South West Wales – Stage 1 Strategic Flood Consequence Assessment

Final report

November 2022

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Revision History

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Contract

This report describes work commissioned by Tom Evans on behalf of City and County of Swansea Council by an email dated February 2022. Charlotte Lickman, Erica Skinner, Hannah Booth, and Peter Rook of JBA Consulting carried out this work.

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Purpose

This document has been prepared as a Draft Report for City and County of Swansea Council. JBA Consulting accepts no responsibility or liability for any use that is made of this document other than by the Client for the purposes for which it was originally commissioned and prepared.

JBA Consulting has no liability regarding the use of this report except to City and County of Swansea Council.

Acknowledgements

JBA would like to acknowledge LPA and LLFA staff from:

- Carmarthenshire County Council
- Neath Port Talbot Council
- Pembrokeshire County Council
- Swansea County Council
- Brecon Beacons National Park Authority
- Pembrokeshire Coast National Park Authority

We would also like to thank Dŵr Cymru Welsh Water, Natural Resources Wales and the Welsh Government for their input into the SFCA.

Carbon Footprint

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Executive summary

Project background

This Stage 1 Strategic Flood Consequence Assessment (SFCA) has been commissioned by a group of six Local Planning Authorities (the Councils) in South West Wales including:

- Carmarthenshire County Council
- Neath Port Talbot Council
- Pembrokeshire County Council
- Swansea County Council
- Brecon Beacons National Park Authority
- Pembrokeshire Coast National Park Authority

Typically, SFCAs are completed in three stages, with an increasing level of detail required in the analysis at each stage.

This Stage 1 SFCA is a desk-based study which collates existing information to undertake a broad assessment of potential flood risks across the entire study area from all sources of flooding. The study identifies areas at potential high risk from flooding as well as providing details of historical flood events and any details of any flood risk management structures or procedures present.

The SFCA also provides information on the opportunities to slow and store water as part of natural flood management schemes as well as guidance on implementing TAN-15 and managing flood risk in a development site.

Study area

South West Wales includes some of the main urban areas in Wales and is home to Wales's second largest city, Swansea. The area has a rich industrial history from mining in the South Wales valleys, exporting 13 million tons of coal at its peak in the 1880's, to Port Talbot and Swansea Docks. This industrial part of South Wales has shaped the landscape, influencing the location of settlements, channels of watercourses, and location of vegetation across the area. South West Wales also includes from St David's in Pembrokeshire in the west, to Abergwynfi in Neath Port Talbot in the east. The Brecon Beacons National Park forms a small part of eastern Carmarthenshire, and the Pembrokeshire Coast National Park is located within the coastal zone of Pembrokeshire to the west of the study extent.

In the context of this report, South West Wales covers four Local Authorities (Pembrokeshire, Carmarthenshire, Swansea and Neath Port Talbot) and six Local Planning Authorities (including Brecon Beacons National Park Authority, and Pembrokeshire Coast National Park Authority). The area is approximately 4962km² and stretches from St David's in Pembrokeshire in the west where it is bound by the River Alun, to Abergwynfi in Neath Port Talbot in the east at the head of the River Avan. The Brecon Beacons National Park forms a small part of the east of Carmarthenshire Local Authority area.

Policy and strategy

Key legislation and policies have been reviewed as part of the SFCA, this includes national policies and strategies such as the National Flood and Coastal Erosion Risk Management (FCERM) Strategy for Wales, Future Wales: The National Plan 2020 and Planning Policy Wales. Regional documents such as Shoreline Management Plans and Catchment Flood Management Plans have also been reviewed to understand specific flood risk and coastal erosion policies in the region. TAN-15 and flood risk policy has also been reviewed and outlined with regard to flood risk in this section.

Flood risk

The SFCA has identified the risk of flooding from all sources across the study area and has provided information relating to the sources of information used to understand this flood risk. The planning process is primarily concerned with the location of receptors, taking appropriate account of potential

sources and pathways that might put those receptors at risk. It is therefore important to define the components of flood risk in order to apply this guidance in a consistent manner.

A review of flood risk has been undertaken from all sources of flooding in each of the four Local Authority areas. This assessment should be used in conjunction with the mapping appendices in order to understand flood risk at a strategic scale.

Further TAN-15 guidance

In accordance with the direction of the Minister for Climate Change, provided in guidance accompanying the decision notice to delay its implementation, this SFCA has been prepared in accordance with the updated TAN-15 due to be implemented from June 2023. Further clarifications and advice have subsequently been issued by Welsh Government and NRW. The following chapter seeks to capture the latest advice and understanding of the new TAN-15. Additionally, guidance is provided on how LPA's within the region should interpret and apply the new TAN-15.

The guidance and recommendations within this chapter is based on the following:

- Ministerial letter; 23rd November 2021. Announcement of the suspension of the new TAN-15 to 1st June 2023.
- Chief Planner letter; 15th December 2021. Advice to LPA's on the suspension of TAN-15, key implications and actions for LPA's.
- Various consultations with Welsh Government and NRW during the preparation of the SFCA.

Requirements for a Flood Consequence Assessment

Site specific FCA's are carried out by (or on behalf of) developers to assess the risk and consequences of flooding to a proposed development site, and the risk and consequences of that development to third party land. Advice on preparing an FCA has been provided as part of this report.

Flood risk mitigation and flood response planning

TAN-15 outlines the complementary role that planning and building regulations have in flood management, and the requirement for the use of flood mitigation and damage resistant measures to ensure the consequences of flooding are acceptable. Any new development in Zones 2 and 3 and the TAN-15 Defended Zones must have resilience to flooding built-in at site and property level. Where possible, development should still be directed to Flood Zone 1 (where there is a lower risk of flooding). Highly vulnerable development in Flood Zone 3 is not considered to be acceptable due to the associated consequences of flooding, and planning applications must not be proposed.

Flood response planning is one option to help manage flood related incidents. From a flood risk perspective, flood response planning can be broadly split into three phases: before, during, and after a flood. These measures involve developing and maintaining arrangements to reduce, control, or mitigate the impact and consequences of flooding and to improve the ability of property to absorb, respond to, and recover from flooding,

Advice and guidance on Working with Natural Processes and Natural Flood Management has also been prepared.

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Abbreviations

	Definition
AEP	Annual Exceedance Probability - the chance of an event with a particular magnitude occurring in each and every year
AOD	Above Ordnance Datum
AONB	Area of Natural Beauty
CIRIA	Construction Industry Research and Information Association
CFMP	Catchment Flood Management Plan
DAM	Development Advice Map - shows areas at risk of flooding from rivers and the sea for the purposes of land-use planning
DCWW	Dŵr Cymru Welsh Water
FCA	Flood Consequence Assessment
FMfP	Flood Map for Planning
FRAW	Flood Risk Assessment Wales
FRMP	Flood Risk Management Plan
FWMA	Flood and Water Management Act
JBA	Jeremy Benn Associates
LFRMS	Local Flood Risk Management Strategy
LLFA	Lead Local Flood Authority - Local Authority responsible for taking the lead on local flood risk management
LPA	Local Planning Authority
Main River	A watercourse shown as such on the Main River Map, and for which NRW has responsibilities and powers
NFF	National Flood Forum
NFM	Natural Flood Management
NRW	Natural Resources Wales
Ordinary Watercourse	All watercourses that are not designated Main River. Local Authorities or, where they exist, IDBs have similar permissive powers as the Environment Agency in relation to flood defence work. However, the riparian owner has the responsibility of maintenance.
PFRA	Preliminary Flood Risk Assessment
PPW	Planning Policy Wales
RBMP	River Basin Management Plan
SAB	SuDS Approval Body
SFCA	Strategic Flood Consequence Assessment
SMP	Shoreline Management Plan
SuDS	Sustainable Drainage Systems
TAN-15	Technical Advisory Note 15 - Guidance for local planning authorities to reduce flood risk and develop away from high-risk areas.
WFD	Water Framework Directive
WWNP	Working With Natural Processes

1 Introduction

1.1 Project overview

1. This Stage 1 Strategic Flood Consequence Assessment (SFCA) has been commissioned by a group of Local Planning Authorities (the Councils) in South West Wales including:
   - Carmarthenshire County Council
   - Neath Port Talbot Council
   - Pembrokeshire County Council
   - Swansea County Council
   - Brecon Beacons National Park Authority, and
   - Pembrokeshire Coast National Park Authority
2. The SFCA also covers areas where the Brecon Beacons National Park Authority and Pembrokeshire Coast National Park Authority are the Local Planning Authority. As these areas fall within existing Local Authority boundaries these are not covered separately within this report.
3. This SFCA provides a robust evidence base to inform the Councils individual Local Development Plans (LDPs) and will inform the development of LDP policies and land allocation decisions. The SFCA has been carried out in accordance with the Welsh Government's development planning guidance, Planning Policy Wales (PPW), Technical Advice Note 15: Development, flooding and coastal erosion (TAN-15) and associated Welsh Government Chief Planning Officers letters and Welsh Government FCA Climate Change allowances.

1.2 Stages of SFCA

4. To provide a robust assessment of the potential flood risk, SFCAs should involve the collection, analysis, and presentation of all the available information from all sources of flood risk in the study area.
5. Typically, SFCAs are completed in three stages, with an increasing level of detail required in the analysis at each stage. The three stages of SFCAs are summarised below:

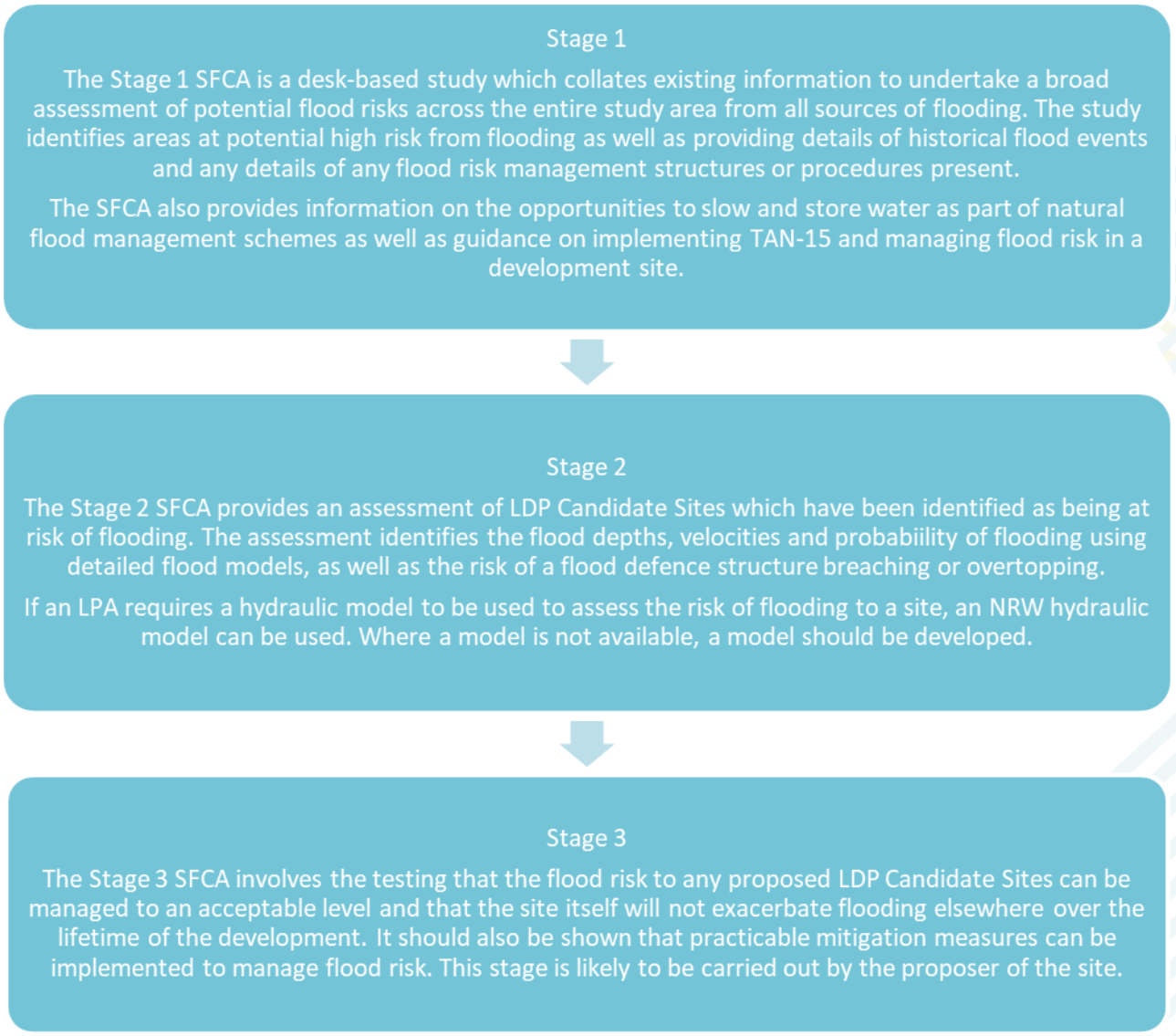

Figure 1-1 Outline of the SFCA process

1.3 SFCA objectives

6. This report fulfils the aims and objectives of the Stage 1 SFCA are:

- To inform development policy and choices regarding the management of flood risk within each Council's individual Local Development Plans.
- To understand flood risk from all sources and to investigate and identify the extent and severity of flood risk throughout the Stage 1 study area. This assessment will enable the Council to steer development away from those areas where flood risk is considered greatest, ensuring that areas allocated for development can be developed in a safe, cost effective, and sustainable manner.
- To evaluate and consider flood risk from all sources of flooding, using Natural Resources Wales (NRW) recently published Flood Map for Planning (FMfP).
- To enable the Councils to meet their obligations under PPW and Technical Advice Note 15: Development, flooding and coastal erosion (TAN-15).
- To supplement current policy guidelines and to provide a straightforward risk-based approach to development management in the area. This is aimed at councillors, Local Planning Authority officers, the public and developers.
- To provide a reference document to which all parties involved in development planning and flood risk can reliably turn to for initial advice and guidance.

