceptable levels.
Raise ground levels for new development at the factory site. <b>£180,000</b>	Alleviation of the depth of flooding in the factory area.	Acceptability criteria (Appendix 1 TAN15 and Section 3.3 of SFCA) are satisfied. Possible change in the Flood Zones reduces constraints on development. Impact of loss of flood storage would need to be considered.
Provision of flood gates on Felindre road in the west of the Strategic Area. <b>£20,0000</b>	Alleviation of flooding along the roads to the west of Pencoed where high velocities are experienced. Improved access during a flood. May impact on 3 <sup>rd</sup> parties and operational issues need to be considered.	No impact on the Flood Zones. Development would still be subject to the Justification Test although consequences of flooding may be reduced to acceptable levels.
Localised land raising or flood resilience measures for properties in shallow flood depth areas. <b>£5000 to £10,000/property</b>	Provides protection to properties to manage consequences of flooding.	No impact on the Flood Zones, therefore all development within Flood Zone C will be subject to the Justification Test. Emergency Services and Highly vulnerable may not be permitted.
Flood relief culverts under A473 road embankment north of M4. <b>£15,000</b>	Spread flood water from the Ewenny River floodplain to the flood free area between Ewenni Fach and Ewenny River. Alleviate flooding downstream on the Ewenni Fach floodplain	Increase the extent of the Flood Zone C, however may reduce the consequences of flooding to acceptable levels. Impact on downstream areas would need to be considered.

1. The Environment Agency may require that compensatory storage was provided in the within the development area.

## 6.4 Waterton

### Description of Flooding

- 6.4.1 The main river that flows through the Strategic Area of Waterton is the Ewenny River. The Nant Ganna may also pose a risk to parts of Waterton. Waterton Industrial Estate covers the majority of the strategic area. Most of the estate is located within the current and future



SFCA Flood Zone C2 (Map FC and FF). The maps indicate that parts of the estate are within the Flood Zone B. The maps indicate that there is unlikely to be large change in Flood Zone C in the future due to climate change however a larger extent of the industrial estate and Waterton Road experiences more flooding is shown in SFCA Zone C when compared to Map FC.

- 6.4.2 TAN15 (Appendix 1) and the SFCA (Table 3-2) provides details of the threshold frequency of flooding allowed. Any type of development (excluding Emergency Services, which should be flood free for the 0.1% AEP event) should be flood free for the 1% AEP fluvial event. Map AR1 indicates that there is not a large difference between the 1% and 0.1% AEP future flood extents
- 6.4.3 For the future 0.1% AEP event, the flood depths are fairly shallow in most of the area, below 0.3 m. There are some locations where the flood depths are deeper reaching up to 2m. There are some uncertainties in the topographic data (LiDAR data) which would require further investigation in these areas to clarify the flood depths reported in Map FC and FF. The flood velocities are 0.45 m/s in the shallower areas, in the deeper flooded areas the flood velocities reach up to 0.6 m/s in some locations (Map AR2). The locations where the flood velocity reaches 2 m/s tend to be along roads and the main channel. The speed of inundation varies across the area, refer to Map AR5, in most of the area it is between 0 and 2 hours however in some locations time to inundation is over 10 hours. The rate of rise is generally between 0 and 0.3 m/h.
- 6.4.4 In accordance with TAN15 guidance, much of the area shown within SFCA Zone C2 (refer to Map FC) would not be suitable for highly vulnerable development and emergency services and all development within Zone C is subject to the Justification Test. Without appropriate mitigation the consequences of flooding are unlikely to be acceptable, even for less vulnerable development, particularly in the northern parts of the industrial estate.
- 6.4.5 A significant proportion of Waterton is shown as being susceptible to surface water flooding (Map SW). There are significant areas of industrial land to the south shown as being of more and intermediate susceptibility.
- 6.4.6 Map G shows that the north western part of the Strategic Development area is assessed as being at low susceptibility to groundwater flooding and in the remaining area no risk has been highlighted.

### **Flood Risk Management Measures**

- 6.4.7 The majority of the Waterton Strategic Area is currently industrial, however alternative land uses (e.g. employment, commercial and residential) may be proposed for future development. The main source of flooding in Waterton is fluvial, although other sources of flooding that should be considered include surface water and groundwater. The current flood zone extents and anticipated flood consequences are likely to place constraints on development in the industrial estate, particularly closer to the Eweny River.
- 6.4.8 In accordance with the precautionary framework the overarching flood risk management measure within the Strategic Development Area is for the LPA direct new development outside of Flood Zone C, where possible. If development is required in Zone C, appropriate flood risk management measures would need to be implemented to reduce the extent and consequences of flooding to acceptable levels. This will only be acceptable if development is justified (refer to Section 3.3). If development was required within Zone C it would need to meet the acceptability requirements detailed in TAN15 (table in Appendix 1). Potential strategic mitigation measures to reduce the constraints on development have been reviewed and are detailed in Table 6-3.

**Table 6-3 Proposed Flood Risk Management Measures - Waterton**

<b>Flood Risk Management Measure / Indicative Cost (£)</b>	<b>Benefit provided</b>	<b>Impact of management measure on development constraints</b>
Raising ground levels for all new development within the area. <b>£164,000.</b>	Reduced flood consequences to new development.	Possible reduction in Flood Zone C would reduce the constraints on development. Impact of loss of flood storage would need to be assessed. Reduction in flood consequences to acceptable levels will help to meet the requirements of the Justification Test.
Localised land raising or flood resilience measures for residential properties in shallow flood depth areas - <b>£5000 - £10,000 /property</b>	Provides protection to properties (to manage consequences of flooding.)	No impact on the Flood Zones, therefore all development within Flood Zone C will be subject to the Justification Test. Emergency Services and Highly vulnerable development may not be permitted.
Implementation of flood gates at the Industrial Estate to provide safe escape route during a flood event - <b>£20,000</b>	Provide safe escape route from the development to a higher areas during a flood event. Further investigations would be required to determine the location and operation of these gates. The main access route would be through Brocastle Avenue which mainly remains flood free. Impact on 3 <sup>rd</sup> parties and operational issues would need to be addressed.	No impact on the Flood Zones, therefore all development within Flood Zone C will be subject to the Justification Test. Emergency Services and Highly vulnerable development may not be permitted. However reduced flood consequences may mean that less vulnerable development is acceptable.
Flood defence along the left (south) bank of Ewenny River to provide protection for 1% AEP flood event 2110 (approximately 650m to tie into existing levels) - <b>£500,000</b> (refer to Figure 6-2)	Reduced extent in Flood Zone C2 and actual flood consequences (flood frequency, depth, flood velocities, speed of inundation and rate of rise of flood waters)	Reduction in Flood Zone C2 reduces constraints on highly vulnerable development and Emergency Services. Development would still be subject to the Justification Test. FCAs would need to consider residual risk from possible failure or exceedance of flood defences.