- To develop a report that forms the basis of an informed development management process that also provides guidance on the potential risk of flooding associated with future planning applications and the basis for site specific Flood Consequence Assessments (FCAs) where necessary.
- To assist the Councils in identifying specific areas where further and more detailed flood risk data and assessment work may be required.
- To provide an update to the Councils previous SFCAs (where applicable) using new and updated flood risk information to summarise flood risks to each Local Authority area to inform the councils individual Local Development Plans.

7. It is important to highlight that this SFCA is strategic in nature and makes use of the most current available information. This SFCA should be used as a starting point for planners, developers, and the public to initially consider development and flood risk and whether more detailed, site specific assessments of flood risk, such as an FCA, are required. It is also worth noting that the presence of flood zones in an area, be it fluvial, tidal, or surface water, does not mean that development simply cannot happen. Although, sites located within areas of lower risk should be considered in preference to areas at higher risk as part of the development planning process, a more detailed assessment of flood risk may be required to ensure that risks can be effectively managed.

1.4 Stakeholder engagement

8. The following stakeholders have been consulted during the preparation of this Stage 1 SFCA:
    - 'The Councils' listed in Section 1.1 in their role as:
        - Local Planning Authorities; and
        - Lead Local Flood Authorities (including SAB)
    - Natural Resources Wales
    - Welsh Government
    - Dŵr Cymru Welsh Water (DCWW)

1.5 Structure of the SFCA

Table 1-1 Stage 1 SFCA report structure

Section	Contents
1. Introduction	Provides a background to the study, defines objectives, outlines the approach adopted and the consultation performed.
2. Study Area	Includes an overview of the study area including information on the topography, geological and hydrological characteristics of the area
3. Policy and Strategy	Includes information on the implications of recent changes to planning and flood risk policies and legislation, as well as documents relevant to the study.
4. Understanding of flood risk	Introduces the assessment of flood risk and provides an overview of the different types and sources of flooding in the study area.
5. Flood risk review	Provides a review of flood risk from all sources for each Local Authority area.
6. Working with Natural Processes	Includes information on areas which could be suitable for implementing natural flood management measures.
7. Additional TAN-15 Guidance	Provides guidance on how Local Planning Authorities (LPA's) within the region can interpret and apply the new TAN-15.
8. Requirements for a Flood Consequence Assessment	Outlines what an FCA is and the requirements for an FCA.
9. Emergency Planning and Flood Warning	Outlines the flood warning service in the Local Plan area and provides advice for emergency planning, evacuation plans and safe access and egress.
10. Summary	Provides a summary of the Stage 1 SFCA study

2 Study Area

2.1 Geographic Extent

9. South West Wales includes some of the main urban areas in Wales and is home to Wales's second largest city, Swansea. The area has a rich industrial history from mining in the South Wales valleys, exporting 13 million tons of coal at its peak in the 1880's from Port Talbot and Swansea Docks. This industrial past of South Wales has shaped the landscape, influencing the location of settlements, channels of watercourses and location of vegetation across the area.

10. In the context of this report, South West Wales covers approximately 4962km² and stretches from St David's in Pembrokeshire in the west, to Abergwynfi in Neath Port Talbot in the east. The Brecon Beacons National Park forms a small part of the east of Carmarthenshire, and the Pembrokeshire Coast National Park is located within the coastal zone of Pembrokeshire to the west of the study extent, as shown below in Figure **2**-**1**.

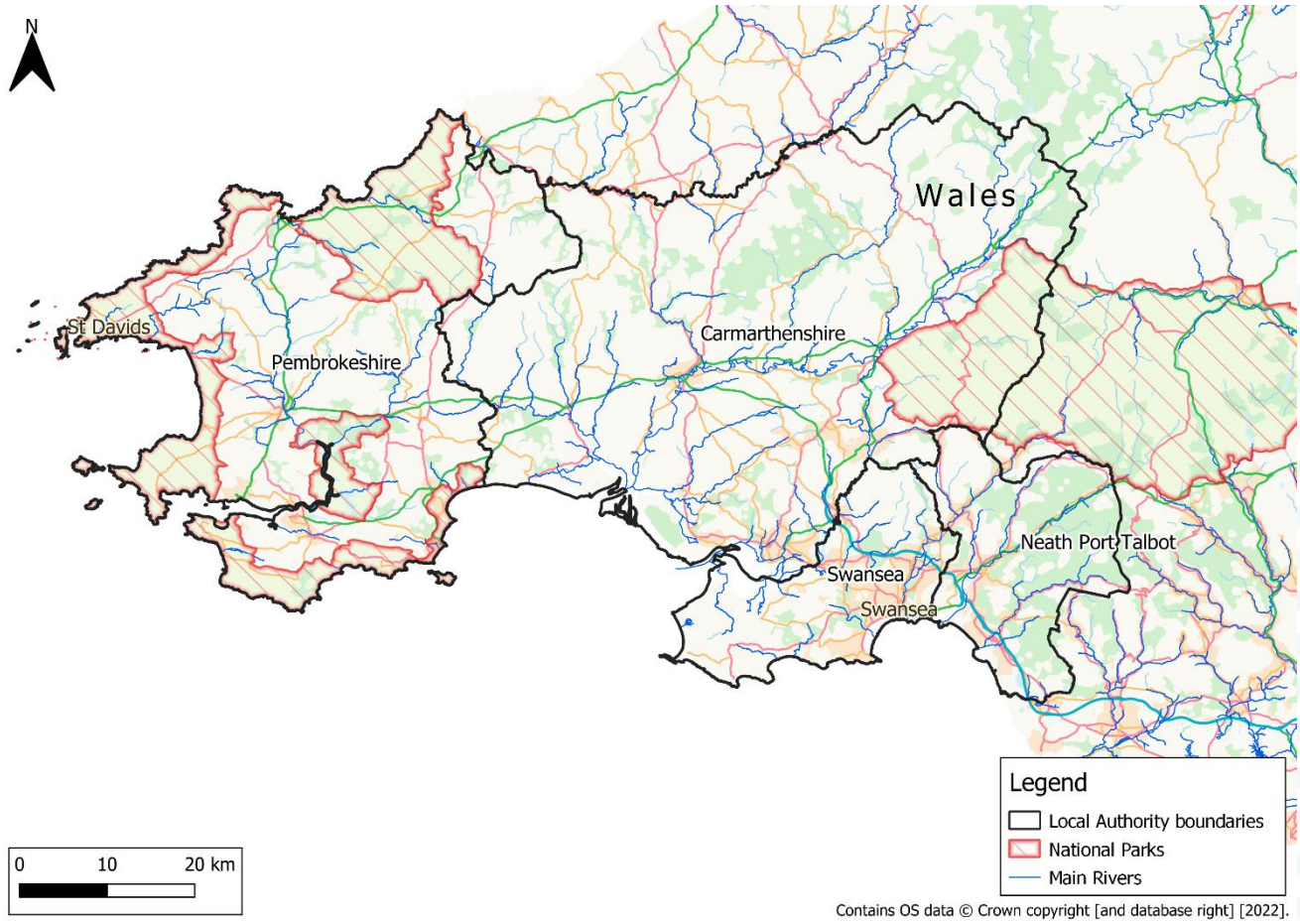

Figure 2-1 Study area

11. The population of South West Wales as of mid 2020 was approximately 707,733[1], split between the 4 Unitary Authorities: Swansea (246,563), Neath Port Talbot (144,386), Pembrokeshire (126,751) and Carmarthenshire (190,073). The 4 Unitary Authorities above, along with the National Park areas which form their own individual planning authorities, are each formed of several key settlements; a summary of which is provided below in Table **2**-**1**.

1 https://statswales.gov.wales/Catalogue/Population-and-Migration/Population/Estimates/Local-Authority/populationestimates-by-localauthority-year

Table 2-1 Key settlements in South West Wales

County	Key Settlements	Other Settlements
Swansea	Goreseinon Pontarddulais Swansea The Gower	Clydach Fforestfach Garden Village Llangyfelach Morriston Mumbles Mynyddbach Pellergaer Pontarddulais SkettyPenlan Sketty
Neath Port Talbot	Neath Pontardawe Port Talbot	Aberavon Aberdulais Baglan Blaengwrach Blaengywnfi Briton Ferry Bryncoch Cimla Croeserw Crynant Cwmafan Cwmgors Cymmer Dyffryn Cellwen Glyncorrwg Glynneath Godergraig Gwaun Cae Gurwen Llandarcy Margam Cwmllynfell Resolven Rhos Sandfields Seven Sisters Skewen Taibach Tonna Trebanos Ystalyfera
Pembrokeshire	Fishguard Haverfordwest Milford Haven Pembroke Pembroke Dock	Goodwick Narberth Neyland Crymych Johnston Kilgetty Letterston
Pembrokeshire Coast National Park	Saundersfoot St Davids Newport Tenby	Amroth Angle Bosherston Broad Haven

		Castlemartin Dale Dinas Cross Herbrandston Lawrenny Little Haven Marloes Moylegrove Mynachlogddu Nevern Newgale Nolton Haven Pontfaen Porthgain Roch Rosebush Solva St Ishmaels Trefin Wiseman's Bridge
Carmarthenshire	Ammanford Carmarthen Gwendraeth Llanelli Teifi	Cross Hands Cwmamman Kidwelly Laugharne Llanbydder Llandeilo Llandovery Burry Port Llangadog Newcastle Emlyn St Clears Whitland
Brecon Beacons National Park (Carmarthenshire overlap)		Myddfai Gwynfe

12. Land use outside of key settlement areas is predominantly agricultural, or areas dominated by forest and moorland across the South West Wales region. Key protected areas within the region include the Gower Area of Outstanding Natural Beauty (AONB), Brecon Beacon National Park and Pembrokeshire Coast National Park.
13. Key infrastructure in the area includes the M4 crossing from southeast to northwest through Neath Port Talbot and Swansea. Between Carmarthenshire and Pembrokeshire the A40 crosses from east to west. Several train services connect from Pembrokeshire across to Neath Port Talbot and into South East Wales.

2.2 Topography and geology

2.2.1 Topography

14. The topography varies from low lying relatively flat, coastal areas in the south to steep valleys in the north of Pembrokeshire, Carmarthenshire and Swansea. Neath Port Talbot has high elevations throughout the county reaching over 550mAOD within Afan Forest Park in the east. Carmarthenshire has the highest topography with over 745mAOD within the Brecon Beacons to the east of the county.

15. Topographic information has been derived from OS Terrain 50 which is a digital terrain model of the landscape. This dataset has been used over LiDAR data from NRW as it provides greater coverage of the study area, as shown in Figure **2**-**2**.