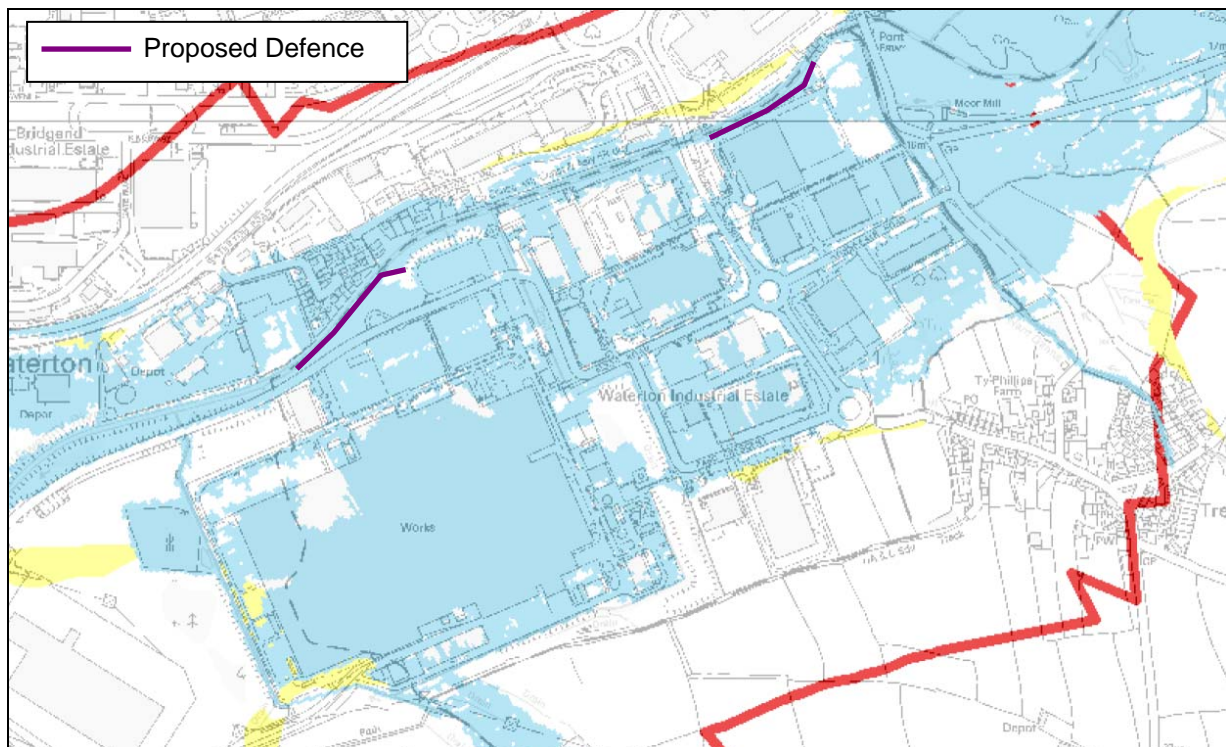


Figure 6-2 Proposed flood defence in Waterton

## 6.5 Valleys Gateways

### Description of Flooding

6.5.1 The Strategic Development Area of Valleys Gateway includes a number of communities, Abergarw, Bryncethin, Sarn, Ynysawdre, Brynmenyn and Aberkenfig. The main river flowing through the area is the River Ogmore, along with its tributaries the River Garw, Nant Bryncethin, Nant Kenfig and Llynfi River. The main influence of flooding in this strategic area is fluvial. However the flood maps provided in the SFCA show that other types of flooding may impact the area including surface water (Map SW), ground water (Map G) and sewers (Map S). The maps indicate that:

- a significant portion of proportion of Brynmenyn is shown as being susceptible to surface water flooding.
- groundwater flooding in Abergarw is variable. In the north-eastern part of the strategic area there are small areas of high, medium and low relative susceptibility, and in the majority of the south-western part the susceptibility is assessed as being high or medium.
- flooding from sewers within Abergarw is low to high. The majority of events occurred in the western part of the strategic site.

6.5.2 From the Flood Zone maps, Map FC and FF, within the area of Abergarw there is a small increase expected in Flood Zone C2 in the area shown as a Timber Yard north of brynmenyn Industrial Estate. Further downstream there is no significant change in the flood zones. There are flood defences along the bank of the River Ogmore, which provide limited protection during current and future events. In accordance with the precautionary framework, development should ideally be located outside these zones, however there is currently a significant portion of existing development located within Flood Zone C.

6.5.3 TAN15 (Appendix 1) and the SFCA (Table 3-2) provides details of the recommended threshold frequency of flooding. Any type of development (excluding Emergency Services

which should be flood free for the 0.1% AEP event) should be flood free for the 1% AEP fluvial event. Map AR1 indicates that the former Christie Tyler factory site and Brynmenyn Industrial estate is flood free for the 1% AEP future flood event. Further downstream, Map AR1 shows that some areas such as the residential area south east of the swimming pool (adjacent to Heol-Yr-Ysgol), the decompression station, and cricket ground are flood free for the 1% AEP future flood event, but are flooded for extreme flood events. In the lower part of the Strategic area there is only a small difference between the 1% and 0.1% AEP future flood event extents.

- 6.5.4 In the upper section of the Valleys Gateway, for the future 0.1% AEP flood event the flood depth is below 600 mm. There are areas adjacent to the River Ogmore and upstream of the dismantled railway embankment where floodwaters are shown slightly deeper, reaching 2m in some locations. The flood velocity varies across the area, higher flood velocities are experienced in the former Christie Tyler factory site (reaching between 1 and 2 m/s in some locations) and lower in the Brynmenyn Industrial Estate (between 0 and 0.15 m/s). The rate of rise of floodwater varies through this area; for the majority of the area it is below 0.3 m/hour, however there is small area upstream of the dismantled railway embankment that is between 0.3 and 0.5 m/hour. The speed of inundation is between 0 and 2 hours. The consequences of flooding are such that in the north section of Valleys Gateway (upstream of the disused railway) they do not meet the acceptability criteria guidance detailed in TAN15 (detailed in Appendix 1 of TAN15 and Section 3.3 of the SFCA) for any types of development; therefore even if development is justified it may not be permitted.
- 6.5.5 In the middle section of the Valleys Gateway the flood depth is generally shallow through the residential properties, however along the road and along the banks of the River Ogmore the flood depths are deeper, up to 1 m in some locations. Around the sports ground, east of the railway line, the flood depths are deep, approximately 1 m, as the water ponds upstream of the railway embankment. The flood velocities are quite high, mainly between 0.45 and 0.6 m/s. The rate of rise of floodwaters in this area is between 0 and 0.1 m/hour, although there are some areas, the sports ground and near the residential properties, where the rate of rise is between 0.1 and 0.3 m/hr. The speed of inundation varies through the area, in the sports ground and south of the gas decompression station it is between 2 and 4 hours, although faster in some isolated areas (refer to Map AR5). The middle section of Valleys Gateway does not meet the requirements of TAN15 (detailed in Appendix 1 of TAN15 and Section 3.3 of the SFCA), the flood velocities are particularly high, and therefore it is not advisable for development within Flood Zone C in this mid area of Valleys Gateway.
- 6.5.6 In the lower section of Valleys Gateway, the flood depth in the floodplain on the right (west) bank is above 1 m, and the flood velocity reaches up to 0.6 m/s in some areas. On the left bank, the flood depth in parts of the floodplain is up to 3 m and in a small area at the junction of the B4281 and A4063 in the field the flood depth is greater than 3 m (Map AR3). In this field the flood velocities range between 0.15 and 0.6 m/s, the velocities are greater along the River Ogmore. The rate of rise in this area is between 0.3 and 1.0 m/hr and the speed of inundation is between 2 and 4 hours. Without mitigation it is unlikely that the consequences of flooding on development would meet the acceptability criteria detailed in Appendix 1 of TAN15 and Section 3.3 of the SFCA.