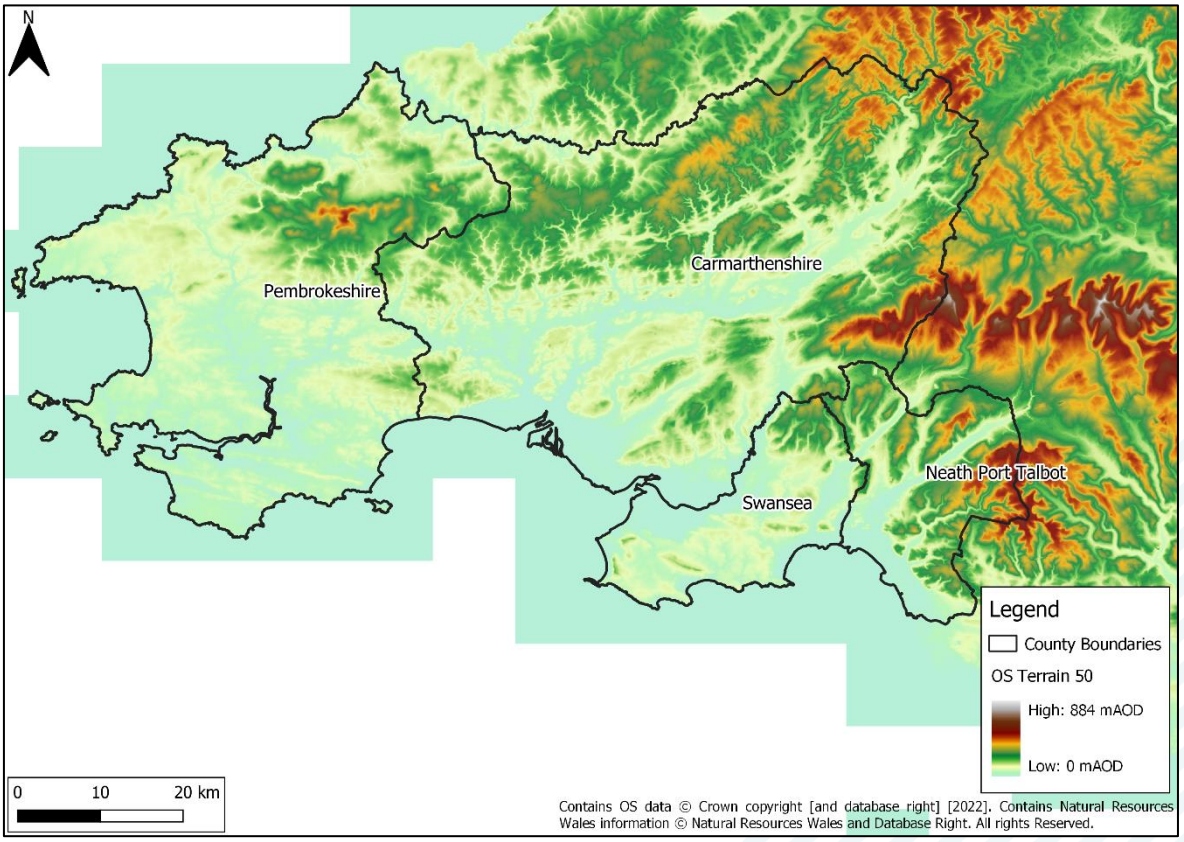

Figure 2-2 Natural Resources Wales 2m DTM LiDAR

2.2.2 Geology and soils

16. South West Wales has a very varied geology but is predominantly comprised of Coal Measure Formations and Ashgill Rocks. Across Pembrokeshire the geology is largely mudstone, sandstone and siltstone although in north Pembrokeshire the dominant geology is older igneous and metamorphic rocks, with some superficial deposits of glacial sand and gravel. There are some areas in the south of Pembrokeshire which are comprised of Pennine Lower Coal Measures and South Wales Lower Coal Measures Formations (Broad Haven to Saundersfoot), and some small areas near to the coastline (Pembroke to Tenby, and Bosherston) which are made up of Limestone.

17. Carmarthenshire is almost entirely made up of geology comprised of mudstone, siltstone, and sandstone, aside from areas to the south of Llandybie. To the south of the Black Mountains, including the south of Carmarthenshire, north of Swansea, and Neath Port Talbot, the geology is incorporates Pennine Lower and Middle Coal Measures Formations, and is predominantly made up of South Wales Upper Coal Measures Formations.

18. To the south of Swansea, the Gower is primarily made up of Limestone.

19. Mudstone is formed from fine grains of clay and mud and is relatively impermeable. Siltstone is formed from larger particles which are predominantly silt. Sandstone is formed

from even larger 'sand sized' particles. In contrast to mudstone and siltstone rock types, sandstone is usually porous enough to allow percolation and can store large volumes of water. These rocks underlie almost all of the western and north east areas of South West Wales.

20. The large bands of coal that dominate the south east of South West Wales are formed of plants preserved and fossilised millions of years ago. The porosity of coal varies; however, it is generally considered a relatively porous rock. Due to the intensive coal mining that South Wales experienced since the start of the industrial revolution, large networks of tunnels are present in much of the South West Wales coal field. This alters the hydrogeology and natural flow paths within these catchments, making it challenging to understand flood flows in these areas of South West Wales.

21. Superficial deposits across South West Wales are made up of Alluvium formed of clay, silt, and sand. Till dominates the superficial deposits in the east of South West Wales. In Neath Port Talbot there are small areas of Peat which make up the superficial deposits.

22. Across the north of South West Wales soils are described as 'Freely draining acid loamy soils over rock', with the south west the study area being dominated by 'Freely draining slightly acid loamy soils'. Other areas in the west of South West Wales, and in the eastern vicinity are predominantly 'Slowly permeable wet very upland acid soils with a peaty surface' and 'Slowly permeable seasonally wet acid loamy and clayey soils'. Within Neath Port Talbot there is an area which is described as 'Very acid loamy upland soils with a wet and peaty surface'.

2.3 Catchments and watercourses

23. The main river catchments in South West Wales are South West Wales, Loughor to Taf and Ogmore to Tawe as shown in Figure **2**-**3**.

South West Wales

24. The South West Wales catchment covers a number of counties in South West Wales and includes several major watercourses. The main watercourse is the River Cleddau. The River Cleddau consists of the Eastern and Western Cleddau rivers in Pembrokeshire, which flow in a predominantly southerly direction, joining to form the Daugleddau estuary.

25. The River Teifi is also of note as it partly defines the edge of the study area and should be considered both in a Pembrokeshire and Carmarthenshire context.

Loughor to Taf

26. The Loughor to Taf catchment is made of four main watercourses: the River Loughor, Taf, Tywi and Gwendraeth. The River Loughor marks the boundary between Carmarthenshire and Swansea and flows in a south-westerly direction before entering the sea at Loughor.

27. The River Gwendraeth has two almost equal branches (the Gwendraeth Fawr and the Gwendraeth Fach) that form a confluence in Carmarthen Bay.

28. The Rivers Taf and Tywi also enter the sea via Carmarthen Bay, with the River Taf flowing in a south-easterly direction through Glandwr and Whitland, and the River Tywi flowing in a south-westerly direction through Llandovery and Llandeilo. The River Tywi is one of the longest rivers flowing entirely within Wales over a distance of 75km.

Ogmore to Tawe

29. The three main watercourses within the boundaries of this report in this catchment are the River Afan, the River Neath and the River Tawe. The River Ogmore (which forms the name of the basin) does not cross the county boundaries listed in this report and is therefore not discussed further.

30. The River Neath flows in a south-westerly direction from its headwaters in Brecon Beacons National Park to its mouth at Baglan Bay on the east side of Swansea Bay. Similarly, the River Tawe also flows in a southerly direction from its headwaters in Brecon Beacons

National Park and then southwest into its estuary at Swansea. The River Afan flows in a south-westerly direction through Port Talbot.

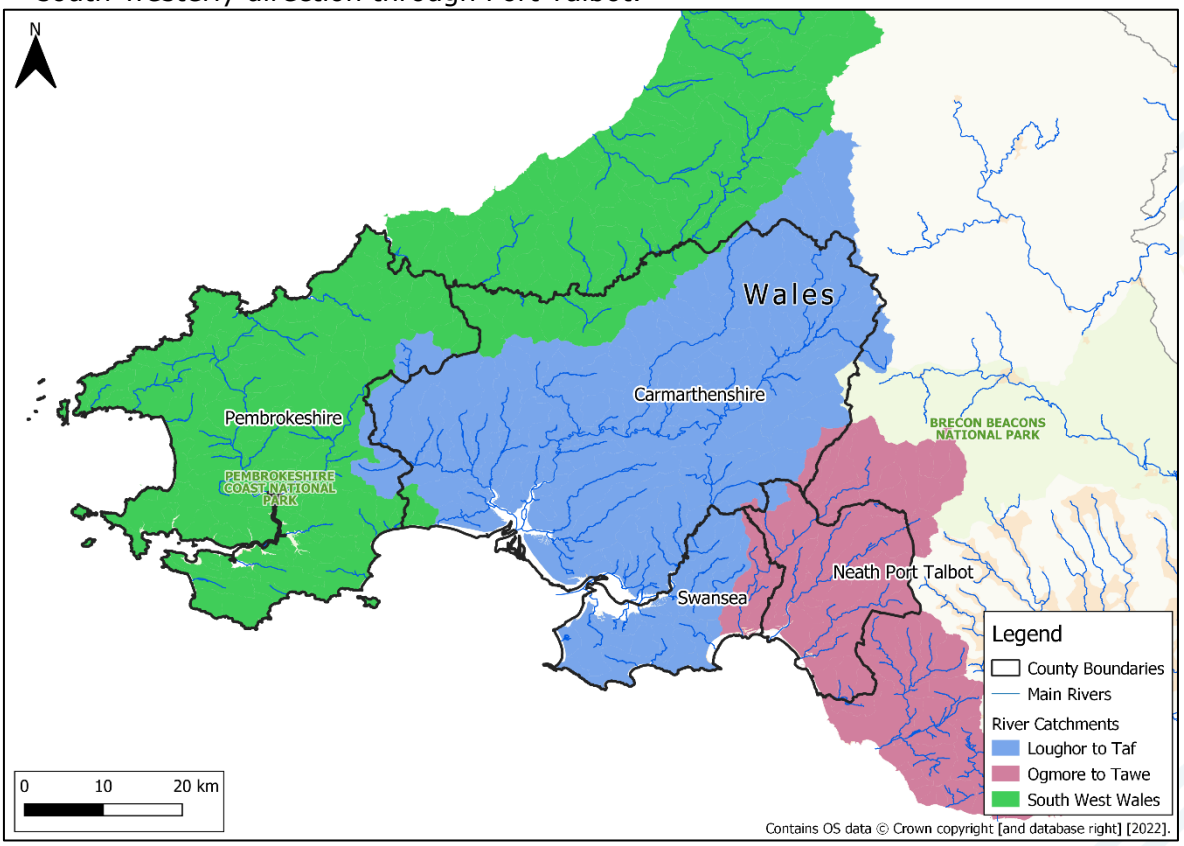

Figure 2-3 River catchments in South West Wales

3 Policy and Strategy

3.1 Legislation

3.1.1 EU Floods Directive and the Flood Risk Regulations

31. The European Flood Directive (2007) sets out the EU's approach to managing flood risk and aims to improve the management of the risk that floods pose to human health, the environment, cultural heritage and economic activity.

32. The Directive was translated into Welsh law by the Flood Risk Regulations (FRR) 2009 and outlines the requirement for Natural Resources Wales and Lead Local Flood Authorities (LLFA) to create Preliminary Flood Risk Assessments (PFRAs), with the aim of identifying significant Flood Risk Areas.

33. PFRAs should cover the entire area for local flood risk (focusing on ordinary watercourses, surface water and groundwater flooding). Where significant Flood Risk Areas are identified using a national approach (and locally reviewed), the LLFA are then required to undertake flood risk hazard mapping and Flood Risk Management Plans (FRMPs).

34. The FRMP will need to consider objectives for flood risk management (reducing the likelihood and consequences of flooding) and measures to achieve those objectives.

35. NRW have produced National Flood Hazard Mapping which is based on generalised modelling as part of Flood Risk Assessment Wales. They have been created for three sources of flooding – rivers, the sea, surface water and small watercourses. The maps show flood depth, velocity, hazard, and extent for high, medium, and low risk scenarios.

36. Natural Resources Wales (NRW) has implemented one of the exceptions for creating PFRAs, etc for Main Rivers and coastal flooding, as they already have mapping (i.e. Risk of Flooding from Rivers and Sea Map) and plans (i.e. CFMPs) in place to deal with this. NRW has therefore focused their efforts on assisting LLFAs through this process.

3.1.2 Flood and Water Management Act

37. The Flood and Water Management Act (FWMA) was passed in April 2010. It aims to improve both flood risk management and the way water resources are managed.

38. The FWMA creates clearer roles and responsibilities and instils a more risk-based approach. This includes a new lead role for Local Authorities in managing local flood risk (from surface water, groundwater and ordinary watercourses) and a strategic overview role of all flood risk for Natural Resources Wales.

39. The content and implications of the FWMA provide considerable opportunities for improved and integrated land use planning and flood risk management by Local Authorities and other key partners. The integration and synergy of strategies and plans at national, regional and local scales, is increasingly important to protect vulnerable communities and deliver sustainable re-generation and growth. Table **3-1** provides an overview of the key LLFA responsibilities under the FWMA.

Table 3-1 Key LLFA Responsibilities

Responsibility	Description
Developing a Local Flood Risk Management Strategy	The LLFA is required to develop, maintain, apply and monitor its local strategy for flood risk management in its area. The local strategies will build on information such as national risk assessments and will use consistent risk-based approaches across different Local Authority areas and catchments. The Local Strategy will not be secondary to the National Strategy; rather it will have distinct objectives to manage local flood risks important to local communities.
Investigating Flood Incidents	An LLFA has a duty to investigate and record details of 'significant flooding' in its area, under Section 19 of the FWMA. The National Strategy for FCERM in Wales states that the Welsh Government expects Section 19 reports to be undertaken where 20 or more homes in one area experience internal flooding, However, Local Authorities may choose a lower threshold as it is noted that small scale floods are still capable of causing significant damage. What constitutes significant flooding is defined by each LLFA. This duty includes identifying risk management authorities and their functions and how they intent to exercise those functions in response to a flood. The responding risk management authority (RMA) must publish the results of its investigation and notify other relevant risk management authorities.
Asset Register	An LLFA has a duty to maintain a register of structures or features, which are considered to have an effect on flood risk, including details on ownership and condition as a minimum. The register must be available for inspection and the Secretary of State will be able to make regulations about the content of the register and records.
Works Powers	The Act provides the LLFA with powers to do works to manage flood risk from surface water runoff, groundwater and ordinary watercourses, consistent with the local flood risk management strategy for the area.
Designation Powers	Schedule 1 of the Act provides the LLFA with powers to designate structures and features that affect flooding or coastal erosion. The powers are intended to overcome the risk of a person damaging or removing a structure or feature that is on private land and which is relied on for flood or coastal erosion risk management. Once a feature is designated, the owner must seek consent to alter, remove or replace it.
SuDS Approval Body	Schedule 3 of the Act establishes each LLFA as a SuDS Approval Body (SAB). The SAB has responsibility for the approval of proposed drainage systems in new developments and redevelopments, subject to exemptions and thresholds. Approval must be given before the developer commences construction. The SAB is also responsible for adopting and maintaining SuDS which serve more than one property, where they have been approved. Highways authorities will be responsible for maintaining SuDS in public roads, to National Standards.

3.1.3 Sustainable Drainage Systems (SuDS)

40. Disposal of surface water runoff is a key consideration, whether a development site falls within a flood risk area or not. Intense development within a catchment could result in increased runoff which if not appropriately managed could result in increased flooding within and downstream of the study area. Consequently, the impact of new developments on flood risk needs to be managed to avoid any negative impacts to the development itself and to other assets within the catchment.

41. New developments can also increase pressure on sewer systems and urban drainage. It is therefore important to manage the impact of developments in a sustainable manner.

42. Sustainable Drainage Systems (SuDS) aim to mimic the natural processes of Greenfield surface water drainage by allowing water to flow along natural flow routes and also aims to reduce the runoff rates and volumes during storm events, whilst providing water treatment benefits. SuDS also have the advantage of providing Blue and Green Infrastructure, ecology and recreational benefits when designed and maintained properly.

43. Schedule 3 of the Flood and Water Management Act 2010 was enacted in Wales in January 2019, leading to the requirement for all new developments to incorporate the four pillars of SuDS design, shown in Figure **3-1**. The statutory requirement for SuDS approval and the associated approval process is separate from planning permission, although there is need for significant interactions and alignment between the two processes.

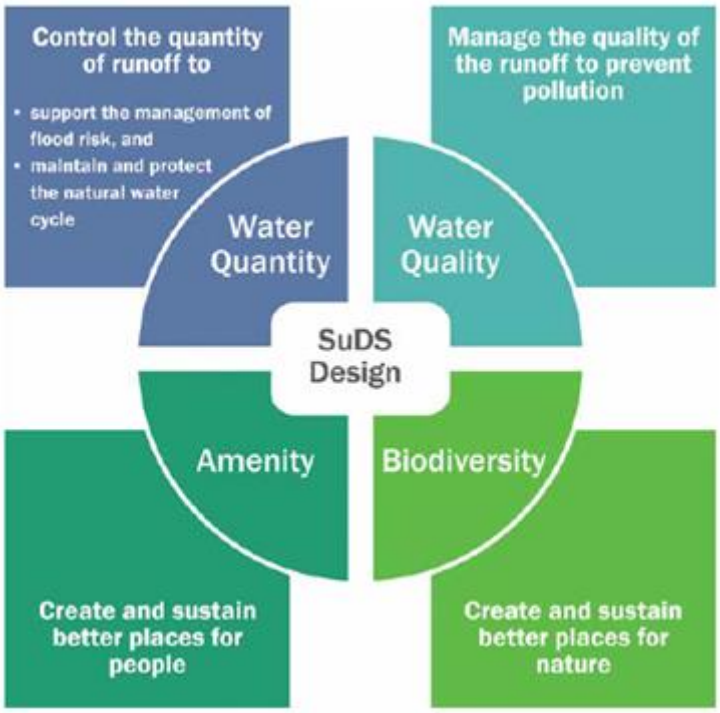

Figure 3-1 Four Pillars of SuDS (CIRIA, 2015)

44. There are a number of technical standards and design guidance for SuDS which are available in the documents listed below:

- Statutory standards for sustainable drainage systems – designing, constructing, operating and maintaining surface water drainage systems (Welsh Government, 2018),
- C753 The SuDS Manual (Ciria, 2015),
- Rainfall Runoff Management for Developments – SC030219 (Environment Agency, 2013),
- PPW – Edition 11, February 2021,
- The Building Regulations 2010 Part H: Drainage and Waste Disposal,
- Design and Construction Guidance.

3.1.4 Water Framework Directive and Water Environment Regulations

45. The purpose of the Water Framework Directive (WFD) is to deliver improvements across Europe in the management of water quality and water resources. The first cycle of River Basin Management Plans (RBMP) and WFD required all inland and coastal waters to reach "good ecological status" by 2015 through a catchment-based system. Incorporating a programme of measures to improve the status of all natural water bodies. There is an exception for "heavily modified water bodies", that are required to achieve "good ecological potential". The Water Environment Regulations (2003) transposed the WFD into law in England and Wales. Natural Resources Wales is leading on the delivery of the WFD in Wales.

46. The River Basin Management Plans for Western Wales is discussed in more detail in Section 3.4.2.

3.1.5 Well-being of Future Generations (Wales) Act 2015

47. The Well-being of Future Generations (Wales) Act 2015 places a duty on all public bodies to safeguard the well-being of future generations. The duty is based on the principle of sustainable development and requires public bodies to think about the long-term impact of their decisions, whilst collaborating with others, communities, and each other. The seven well-being goals listed within the Act aim to present Wales with an opportunity to make a long-lasting and positive change to current and future generations.

48. In terms of flood risk management, it is therefore important to ensure that developments do not occur in areas at risk of flooding, or where the risk of flooding cannot be managed to an acceptable level. Additionally, any flood risk management works should not result in an increase of flooding elsewhere. A precautionary approach is undertaken in this SFCA to ensure that the well-being of future generations is not compromised as a result of proposed development.

3.2 National Policy

3.2.1 Future Wales – The National Plan 2040

49. Future Wales is a national development framework which sets the direction for development in Wales to 2040. It is a development plan with a strategy for addressing key national priorities through the planning system, including achieving decarbonisation and climate resilience. Future Wales sets a direction for where investment should be made in infrastructure and development and makes clear the importance of planning new infrastructure and development in a way that ensures opportunities are maximised and multiple benefits are achieved.

50. Policy 8 of Future Wales sets out considerations for the future of Wales in terms of Flood Risk. It states that Flood Risk Management that enables and supports strategic growth and regeneration in National and Regional Growth Areas shall be supported. Additionally, Welsh Government will work with authorities and developers to plan and invest in new and improved infrastructure, promoting nature-based solutions as a priority, where opportunities for social, economic and environmental benefits are maximised when investing in flood risk management infrastructure.

51. Policy 8 highlights that flood risk is a constraining factor to development, especially as a result of a large number of Wales' towns and cities being located on the coast or located alongside major rivers. It identifies that the likelihood of rising sea levels and increased rainfall caused by climate change means the risk of flooding is projected to increase over the lifetime of the development and sustainable solutions will be required. The ambition to grow and regenerate places within the National Growth Areas will require strategic decisions on the location of development, and it is not appropriate to develop flood risk management infrastructure to enable new development on greenfield land. The policy identifies that a strategic approach should be taken to prioritising development in places that are not at flood risk, followed by places where flood risk can be managed in an acceptable way. Policy 8 points towards the requirements of PPW and the requirements of Technical Advice Note 15: Development, flooding and coastal erosion (TAN-15) to direct development away from areas at risk of flooding.

3.2.2 Planning Policy Wales

52. PPW Edition 11 (PPW 11) aims to ensure that the planning system contributes towards the delivery of sustainable development and improves the social, economic, environmental and cultural well-being of Wales, as required by the Planning (Wales) Act 2015, the Well-being of Future Generations (Wales) Act 2015 and other key legislation. It is supplemented by a series of Technical Advice Notes (TANs).

53. PPW addresses a wide range of issues including the placemaking of sustainable settlements, the location of new development, the commitment to the re-use of land and promoting sustainability through good design.

54. PPW indicates that Local Authorities should recognise in their policies the housing needs of all and must ensure that sufficient land is genuinely available, or will become available, to provide land for housing judged against the general objectives and the scale and location of development provided for in the development plan.

55. Paragraph 6.6.18 of PPW states that *'the provision of SuDS must be considered as an integral part of the design of the new development and considered at the earliest possible stage when formulating proposals for new development'.*

56. Paragraph 6.6.22 of PPW refers to `Development and flood risk' and states that *"Planning authorities should adopt a precautionary approach of positive avoidance of development in areas of flooding from the sea or from rivers."*

57. Paragraph 6.6.24 adds that *"planning authorities [should] take a strategic approach to flood risk and consider the catchment as a whole by providing a preliminary representation of flood risks, which inform decisions on the location of new development and the requirements necessary to support any applications which may be proposed."*

58. Paragraph 6.6.23 continues that *"Government resources for flood and coastal defences are directed at protecting existing developments and are not available to provide defences in anticipation of future development."* PPW then advises that a sustainable approach to flooding will involve avoiding development within areas at flood risk.

3.2.3 National Flood Risk and Coastal Erosion Management (FCERM) Strategy for Wales

59. The National FCERM Strategy for Wales[2] was published in October 2020 and sets out how the Welsh Government intends to manage flood and coastal erosion risks in Wales over the next ten years. The Strategy has been drafted with a longer-term, strategic view, recognising the nature of flood and coastal erosion risk with respect to the challenges of climate change. It will work alongside other strategic plans for shoreline management, infrastructure and development planning.

60. With regard to managing flood and coastal erosion risk in Wales, the strategy sets out five high level objectives:

    A. Improving our understanding and communication of risk;
    B. Preparedness and building resilience;
    C. Prioritising investment to the most at risk communities;
    D. Preventing more people becoming exposed to risk;
    E. Providing an effective and sustained response.

61. Each of these objectives are related to specific measures and actions outlined in the national strategy. NRW will report on the application of the national strategy through a Section 18 report every two years. This will be reviewed by the Flood and Coastal Erosion Committee.

2 https://gov.wales/national-strategy-flood-and-coastal-erosion-risk-management-wales

3.3 Technical Advice Note 15: Development, flooding and coastal erosion

62. Technical Advice Note 15: Development, flooding and coastal erosion (TAN-15) sets out the criteria against which the consequences of a development in an area at risk of flooding can be assessed.

63. TAN-15 also states that Local Planning Authorities should ensure development is set back appropriately from flood zones to allow for extreme surface water and small watercourse events.

64. TAN-15 was introduced in 2004 by the Welsh Government. It is technical guidance related to development planning and flood risk using a sequential characterisation of risk based on the Development Advice Map (DAM). An update to TAN-15, which is supported by the FMfP, was initially released in September 2021 for implementation from December 2021. However, on the 24th November 2021 Welsh Government suspended the implementation of the new TAN-15 until 1st June 2023.

65. **In accordance with the direction of the Minister for Climate change, provided in guidance accompanying the decision notice to delay its implementation, this SFCA has been prepared in accordance with the updated TAN-15 and associated FMfP due to be implemented from June 2023.**

66. TAN-15 reflects the core principles of the National Strategy for Flood and Coastal Erosion Risk Management in Wales3 to adopt a risk-based approach in respect of new development in areas at risk of flooding and coastal erosion. TAN-15 comprises technical guidance related to development planning and flood risk and provides a framework within which the flood risks arising from rivers, the sea and surface water, and the risk of coastal erosion can be assessed.

67. Its initial requirement is to identify the flood zones and vulnerability classification relevant to the proposed development, based on an assessment of current and future conditions. An indicative sequence to negotiating the various elements of TAN-15 is provided below in Figure **3-2**.