## **Flood Risk Management Measures**

- 6.5.7 The main flood risk to Valleys Gateway is fluvial. Other sources of flooding affecting the area are surface water, groundwater and sewers. In the upper sections the flood depths tend to be quite shallow, however flooding is deeper in the middle and lower sections due to the embankments located across the floodplain. The flood velocities are relatively high especially in the lower area. The consequences of flooding do not meet the guidance on acceptable flood consequences across much of the strategic area. In accordance with the precautionary framework, the overarching flood risk management measure within the Strategic Area should be to allocate proposed development away from Flood Zone C, where possible

- 6.5.8 Due to the flooding mechanisms in the Strategic Area of Valleys Gateway, in particular the influence of the dismantled railway line embankment and the road embankments, B4281 and A4063, it is recommended that the LPA seek to direct new development outside Flood Zone C as appropriate mitigation may be difficult to achieve. However, if development is required in areas at risk of flooding appropriate flood risk management measures would need to be implemented to reduce the extent and consequences of flooding to acceptable levels. This will only be acceptable if development is justified (refer to Section 3.3). If development was required within Zone C it would need to meet the acceptability requirements detailed in TAN15 (table in Appendix 1). Potential strategic mitigation measures to reduce the constraints on development have been reviewed and are detailed in Table 6-4.
- 6.5.9 The flood mechanisms in the lower part of the Valleys Gateway Strategic Area are influenced by the presence of the high road embankments (the B4281 and A4063). Flood waters are restricted and water must flow back into the river before proceeding downstream. Prior to development of this area more detailed modelling would be required, to ensure that all flow paths have been represented, to convey water downstream. This would include any culverts under that B4281 and A4063.

**Table 6-4 Proposed Flood Risk Management Measures – Valleys Gateway**

Flood Risk Management Measure / Indicative Cost (£)	Benefit provided	Impact of management measure on development constraints
Raised ground levels in Brynmenyn Industrial Estate and former Christie Tyler factory site and residential area near Heol-Yr-Ysgol <sup>1</sup> . <b>£110,000.</b>	Reduced flood consequences to new development.	Possible reduction in Flood Zone C would reduce the constraints on development. Impact of loss of flood storage would need to be assessed. Reduction in flood consequences to acceptable levels will help to meet the requirements of the Justification Test.
Localised land raising or flood resilience measures for properties in shallow flood depth areas. <b>£5,000 - £10,000 / property</b>	Provides protection to properties (to manage consequences of flooding.)	No impact on the Flood Zones, therefore all development within Flood Zone C will be subject to the Justification Test. Emergency Services and Highly vulnerable development may not be permitted.
Upgrade existing flood wall along the banks River Ogmor, from Heol Persondy road to B4281(Aberkenfig) to provide protection against the 1% AEP flood event 2110. <b>£160,000</b>	Reduced extent in Flood Zone C2. Actual flood consequences (flood frequency, depth, flood velocities, speed of inundation and rate of rise of flood waters) reduced. Note this may cause a significant impact to flooding upstream and downstream.	Reduction in Flood Zone C2 reduces constraints on highly vulnerable development and Emergency Services. Development would still be subject to the Justification Test. FCAs would need to consider residual risk from possible failure or exceedance of flood defences and impact elsewhere.