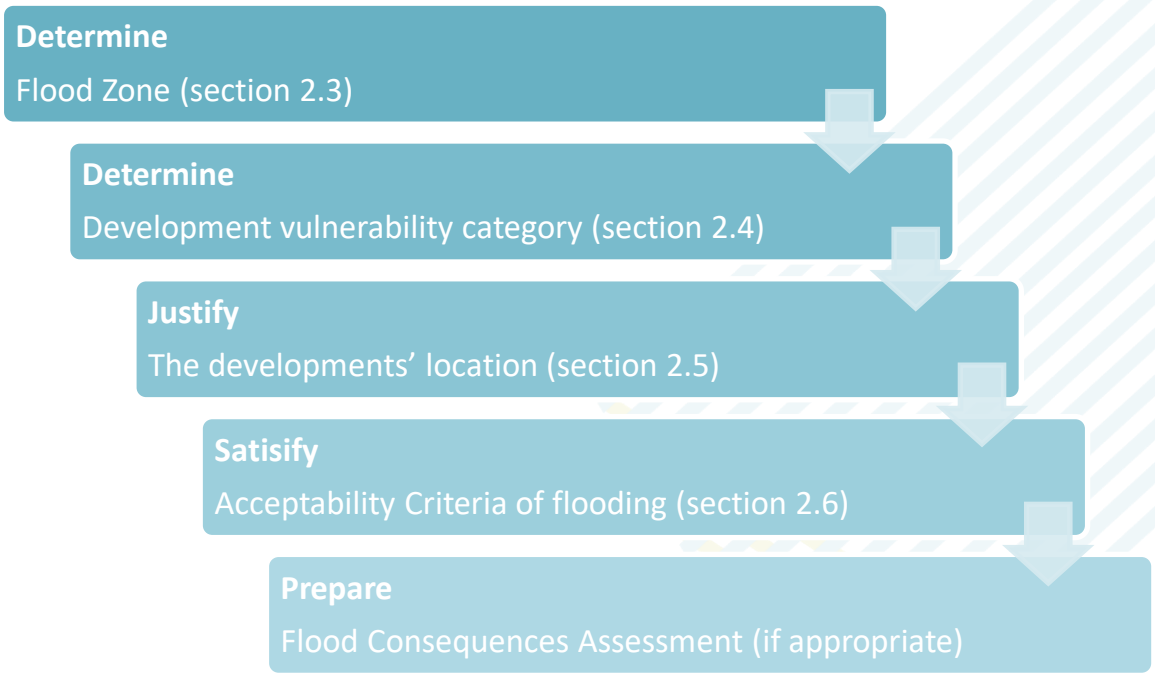

Figure 3-2 Navigating TAN-15 requirements

3 National Strategy for Flood and Coastal Erosion Risk Management in Wales. Welsh Government (October 2020) https://gov.wales/national-strategy-flood-and-coastal-erosion-risk-management-wales

3.3.1 Flood Map for Planning

68. TAN-15 defines a number of flood zones based on the likelihood of flooding. **Error! Reference source not found.** summaries the definition of the flood zones in the Flood Map for Planning (FMfP) 4. The FMfP flood extents are based on the central estimates of climate change, assuming a 100-year lifetime of development.

Table 3-2 TAN-15 Definition of FMfP flood zones

Zone	Flooding from rivers	Flooding from the sea	Flooding from surface water and small watercourses
1	Less than 1 in 1000 (0.1%) (plus climate change) chance of flooding in a given year		
2	Less than 1 in 100 (1%) but greater than 1 in 1000 (0.1%) chance of flooding in a given year, including climate change	Less than 1 in 200 (0.5%) but greater than 1 in 1000 (0.1%) chance of flooding in a given year, including climate change	Less than 1 in 100 (1%) but greater than 1 in 1000 (0.1%) chance of flooding in a given year, including climate change
3	A greater than 1 in 100 (1%) chance of flooding in a given year, including climate change	A greater than 1 in 200 (0.5%) chance of flooding in a given year, including climate change	A greater than 1 in 100 (1%) chance of flooding in a given year, including climate change
TAN-15 Defended zone	Areas where flood risk management infrastructure provides a minimum standard of protection against flooding from rivers of 1:100 (plus climate change and freeboard)	Areas where flood risk management infrastructure provides a minimum standard of protection against flooding from the sea of 1:200 (plus climate change and freeboard)	Not applicable

69. Additionally, NRW has published a 'Recorded Flood Extents' layer which identifies areas that have been recorded as having flooded in the past, these records are from a number of evidence sources including Natural Resources Wales, its predecessors or other Risk Management Authorities. The datasets include flooding records from rivers, the sea, surface water and small watercourses.

3.3.2 Climate change

70. Welsh Government publishes climate change guidance5 for Flood Consequence Assessments. This was last updated in September 2021 to provide revised sea level allowances. Assessing the future effects of climate change is a key aspect of TAN-15 and any FCA required to support a planning application.

71. There are three sources of flooding that utilise different climate change allowances; these are:

- **River flooding** – Wales is divided into three river basin districts and peak river flow allowances are provided for each area. Recommendations are to use the central estimate (50th percentile) for the relevant river basin district. However, it is also advised that an assessment of risk should be undertaken using the upper end estimate (90th percentile). For the central estimate peak river flows in Wales are predicted to increase by 20-30% over the next 100 years.
- **Flooding from the sea –** Estimated sea level rise is provided for each Local Authority area or can be calculated for specific sites through the UKCP18 User Interface. As a

4 https://flood-map-for-planning.naturalresources.wales
5 Flood Consequences Assessments: Climate change allowances. Welsh Government (Sept 2021) https://gov.wales/sites/default/files/publications/2021-09/climate-change-allowances-and-flood-consequence-assessments_0.pdf

minimum, development proposals should be assessed against the higher central allowance (70th percentile) estimates to inform design levels. An assessment should also be made against the upper end allowance (95th percentile) to inform mitigation measures, access and egress routes and emergency evacuation plans. For the higher central estimate, sea levels along the Welsh coastline are predicted to increase by 0.91-1.01m over the next 100 years.

- **Surface water and small watercourses flooding** – Peak rainfall intensity allowances are provided for catchments less than 5km. Recommendations are to use the central estimate as a minimum, and where there is significant flood risk, the upper end estimate should also be used. The central estimate for increasing peak rainfall intensity is 20% over the next 100 years.

3.3.3 Lifetime of development

72. The climate change uplifts detailed above are provided for different epochs. Consequently, the anticipated lifetime of development can be critical in the assessment of climate change impacts and future flood risk. This is most relevant to flooding from the sea, where sea level increases are estimated on an annual basis with increases accelerating over time. With river and surface water flood risk most climate changes effects are predicted to occur in the next 50 years, without further increases thereafter. Climate change uplifts are based on current Welsh Government guidance at the time of writing this report and may be subject to change.

73. TAN-15 states that "Generally, it is appropriate to think of new dwellings as having a lifetime of 100 years. Lifetimes for other types of development will vary, but 75 years is considered a reasonable rule of thumb."

74. It may be argued that many industrial developments have significantly shorter design lives than 75yrs. Therefore, in the cases of tidal flood risk there can be value in considering lifetimes of development less than 75yrs, although any deviation from the typical TAN-15 values will ultimately need to be agreed with the Local Planning Authority through the planning process.

3.3.4 Vulnerability classification

75. TAN-15 assigns one of three flood risk vulnerability classifications to a development, as shown in Table **3**-**3** below.

Table 3-3 Development vulnerability categories[6]

Development category	Types
Highly vulnerable development	All residential premises (including hotels, Gypsy and Traveller sites and caravan parks and camping sites). Schools and childcare establishments, colleges and universities. Hospitals and GP surgeries. Especially vulnerable industrial development (e.g. power generating and distribution elements of power stations, transformers, chemical plants, incinerators), and waste disposal sites. Emergency services, including ambulance stations, fire stations, police stations, command centres, emergency depots. Buildings used to provide emergency shelter in time of flood
Less vulnerable development	General industrial, employment, commercial and retail development. Transport and utilities infrastructure. Car parks. Mineral extraction sites and associated processing facilities (excluding waste disposal sites). Public buildings including libraries, community centres and leisure centres (excluding those identified as emergency shelters). Places of worship.

6 Source: Figure 3, TAN-15

	Cemeteries. Equipped play areas. Renewable energy generation facilities (excluding hydro generation).
Water compatible development	Boatyards, marinas and essential works required at mooring basins. Development associated with canals. Flood defences and management infrastructure. Open spaces (excluding equipped play areas). Hydro renewable energy generation.

3.3.5 Justifying the location of development

76. TAN-15 states that the Local Planning Authority will need to be satisfied that a development's location is justified. This is determined through the application of the 'Justification Test'. Table **3-4** below summaries the Justification Test for development within the various flood zones.

77. Where a site falls into two or more flood zones the planning authority must make an assessment of the proposal, taking into account each of its proposed land uses, against each of the flood zones to which it applies, in accordance with the Justification Tests.

Table 3-4: Justification Test

Zone 1	**TAN-15 Defended Zones**	**Zone 2 (rivers and sea)**	**Zone 3 (rivers and sea)**
All types of development are acceptable in principle. Planning authorities should develop locally specific planning policies for localised areas at risk of flooding.	Development will be justified in the TAN 15 Defended Zones if:	Development will be justified in Zone 2 if:	Less vulnerable development will only be justified if:
-	Its location meets the definition of previously developed land; **and**	Its location meets the definition of previously developed land; **and**	Its location meets the definition of previously developed land; **and**
-		It will assist, or be part of, a strategy supported by the Development Plan to regenerate an existing settlement or achieve key economic or environmental objectives; **and**	There are exceptional circumstances that require its location in Zone 3, such as the interests of national security, energy security, public health or to mitigate the impacts of climate change; **and**
-	The potential consequences of a flooding event for the particular type of development have been considered and found to be acceptable in accordance with the criteria contained in section 11 of TAN-15.	The potential consequences of a flooding event for the particular type of development have been considered and found to be acceptable in accordance with the criteria contained in section 11 of TAN-15.	The potential consequences of a flooding event for the particular type of development have been considered and found to be acceptable in accordance with the criteria contained in section 11 of TAN-15.

3.3.6 Acceptability of flood consequences

78. If the planning authority is satisfied that proposed development is justified in a flood risk area (Section 3.3.5), this justification will be in the knowledge that development may experience flooding and will need to be planned accordingly. A full understanding of the potential risks and consequences will be required to inform the planning authority in its decision making and to demonstrate that the criteria set out in the Justification Tests have been satisfied. This is demonstrated through the production of a Flood Consequence Assessment (FCA), which is appropriate to the nature and scale of the proposed development (further details of which are provided in Section 8).

79. Whether a development should proceed or not will depend upon whether the consequences of flooding can be safely managed, including its effects on flood risk elsewhere. **This is with the exception of high vulnerable development which is not permitted under any circumstances in Flood Zone 3.**

80. It is not appropriate to permit new development (other than water compatible development) in areas subject to significant flood depths or velocities or where safe access or egress cannot be achieved.

81. Accordingly, the planning authority will need to arrive at a judgement on the acceptability of the flooding consequences and they should only permit development where the developer has demonstrated that the risks and consequences of flooding are manageable and meet the 'Acceptability Criteria'.

82. There are three principal aspects to the Acceptability Criteria:

    1. **Flood frequency requirements**. The frequency at which flooding is regarded to be acceptable. TAN-15 states that all development must be designed to be flood free during the 1% river flood and 0.5% flooding from the sea events, with an allowance for climate change over the lifetime of development. See Table **3-5** for frequency thresholds
    2. **Tolerable conditions**. The flood conditions that are regarded to be acceptable during an extreme flood event with allowance for climate change. See Table **3-6**.
    3. **Avoidance of third-party impacts**. Development must not cause or exacerbate the nature and frequency of flood risk elsewhere up to and including the 0.1% extreme flood event plus climate change over the lifetime of development.

Table 3-5: Flood frequency requirements[7]

Vulnerability categories		**Flood event types**	
		Rivers	**Sea**
Highly vulnerable development	Emergency services (command centres and hubs)	0.1% +CC (1 in 1,000)	0.1% +CC (1 in 1,000)
	All other types	1% +CC (1 in 100)	0.5% +CC (1 in 200)
Less vulnerable development Water compatible development (limited to those built elements of development that may be occupied by people)		1% +CC (1 in 100)	0.5% +CC (1 in 200)

7 Source: Figure 6, TAN-15

Table 3-6: Tolerable conditions in extreme flood event[8]

Type of development	Maximum depth of flooding (mm)	Maximum velocity of flood waters (m/s)
Highly vulnerable development	600	0.15
Less vulnerable development Infrastructure associated with highly vulnerable development e.g. car parks, access, paths and roads Water compatible development (limited to those built elements of development that may be occupied by people)	600	0.3
Note: The extreme flood event is defined as the 0.1% AEP flood event		

3.3.7 Surface water and ordinary watercourse flood risk

83. Flooding is not confined to floodplains, as heavy rain falling on waterlogged ground or impermeable surfaces can cause localised flooding almost anywhere. Heavy rain can also result in drainage systems and ordinary watercourses, such as streams, reens and brooks quickly becoming inundated, leading to localised flooding. As the climate changes, this type of flooding will become more commonplace and more severe.