1. The Environment Agency may require that compensatory storage was provided in the within the development area.

## 6.6 Maesteg

### Description of Flooding

- 6.6.1 The floodplain of the Maesteg Strategic Area is narrow due to the steep topography surrounding the area. The main areas in Maesteg at risk of flooding are Caerau, Spelter, Nantyffyllon, Garth and Cwmfelin. Due to the steep topography the area is susceptible to surface water flooding, the more vulnerable areas are generally alongside the main river channels with most of the minor watercourses being assigned an intermediate vulnerability. The width of the more vulnerable zone increases from upstream to downstream through the strategic area. Maesteg is assessed as being at medium relative susceptibility of groundwater flooding (Map G). Flooding from sewers is assessed as (Map S) is medium / low to low - these events tend to occur in the southern part of the Strategic Development Area.
- 6.6.2 The main source of flooding in Maesteg is fluvial. The main river flowing through the strategic development area is Llynfi River, there is one tributary at the downstream of the strategic area which contributes to flooding within the area, the Nant Cerdin. Other ordinary watercourse tributaries of the Llynfi may also contribute to flood risk.
- 6.6.3 Maps FC and FF indicate that there is unlikely to be a large increase in the extent of Flood Zone C in the future. There are two locations in Maesteg where there is a notable increase in the extent, in Spelter (Nantyffyllon) adjacent to the allotment gardens and at the cricket ground near Commercial Road.
- 6.6.4 TAN15 (Appendix 1) and the SFCA (Table 3-2) provides details of the recommended threshold frequency of flooding. Any type of development (excluding Emergency Services which should be flood free for the 0.1% AEP event) should be flood free for the 1% AEP fluvial event. Map AR1 shows that there is a difference between the 1% and 0.1% AEP future flood event in a couple locations in the Maesteg Strategic Area. In Spelter the water tends to stay within bank for the 1% AEP future flood event and in Garth at the factory and parts of the residential area the flood extent is notably smaller for the 1% AEP future flood event when compared to the 0.1%.
- 6.6.5 For the future 0.1% AEP event, flooding in Spelter (Nantyffyllon) is shown as relatively shallow, less than 600 mm and the flood velocities are between 0 and 0.45 m/s (however in some locations closer to the river they are as high as 2 m/s). The speed of inundation is generally less than 2 hours and the rate of rise of floodwater is between 0.00 and 0.30 m/hr. There will be constraints on development within Flood Zone C as the flood velocities and the speed of inundation do not meet the guidance provided in TAN15 (detailed in Appendix 1 of TAN15 and Section 3.3 of the SFCA).
- 6.6.6 Further downstream in Nantyffyllon the water backs up behind the Heol Tywith Road Bridge and this area is within Flood Zone C2. The floodplain is inundated with deep water, greater than 3 m deep. This is caused by the road bridge which restricts the channel and the floodplain. The speed of inundation is between 2 and 4 hours, and the rate of rise is between 0.5 and 1 m/hr. Flood velocities in this area are high, between 0.45 and 0.8 m/s and do not meet the acceptability guidance provided in TAN15 (detailed in Appendix 1 of TAN15 and Section 3.3 of the SFCA).
- 6.6.7 Through Garth the floodplain is slightly wider and the flood depths are larger closer to the Llynfi River, the flood depths are between 0.6 and 1.0 m in some locations. Close to the town centre of Maesteg, the cricket ground and bus station experience shallow flooding, below 0.3 m. The flood velocities are quite high away from the river, between 0.45 and 0.60 m/s and close to the river they reach 1 – 2 m/s. The speed of inundation in this area is less than 2 hours and the rate of rise of floodwater is between 0 and 0.3 m/hour through this area. The flood velocities are high and the speed of inundation is quick, and does not meet

the acceptability guidance provided in TAN15 (detailed in Appendix 1 of TAN15 and Section 3.3 of the SFCA).

- 6.6.8 The Bridge Street bridge, central maesteg constricts the channel and floodplain and causes significant flooding in the playground, between 1 and 2 m deep. The flood velocities are relatively fast between 0.45 and 0.6 m/s. The rate of rise is between 0.3 and 0.5 m/h and the speed of inundation is less than 2 hours.
- 6.6.9 In the lower parts of the Strategic Development area, between where the railway line crosses the Llynfi River to Cwmfelin, the floodplain is wider compared to the upper area, the flood depths are relatively shallow (below 600 mm) apart from a couple of locations where there is deep flooding. There are some inaccuracies in the topographic data for this area therefore there is a need for further investigation. The rate of rise is fairly slow, between 0 and 0.1 m/h, however the speed of inundation is quite fast through this area. The speed of inundation does not meet acceptability guidance provided in TAN15 (detailed in Appendix 1 of TAN15 and Section 3.3 of the SFCA).
- 6.6.10 Further downstream around the Oakwood playing fields, residential properties (Mill View Estate), the recreation ground and the pumping station, the flood depths are quite deep reaching up to 2 m in some areas. These large flood depths are caused by the low ground levels in this area and the varying ground level. The floodplain is restricted due to the railway embankment and higher ground on either side of the river. The flood velocities are high along the river and in the recreation ground, up to 2 m/s however in the floodplain they are lower, between 0.45 and 0.60 m/s (Map AR2). The speed of inundation is between 0 and 2 hours (Map AR5). The rate of rise varies through this area, in the playing fields it varies between 0.10 and 0.50 m/h, and in the recreational ground it varies between 0.00 and 0.30 m/hr (Map AR4). All the parameters do not meet the acceptability guidance detailed in TAN15 (detailed in Appendix 1 of TAN15 and Section 3.3 of the SFCA).