84. The FMfP includes two surface water and small watercourse flood risk zones. Zone 3 contains areas at highest risk, with Zone 2 areas facing a lower risk. Areas considered at minimal risk of flooding from these sources are in Zone 1.

85. Surface water and ordinary watercourse flood risk management are the responsibility of Lead Local Flood Authorities (LLFAs). The LLFA has an important role in advising on surface water and ordinary watercourse flood risks for its area. The LLFA is a statutory consultee to all planning applications, and will pay particular attention to applications affected by surface water and ordinary watercourse flood risk. Applicants are advised to seek the LLFA's input at pre-application stage. This is advised whether the flood risk is potentially a reason for refusal, or not, and where the risk is proposed to be managed or mitigated.

86. A Flood Consequences Assessment will be required for any new development proposal located fully or partly in Flood Zones 2 and 3 – Surface Water and Small Watercourses. An assessment should also be undertaken for development on sites outside of these zones, but which has the potential to affect the course of surface water and/or excess water from ordinary watercourses. Planning authorities may provide specific local advice on this issue in Development Plans.

87. The Justification Test does not apply to development in Flood Zones 2 and 3 of the Surface Water and Small Watercourses flood map. However, there is an expectation that the Acceptability Criteria will generally be applied in demonstrating the acceptability of flood risk. However, the degree of assessment required will depend on the nature, extent, perceived accuracy of the flood mapping, the potential severity and consequences of flooding, and ultimately the requirements of the LLFA.

8 Source: Figure 7, TAN-15

3.4 Regional Policy

3.4.1 Catchment Flood management Plans

88. Catchment Flood Management Plans (CFMP) are an essential component of future flood risk management. The plans are key to delivering the flood risk management outcomes of Welsh Government and Defra. A CFMP is a high-level strategic planning tool, setting out the policies that will be adopted to manage flood risk for the next 50 to 100 years. The plans include actions that NRW, councils and others need to take now and, in the future, to ensure adequate response and adaptation to the increasing and changing flood risk.

89. CFMP's have been developed for the whole of Wales and England. Each plan covers a single large catchment or a combined number of smaller catchments, with boundaries aligned to catchment boundaries. The plans consider all types of flooding and are based on a standard approach to ensure they provide a consistent assessment of flood risk. They also cover tidally influenced flooding from rivers and estuaries.

90. The CFMPs look at the current level of flood risk and compare this to the predicted future flood risk. This allows a targeted approach in dealing with flood risk in areas that will need it the most. The CFMP process assesses how flooding might affect people, property and the environment. The CFMP policies should be considered when making land planning decisions.

91. Each CFMP is divided into a number of 'management units' which are defined as areas with similar sources, pathways and receptors of flooding. Each management unit is assigned a preferred flood risk management policy based on an appraisal of the social, economic and environmental damages of flooding.

92. The 4 councils considered in this report fall into 3 Catchment Flood Management Plans: Ogmore to Tawe (Neath Port Talbot and West Swansea), Pembrokeshire and Ceredigion Rivers (Pembrokeshire) and Loughor to Taf (Carmarthenshire and Swansea).

Ogmore to Tawe CFMP

93. Flood risk management in the Ogmore to Tawe catchment is currently reliant on flood warning, development control and local defences at communities. Table 3-7 shows the different policy options for each sub-area in the catchment. Sub-areas have been derived from the sub-area plan from the CFMP, contained in Figure 3-3.

Table 3-7 Ogmore to Tawe CFMP policy options

Council	Sub-area	Policy options
Neath Port Talbot	Sub-area 4 - Upper Neath	Policy Option 4 – Take further action to sustain the current level of flood risk into the future (responding to the potential increase in risk from urban development, land use change and climate change).
	Sub-area 5 - Lower Neath	Policy Option 4 – Take further action to sustain the current level of flood risk into the future (responding to the potential increase in risk from urban development, land use change and climate change).
	Sub-area 6 - Port Talbot	Policy Option 5 – take further action to reduce flood risk (now and/or in the future).
Swansea	Sub-area 3 – Lower Tawe	Policy Option 5 – take further action to reduce flood risk (now and/or in the future).

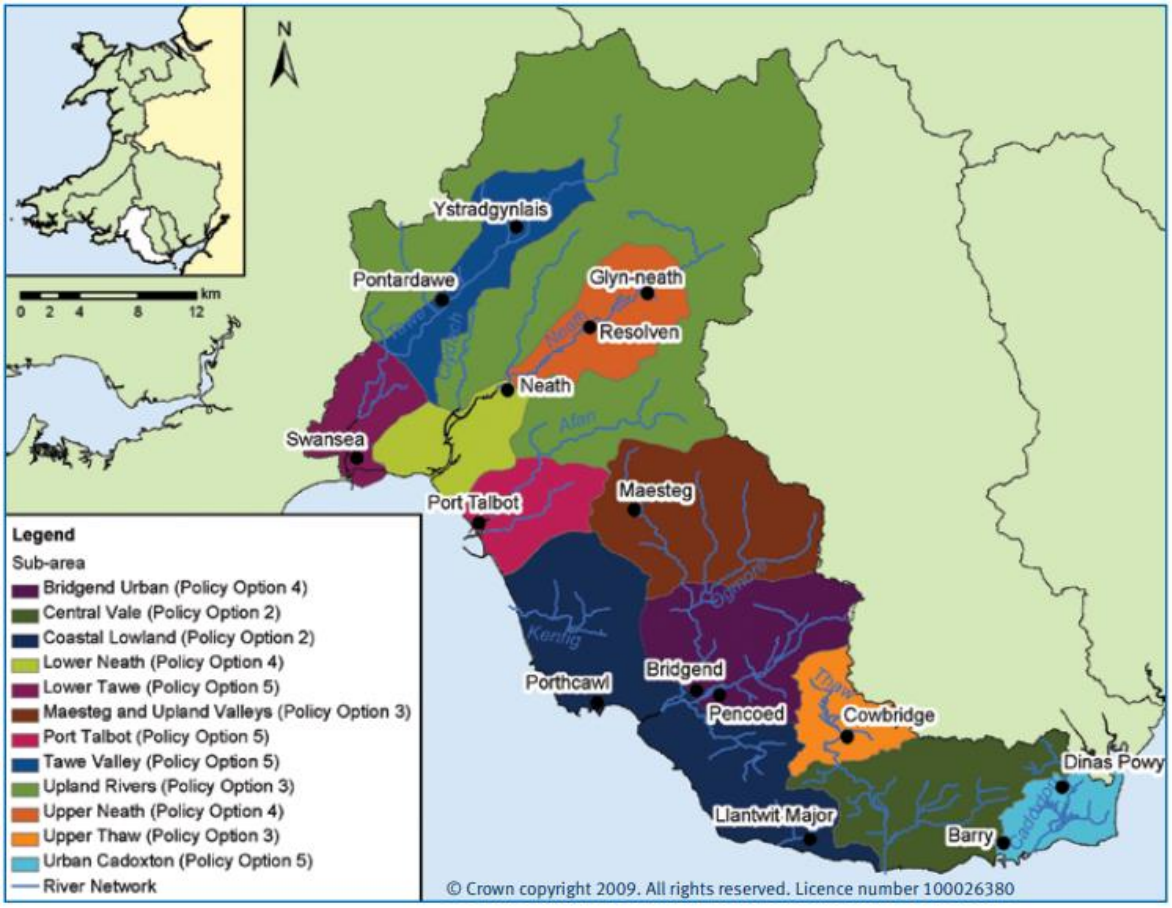

Figure 3-3 Extract of sub-areas from the Ogmore to Tawe CFMP Page 12[9]

Loughor to Taf CFMP

94. Flood risk management in the Loughor to Taf catchment is currently reliant on flood warning, development control and local defences at communities. Table 3-8 shows the different policy options for each sub-area in the catchment. Sub-areas have been derived from the sub-area plan from the CFMP, contained in Figure **3-4**. Within the scope of this report, the Local Authority covered by the Loughor to Taf CMFP is Carmarthenshire (and the Brecon Beacons National Park) and the City and County of Swansea, as shown below.

Table 3-8 Loughor to Taf CFMP policy options

Council	Sub-area	Policy options
Carmarthenshire	Sub-area 5 - Whitland	Policy Option 4 – Take further action to sustain the current level of flood risk into the future (responding to the potential increase in risk from urban development, land use change and climate change).
	Sub-area 6 – Pembrey and Pendine	Policy Option 1 – Continue to monitor and advise areas of little or no flood risk.
Swansea	Sub-area 7 – Loughor and West Swansea	Policy Option 5 – Take further action to reduce flood risk (now and/or in the future).

9 https://www.npt.gov.uk/ldpexamination/SWW04%20Ogmore%20to%20Tawe%20CFMP%20(EA%20Wales%202010).pdf

	Sub-area 8 – Gower Peninsula	Policy option 2 - Reduce existing flood risk management actions (accepting that flood risk will increase over time).

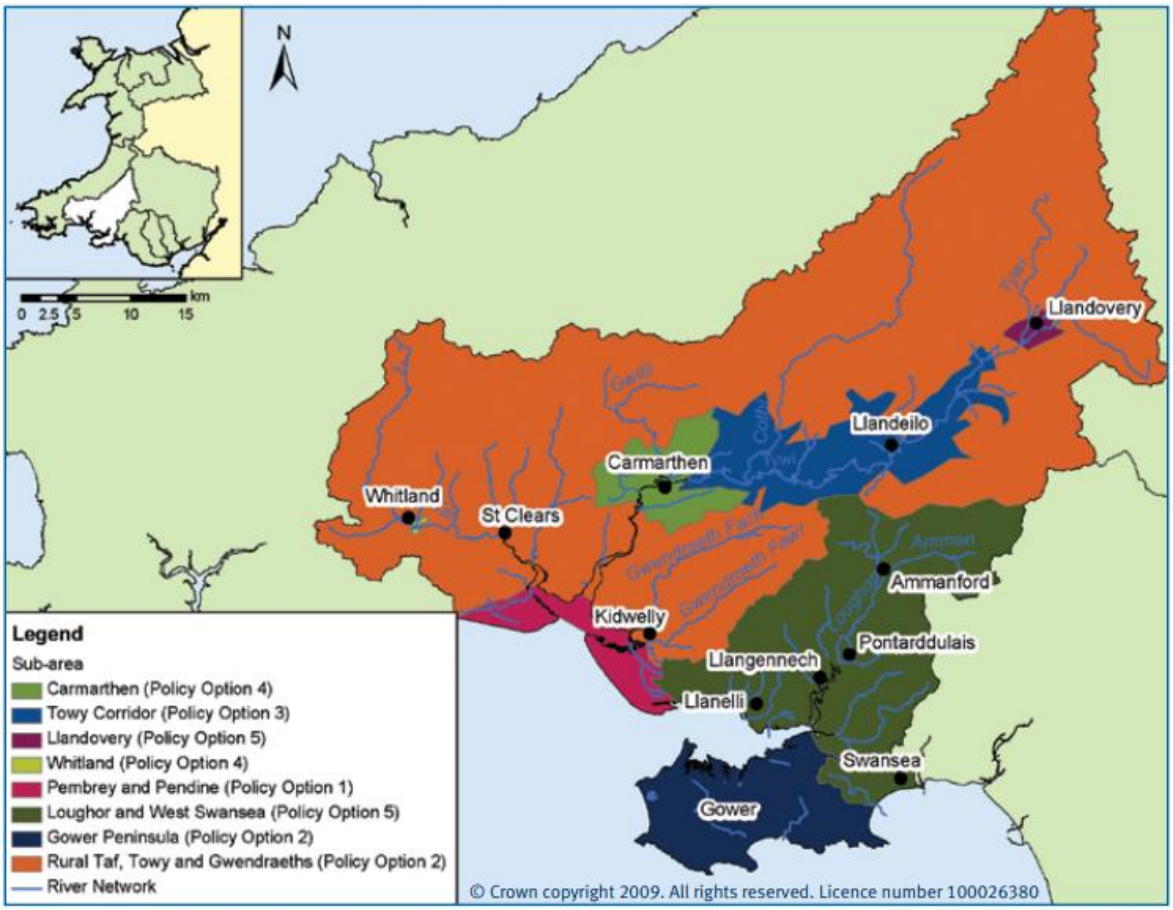

Figure 3-4 Extract of sub-areas from the Loughor to Taf CFMP Page 12[10]

Pembrokeshire and Ceredigion CFMP

95. Flood risk management in the Pembrokeshire and Ceredigion catchment is currently reliant on flood warning, development control and local defences at communities. Table 3-8 shows the different policy options for each sub-area in the catchment. Sub-areas have been derived from the sub-area plan from the CFMP, contained in Figure **3**-**5**. Within the scope of this report, the Local Authority covered by the Pembrokshire and Ceredigion CMP CFMP is Pembrokeshire (including the National Park) as shown below.