### **Flood Risk Management Measures**

- 6.6.11 Maesteg has a very steep topography, consequently the floodplain tends to be quite narrow, and currently a lot of existing development is located within Flood Zone C. The Maesteg floodplain is restricted in some locations due to higher ground, embankments, roads and railways lines. Further investigation is required in this Strategic Area prior to development to ensure that the flooding mechanisms are fully understood and all flow paths are represented. The results of detailed modelling would provide improved information on flood consequences in the Strategic Development area.
- 6.6.12 The consequences of flooding are expected to place significant constraints on development as in many places the consequences are such that development is unlikely to meet the requirements of the Justification Test. In accordance with the precautionary framework, the overarching flood risk management measure within the Strategic Area should be to allocate proposed development away from Flood Zone C, where possible. In exceptional circumstances, if development is required in areas at risk of flooding appropriate flood risk management measures would need to be implemented to reduce the extent and consequences of flooding to acceptable levels. This will only be acceptable if development is justified (refer to Section 3.3). If development was required within Zone C it would need to meet the acceptability requirements detailed in TAN15 (table in Appendix 1). Potential strategic mitigation measures to reduce the constraints on development have been reviewed and are detailed in Table 6-5.

**Table 6-5 Proposed flood risk management measures – Maesteg**

Flood Risk Management Measure / Indicative Cost (£)	Benefit provided	Impact of management measure on development constraints
Raised ground levels for all new development <sup>1</sup> .	Reduced flood consequences to new development.	Possible reduction in Flood Zone C would reduce the constraints on development. Impact of loss of flood storage would need to be assessed. Reduction in flood consequences to acceptable levels will help to meet the requirements of the Justification Test.
Localised land raising or flood resilience measures for properties in shallow flood depth areas - <b>£5000 to £10,000/property</b>	Provides protection to properties (to manage consequences of flooding.)	No impact on the Flood Zones, therefore all development within Flood Zone C will be subject to the Justification Test. Emergency Services and Highly vulnerable development may not be permitted.
Improvements to Heol Tywith Bridge – <b>£200,000</b> (enlargement) or <b>£100,000</b> (deepening the channel)	Improve flood flow and reduce flooding upstream of the bridge.	Possible reduction in Flood Zone C would reduce the constraints on development upstream of the bridge. Impact on areas downstream would need to be considered. Reduction in flood consequences to acceptable levels will help to meet the requirements of the Justification Test.

1. The Environment Agency may require that compensatory storage was provided in the within the development area.

6.6.13 It should be noted that all the potential flood risk management measures suggested should not be regarded as an acceptable means of promoting inappropriate development. The potential management measures may reduce flood risk to existing development, and also help to manage flood risks arising from proposed development in flood risk areas which would need to be fully justified. The residual risk arising from any flood risk management measures also needs to be assessed. Some measures, for example raised flood defences, may lead to a greater level of residual risk. The Environment Agency should be consulted when considering implementation of flood risk management strategic or site-specific).



## 7. How the SFCA links to other plans and policies

### 7.1 Introduction

- 7.1.1 SFCAs enable Local Planning Authorities (LPAs) to allocate areas for development in accordance with the precautionary framework set out within TAN15. Where allocations are proposed within higher probability flood zones, SFCAs should be refined to provide information necessary for application of the Justification Test (TAN15).
- 7.1.2 The SFCA may also be used to set planning constraints within designated areas and where relevant in respect of windfall sites.
- 7.1.3 In urban areas, SFCAs should be used to inform decision makers of the impact of climate change and urbanisation.
- 7.1.4 A SFCA also allows LPAs to identify the level of detail required for site specific FCAs in certain locations and enables the determination of the acceptability of flood risk in relation to emergency planning.
- 7.1.5 The role of the SFCA in planning structure in Wales, together with possible uses is as follows. Figure 7-1 illustrates how the SFCA may fit into the conceptual land use planning framework.

### 7.2 Local Development Documents

- 7.2.1 As part of the planning process, under the Compulsory Purchase Act 2004, LPAs in Wales are required to produce a Local Development Plan (LDP). The LDP has to show that it is encouraging patterns of development that are economically, socially and environmentally sustainable.
- 7.2.2 TAN15 advises a precautionary framework to guide planning decisions specifically aiming to direct new development away from areas thought to be at high risk of flooding. TAN15 discusses action through development plans, specifically the consideration of flooding issues during the preparation of Local Development Plans. Flood risk will therefore become a key consideration when sites are being considered for allocation.
- 7.2.3 The LDP must be a single document that includes the following:
- A strategy based on a vision (inc. aims and objectives, key policies, broad location for development, spatial interpretation of the strategy);
  - Area wide policies for all development and/or development types;
  - Allocations of land and related sites (founded on a robust and credible assessment of suitability);
  - Specific policies and proposals for key areas of change or protection;
  - Reasoned justification for policies;
  - A proposals map on a geographical base.

- 7.2.4 The SFCA needs to inform the evolution of the LDP, its policies and the broad search areas during the progress of the strategy from its vision. The SFCA must be undertaken to an appropriate level of detail to ensure that the LDP is robust and based on a credible evidence base.
- 7.2.5 From the Strategy, the SFCA enables the LPAs to designate areas for development following the precautionary framework of vulnerability of uses (when compared with flood risk) as set out in TAN15 with full justification for allocations within Zone C2 and demonstration that the consequences are acceptable.
- 7.2.6 The Planning and Compulsory Purchase Act 2004 requires those preparing LDPs consider the needs of sustainable development and therefore a sustainability appraisal of the strategies and policies in the UDP.

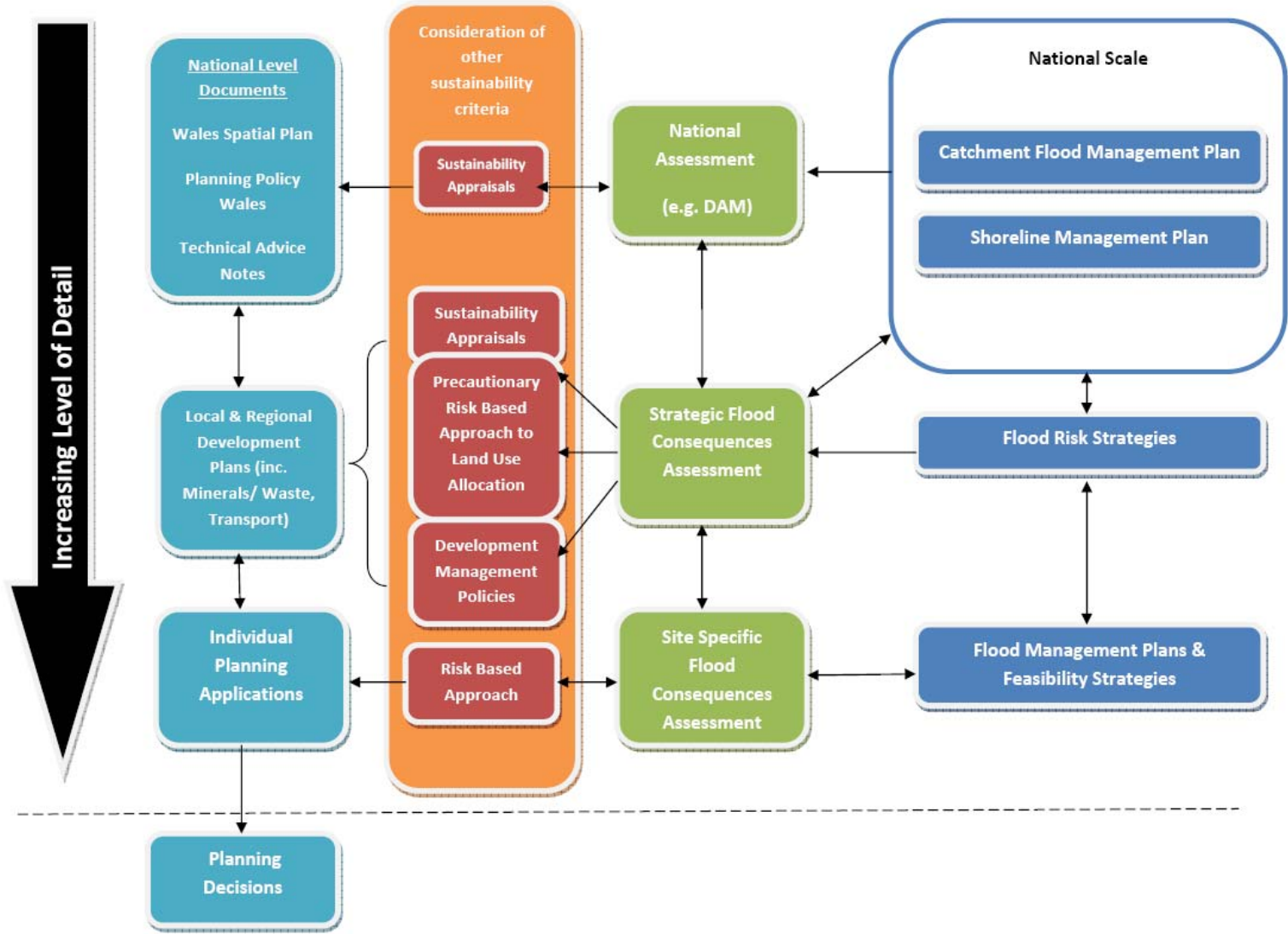


Figure 7-1 How the SFCA may fit into the conceptual land use planning framework

## 8. How to maintain the SFCA

### 8.1 Monitoring the SFCA

- 8.1.1 It is in BCBC's interest that the SFCA remains current and up-to-date. To help facilitate this, it would be useful for Environment Agency Wales to organise an annual meeting with administrative bodies to review SFCA's within their boundary.
- 8.1.2 Prior to this meeting it is recommended that the following maintenance checks be undertaken:
- Review the currency of datasets used in the SFCA.
  - Consider whether a formal review of the SFCA is necessary.
- 8.1.3 Whilst all datasets should be checked for updates and key organisations should be contacted, Table 4.1 contains a list of datasets that are known to be updated regularly.