Table 3-9 Pembrokeshire and Ceredigion CFMP policy options

Council	Sub-area	Policy options
Pembrokeshire	Sub-area 5 - Eastern and Western Cleddau	Policy option 2 - Reduce existing flood risk management actions (accepting that flood risk will increase over time).
	Sub-area 6 – Western Commercial Area	Policy Option 4 – Take further action to sustain the current level of flood risk into the future (responding to the potential increase in risk from urban development, land use change and climate change).

10 https://webarchive.nationalarchives.gov.uk/ukgwa/20140328090736/http://www.environment-agency.gov.uk/research/planning/64223.aspx

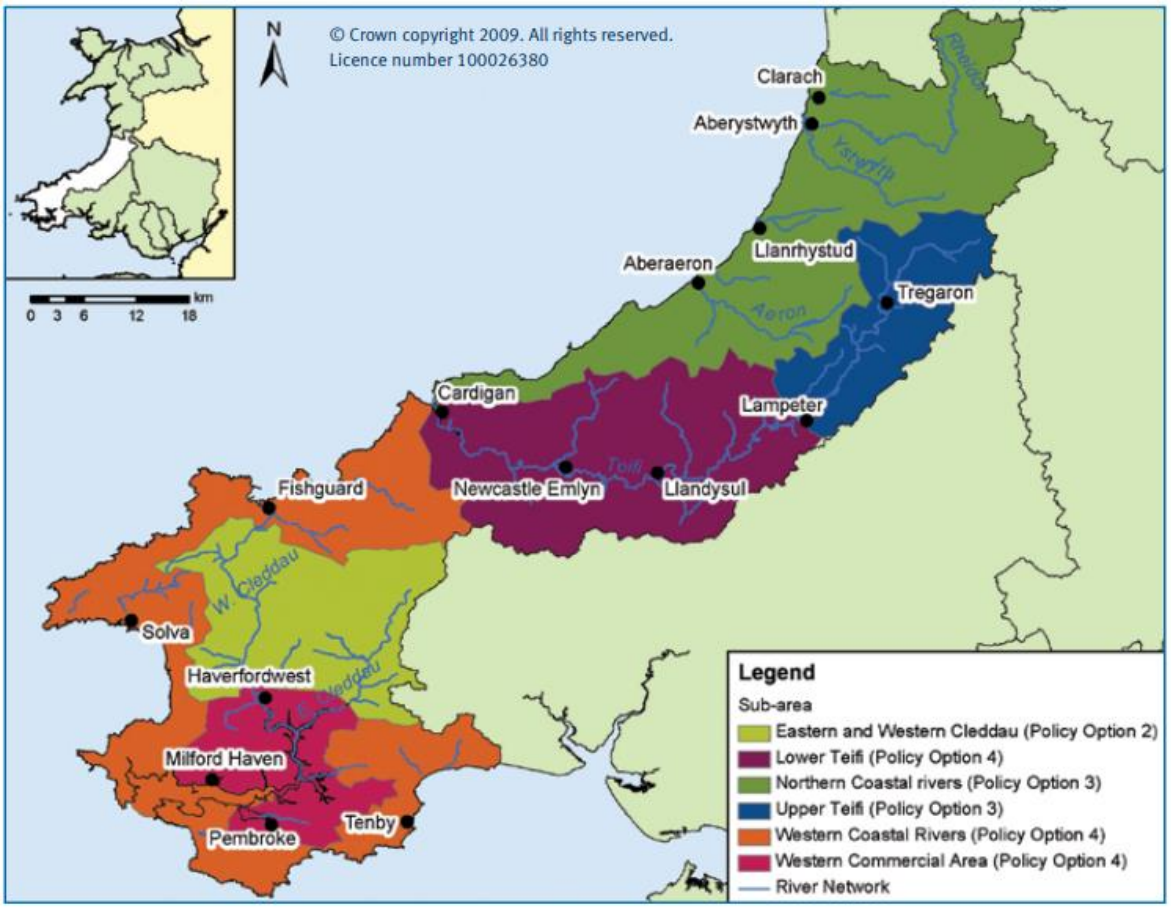

Figure 3-5 Extract of sub-areas from the Pembrokeshire and Ceredigion CFMP Page 12[11]

3.4.2 River Basin Management Plans

Western Wales River Basin Management Plan 2015-2021 – December 2015

96. The plan focuses on the protection, improvement and sustainable use of the water environment in the river basin district for people and the environment. The report details the many actions needed be taken by NRW and the Welsh Government in order to manage issues such as pollution from towns, cities and wastewater, flooding and coastal erosions and invasive species.

3.4.3 Shoreline Management Plans

97. Shoreline Management Plans (SMP) provide a large-scale assessment of the risks associated with coastal processes and present a long-term policy framework to reduce these risks to people and the developed, historic and natural environment in a sustainable manner. SMPs are 'coastal' companion documents to the 'inland' CFMP's. SMPs are non-statutory plans and are produced by Coastal Groups made up of maritime Local Authorities and other bodies with coastal defence responsibilities or interests.

Lavernock Point to St Ann's Head Shoreline Management Plan SMP2

98. The Lavernock Point to St Ann's Head SMP provides a large-scale assessment of the risks associated with coastal erosion and flooding at the coast. It also included policies to help manage these risks to people in a sustainable manner. The plan splits the coastline from Lavernock Point (Vale of Glamorgan) in the east and St Ann's Head (Pembrokeshire) in to 21 policy units. The units relevant to Neath Port Talbot, Swansea, Carmarthenshire and Pembrokeshire (including the National Park) are shown in Table **3-10** and Figure 3-6.

11 https://webarchive.nationalarchives.gov.uk/ukgwa/20140328090736/http://www.environment-agency.gov.uk/research/planning/64223.aspx

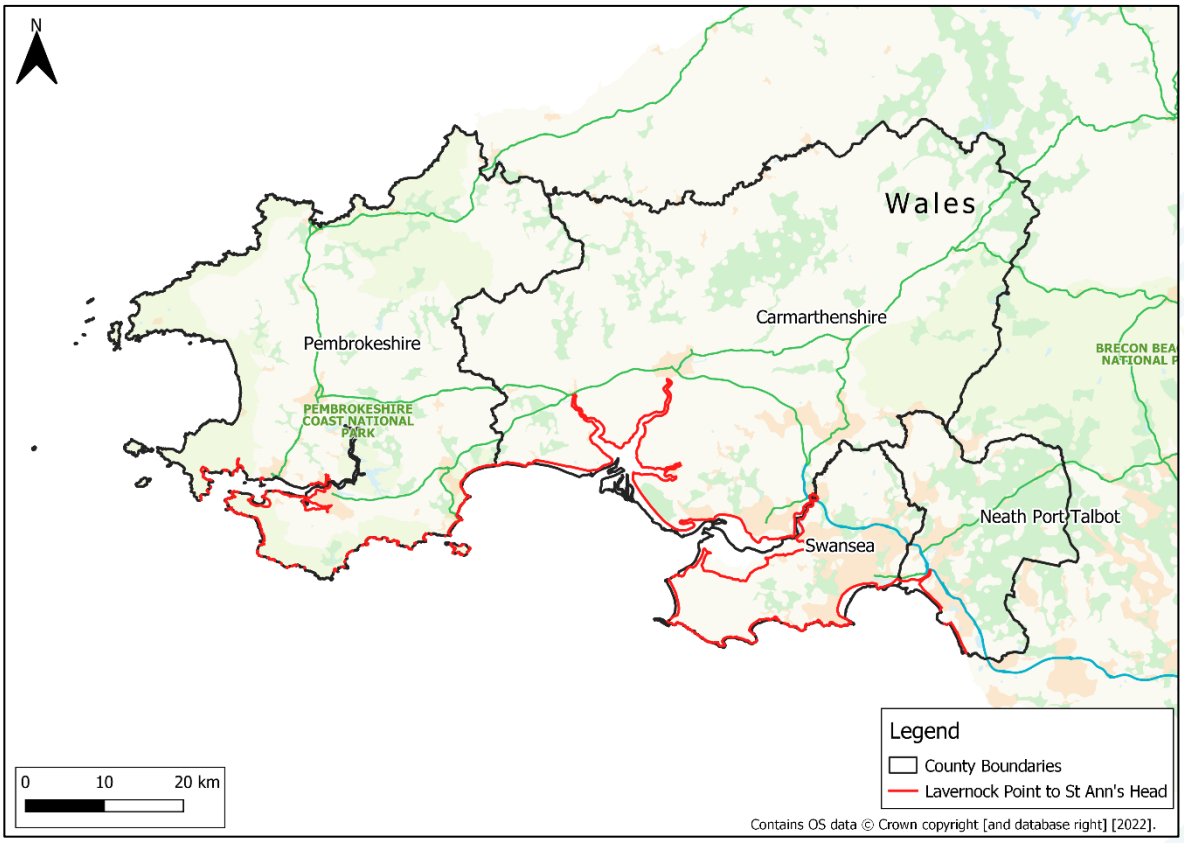

Figure 3-6 Lavernock Point to St Ann's Head Shoreline Management Plan policy units

Table 3-10 Lavernock Point to St Ann's Head Shoreline Management Plan SMP2

Neath Port Talbot		
Policy Units		**Actions**
PU 8/2	Port Talbot steelworks	The policy for the majority of the shoreline is to hold the line through maintenance and upgrading of existing defences to reduce the risk of coastal erosion and flooding to industrial assets and residential properties.
PU 8/3	Port of Port Talbot	
PU 8/4	Port of Port Talbot to Baglan Burrows (Aberavon Beach)	
Swansea		
Policy Units		**Actions**
PU 9/1	Swansea Docks and Channel	Reducing the risk of coastal erosion and flooding to residential, commercial and industrial assets is the main policy driver along this frontage, and therefore the recommended policy is to hold the line by maintaining and upgrading existing defences, subject to the future availability of public funding for coastal erosion and flood risk management.
PU 9/2	Swansea Docks to Singleton Park	
Pembrokeshire		
Policy Units		**Actions**
PU 19/4	Pembroke River	The policy for the undeveloped frontage is to allow natural evolution of the coastline to continue through no active intervention, which includes monitoring of the risk of coastal

PU 19/5	Pembroke River to Martello Tower, Llanreath	erosion and flooding to the oil refinery, Pembroke power station and associated facilities. Should the risk increase significantly, intervention would be permitted to continue to reduce coastal erosion and flood risks to these assets and to prevent contamination.
Carmarthenshire		
Policy Units		**Actions**
PU 14/7	Carmarthen Bay Holiday Centre	In places where there are small-scale localised privately owned 48 defences, including the Carmarthen Bay Holiday Centre, public funding will not be available to maintain and therefore a policy of no active intervention has been recommended. However private funding of defence maintenance and upgrading will be permitted subject to obtaining the necessary consents, licences and approvals and provided that defence improvements are not likely to have an adverse impact on the adjacent shoreline of the wider estuarine system.
PU 14/8	Carmarthen Bay Holiday Centre to south of Ferryside	

West of Wales Shoreline Management Plan 2

99. The SMP2 document sets out the results of the first revision to the original SMPs for the area of coast extending from St Ann's Head to the Great Orme, including Ynys Mon. These areas were then subdivided into policy units to provide information on shoreline management policies. Within the scope of this report, the Local Authority covered by the West of Wales SMP is Pembrokeshire (and the National Park) as shown in Table **3-11** and Figure 3-7.