**Table 8-1 Datasets that are known to be updated regularly**

Dataset	Owner	Comment
Flood Zones	Environment Agency	Updated quarterly
Catchment Flood Management Plans	Environment Agency	Updated every five years
National Flood and Coastal Defence Database (NFCDD)	Environment Agency	Ongoing updates
System Asset Management Plans and Strategies	Environment Agency	Likely to be updated every five years
Historic flood incidents	Environment Agency, Water companies, Fire Brigade, Highways Depots	Unknown

### 8.2 Incorporating new datasets

- 8.2.1 It is Bridgend County Borough Council's responsibility to manage current and existing datasets used in the Bridgend County Borough Council SFCA. Volume II will contain details of the current data used as part of the SFCA.
- 8.2.2 The following tasks should be undertaken when including new datasets in the Bridgend County Borough Council SFCA:
- Identify new dataset (as per Section 8.1).
  - Determine if the dataset is appropriate to supersede current information.
  - Undertake a full review of the dataset.
  - Update the report as detailed in Section 8.3.

### 8.3 Updating SFCA reports and figures

- 8.3.1 Volume II provides a record of all of the technical and data used to develop the Bridgend County Borough Council SFCA. In recognition that the SFCA will be updated in the future, the report has been structured in chapters according to the six sources of flooding investigated. By structuring the report in this way, it is possible to undertake further analyses on a particular source of flooding and only have to supersede the relevant chapter, whilst keeping the remaining chapters unaffected.

- 8.3.2 In keeping with this principle, the following tasks should be undertaken when updating SFCA reports and figures:
- Undertake further analyses as required after SFCA review;
  - Record all new datasets in SFCA report.
  - Document all new technical analyses by rewriting and replacing relevant Volume II chapter/s.
  - Amend and replace relevant Flood Zone Maps.
  - Review and if required, amend appropriate chapter in Volume II.
  - Reissue to Bridgend County Borough Council, Environment Agency and other stakeholders.

## 9. References

- Planning Policy Wales, Technical Advice Note 15: Development and Flood Risk (TAN15), Welsh Assembly Government, July 2004.
- Planning Policy Wales, Edition 3 July 2010, Welsh Assembly Government, July 2010.
- Flood Risk Management: Strategic Flood Consequence Assessment for Wales, Operational Instructions 303\_09, June 2009.
- Environment Agency/Defra (2005) 'Flood Risk Assessment Guidance For New Development' Phase 2 Framework and Guidance for Assessing and Managing Flood Risk for New Developments - Full Documentation and Tools, R&D Technical Report TR2320/TR2, October 2005.
- Defra (October 2006) 'FCDPAG3 Economic Appraisal Supplementary Note to Operating Authorities – Climate Change Impacts.'

## 10. Glossary and notation

<b>Actual risk</b>	The risk that has been estimated based on a qualitative assessment of the performance capability of the existing flood defences
<b>AEP</b>	Annual probability of exceedence. The annual chance of experiencing a flood with the corresponding flood magnitude, i.e. a 1% AEP flood is a flood with a flow magnitude that has a 1% chance of occurring in each and every year
<b>Breach or failure hazard</b>	Hazards attributed to flooding caused by a breach or failure of flood defences or other infrastructure which is acting as a flood defence.
<b>CFMP</b>	Catchment Flood Management Plan
<b>DAM</b>	Development Advice Map. This refers to the map issued by the Welsh Assembly which shows Flood Zones in accordance with Figure 1 in TAN15. The DAM was last updated in 2009.
<b>Flood Zones</b>	Flood Zones in accordance with Figure 1 in TAN15. The Flood Zones are provided in the SFCA in Map FC (Current) and FF (Future).
<b>Flood defence</b>	Natural or man-made infrastructure used to prevent flooding
<b>Flood risk</b>	<i>Flood risk is a combination of two components: the chance (or probability) of a particular flood event and the impact (or consequence) that the event would cause if it occurred (EA 2003).</i>
<b>FCA</b>	Flood Consequence Assessment
<b>Flood risk management</b>	<i>Flood risk management can reduce the probability of occurrence through the management of land, river systems and flood defences, and reduce the impact through influencing development in flood risk areas, flood warning and emergency response (EA 2003).</i>
<b>LDP</b>	Local Development Plan
<b>LPA</b>	Local Planning Authority
<b>Residual risk</b>	Flood risks resulting from an event more severe than for which particular flood defences have been designed to provide protection.
<b>SFCA</b>	Strategic Flood Consequence Assessment
<b>SREP</b>	Strategic Risk Evaluation Procedure
<b>SuDS</b>	Sustainable Drainage Systems
<b>TAN15</b>	Technical Advice Note 15: Development and Flood Risk