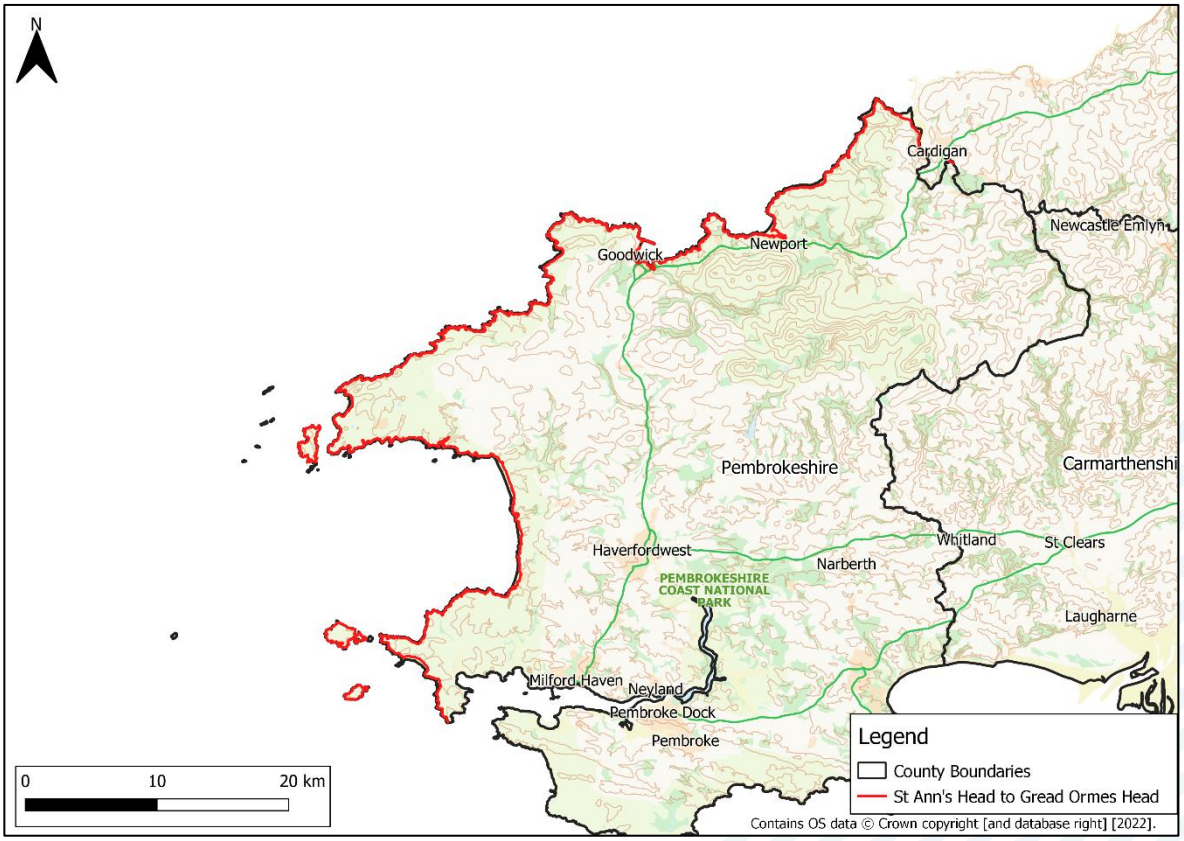

Figure 3-7 West of Wales Shoreline Management Plan policy units

Table 3-11 West of Wales Shoreline Management Plan 2 Policy options

Pembrokeshire					
Policy Scenario Area	**Policy Unit**	**Location**	**Short-term Policy (0-20 years)**	**Medium-term policy (20-50 years)**	**Long-term Policy (50-100 years)**
St Ann's Head to Strumble Head	PU1.1	Mainland	No Active Intervention	No Active Intervention	No Active Intervention
	PU1.2	St Bride's	No Active Intervention	No Active Intervention	No Active Intervention
	PU1.3	Skokholm and Skomer	No Active Intervention	No Active Intervention	No Active Intervention
	PU2.1	Borough Hd. to the Point	No Active Intervention	No Active Intervention	No Active Intervention
	PU2.2	Little Haven	Hold the Line	Hold the Line	Managed Realignment
	PU2.3	The Settlands	No Active Intervention	No Active Intervention	No Active Intervention
	PU2.4	Southern and central Broad Haven	Hold the Line	Hold the Line	Managed Realignment
	PU2.5	Broad Haven	Hold the Line	Managed Realignment	No Active Intervention
	PU2.6	Haroldston Hill	Hold the Line	Hold the Line	Managed Realignment
	PU2.7	Haroldston Cliff	No Active Intervention	No Active Intervention	No Active Intervention
	PU2.8	Nolton Haven	Hold the Line	Managed Realignment	Managed Realignment

	PU2.9	Rickets Head	No Active Intervention	No Active Intervention	No Active Intervention
	PU2.10	Newgale Sands south	Managed Realignment	Managed Realignment	Managed Realignment
	PU2.11	Newgale Sands north	Managed Realignment	Managed Realignment	No Active Intervention
	PU2.12	Newgale village	Managed Realignment	Managed Realignment	Managed Realignment
	PU2.13	Penycwm cliffs	No Active Intervention	No Active Intervention	No Active Intervention
	PU3.1	Dinas Fach to Pen Anglas	No Active Intervention	No Active Intervention	No Active Intervention
	PU3.2	Lower Solva	Hold the Line	Hold the Line	Managed Realignment
	PU3.3	Solva Harbour	Hold the Line	Hold the Line	Hold the Line
	PU3.4	Porth Clais outer	Hold the Line	No Active Intervention	No Active Intervention
	PU3.5	Porth Clais inner	Hold the Line	Hold the Line	Hold the Line
	PU3.6	St Justinian's	No Active Intervention	No Active Intervention	No Active Intervention
	PU3.7	Ramsey Island	No Active Intervention	No Active Intervention	No Active Intervention
	PU3.8	Whitesands bay	Hold the Line	Managed Realignment	Managed Realignment
	PU3.9	Abereiddi	Managed Realignment	Managed Realignment	Managed Realignment

	PU3.10	Porth Gain	Hold the Line	Hold the Line	Hold the Line
	PU3.11	Aber Castle	Hold the Line	Managed Realignment	Managed Realignment
	PU3.12	Aber Mawr	No Active Intervention	No Active Intervention	No Active Intervention
Strumble Head to New Quay Head	PU4.1	Pen Anglas to Pen Cw	No Active Intervention	No Active Intervention	No Active Intervention
	PU4.2	Fishguard Harbour	Hold the Line	Hold the Line	Hold the Line/Advance the Line
	PU4.3	The Parrog and Goodwick Moor	Hold the Line	Managed Realignment	Managed Realignment
	PU4.4	Penyraber	No Active Intervention	No Active Intervention	No Active Intervention
	PU4.5	Hill Terrace	Hold the Line	Hold the Line	Hold the Line
	PU4.6	Lower Town centre	Hold the Line	Hold the Line	Managed Realignment
	PU4.7	Lower Town Quay	Hold the Line	Hold the Line	Hold the Line
	PU4.8	Castle Point Cliffs	No Active Intervention	No Active Intervention	No Active Intervention
	PU4.9	Castle Point to Pwllgwaelod	No Active Intervention	No Active Intervention	No Active Intervention
	PU4.10	Pwllgwaelod Bay	Hold the Line	No Active Intervention	No Active Intervention
	PU4.11	Dinas Head	No Active Intervention	No Active Intervention	No Active Intervention

	PU4.12	Cwm-yr-Eglwys	Hold the Line	Hold the Line	Hold the Line
	PU4.13	Cwm-yr-Eglwys to Carreg Germain	No Active Intervention	No Active Intervention	No Active Intervention
	PU4.14	Newport Parrog West	Managed Realignment	Managed Realignment	Managed Realignment
	PU4.15	Newport Parrog	Hold the Line	Hold the Line	Managed Realignment
	PU4.16	Nyfer Estuary	No Active Intervention	No Active Intervention	No Active Intervention
	PU4.17	The Bennet	No Active Intervention	No Active Intervention	No Active Intervention
	PU4.18	Newport Sands	Hold the Line	Managed Realignment	No Active Intervention
	PU4.19	Newport Bay Cliffs	No Active Intervention	No Active Intervention	No Active Intervention
	PU5.1	Pen-y-Bal to Cemaes Head	No Active Intervention	No Active Intervention	No Active Intervention
	PU5.2	Cemaes Head to Trwyn Carreg-ddu	No Active Intervention	No Active Intervention	No Active Intervention
	PU5.3	Poppit Dunes and Pen-yrErgyd	Managed Realignment	Managed Realignment	Managed Realignment
	PU5.4	Inner Estuary west	No Active Intervention	No Active Intervention	No Active Intervention
	PU5.5	St Dogmaels north	Hold the Line	Hold the Line	Hold the Line

3.4.4 Flood Risk Management Plans

100. Flood Risk Management Plans (FRMPs) highlight the hazards and risks of flooding from rivers, the sea, surface water, groundwater and reservoirs, and set out how Risk Management Authorities (RMAs) work together with communities to manage flood risk. Each flood risk management plan (FRMP) covers a specific area called a river basin district (RBD). FRMPs must be reviewed by the Environment Agency and Lead Local Flood Authorities every 6 years. This is a requirement of the Flood Risk Regulations 2009. The FRMP for the relevant authorities are shown below in Table **3-12**.

3.5 Local policy

101. All 4 local authorities and 2 National Parks were asked to confirm the latest versions of documents available for local policy. Due to disruption from COVID19 some of the planned updates to these documents have not been carried out as yet; therefore, some of the information highlighted below may be out of date. Every endeavour has been made to find as accurate information as possible or highlight where information is likely to be out of date.

102. Most of the authorities have the following documents:

- Local Development Plan
- Local Flood Risk Management Strategy
- Flood Risk Management Plan
- Strategic Flood Consequence Assessment
- Preliminary Flood Risk Assessment

103. The dates of these documents for each council have been summarised in Table **3-12** below. Where possible links to each document are also provided.

104. The LDP policies related to flooding, coastal erosion and climate change have been summarised in Table **3-13** for each council.

Table 3-12 Local Authority Document Review

Local Authority	LDP	Local Flood Risk Management Strategy	Flood Risk Management Plan	Strategic Flood Consequence Assessment	Preliminary Flood Risk Assessment
Neath Port Talbot	2011-2026 Adopted in 2016	2013	2015	2011-2026	-
Swansea	2010-2025	2013	2015	2010	2011
Carmarthenshire	Adopted in 2014	2013	2019	2019	-
Pembrokeshire	2013-2021 Adopted in 2013.	2015	-	2019	2011
Brecon Beacons National Park	2013	N/A	N/A		N/A
Pembrokeshire Coast National Park	2020-2031	N/A	N/A		N/A

Table 3-13 Local Authority LDP review

Local Authority	LDP	LDP Policies
Neath Port Talbot	2011-2026 Adopted in 2016	**Strategic Policy SP1 Climate Change - LDP Objective: OB 1 and OB 2 -** The causes and consequences of climate change will be addressed by increasing efficiency and sustainability of settlements, reducing greenhouse gas emissions from transport, increasing public/sustainable transport and making provision for renewables. Future increased flood risk will be taken into account and awareness for resilience will be increased.
Swansea	2010-2025	**ER 1: Climate Change -** To mitigate against the effects of climate change, adapt to its impacts and ensure resilience, development proposals should reduce carbon emissions, increase carbon sinks, adapt to climate change at both a strategic and detailed design level, promote energy and resource efficiency, avoid unnecessary flood risk and maintains ecological resilience.
Carmarthenshire	Adopted in 2014	**SO5:** To make a significant contribution towards tackling the cause and adapting to the effect of climate change by promoting the efficient use and safeguarding of resources.

		SP2 Climate Change: Development proposals will be supported if they adhere to waste hierarchy, promote efficient resource consumption, reflect sustainable transport, minimise the risk of flooding by incorporating SUDS and flood resilient designs, promote the energy hierarchy and incorporate climate responsive design solutions and sustainable construction methods.
Pembrokeshire	Adopted in 2013. Up to 2021 (although the plan will remain in force until LDP 2 is adopted).	**GN.1 General Development Policy** – Provides a framework for evaluation of potential development impacts and ensures that development is appropriate for the immediate location in which it is proposed and its wider setting/context. **GN.2 Sustainable Design –** New development will be expected to conform to the recognised national sustainable building standards of the Code for Sustainable Homes (CfSH) and/ or the Building Research Establishment Environmental Assessment Method (BREEAM). Designs will need to incorporate responses to the likely impact of climate change in relation to increased temperatures via natural shading, cooling and ventilation and the implications of storms and flooding. **GN.4 Resource Efficiency and Renewable and Low-carbon Energy Proposals -** Development proposals should seek to minimise resource demand, improve resource efficiency and seek power generated from renewable resources, where appropriate.
Brecon Beacons National Park	2013	**3.16.3 Location of Development Avoiding Areas Subject to Flooding -** Development proposals must be able to demonstrate that any future flood risk and consequence has been managed in line with the requirements of TAN 15. **SP4 Climate Change -** All proposals will be required to demonstrate where relevant how the development will; a) be resilient and adaptable to the likely effects of climate change. b) limit and mitigate the causes of climate change; and c) contribute to the aim of carbon neutrality.
Pembrokeshire Coast National Park	2020-2031	**Policy 29 Sustainable Design (Strategy Policy) -** The aim of this policy is to make more efficient use of water, through for example, rainwater harvesting, or employing a sustainable drainage system. **Policy 33 Renewable and Low Carbon Energy -** Proposals for renewable and low carbon energy development including those relating to wind, solar and hydro power, anaerobic digestion and biomass will be permitted. **Policy 34 Flooding and Coastal Inundation (Strategy Policy) -** In planning for the future development of the National Park; a) development will be directed away from those areas which are at risk from flooding now or as predicted for the future by TAN-15 Development Advice Maps or Shoreline Management Plan 2. Sustainable defence of the coast will be permitted where it can be demonstrated that the works are consistent with the management approach for the frontage presented in the relevant Shoreline Management Plan and there will be no unacceptable adverse effect on the environment.

3.5.1 Local Flood Risk Management Strategy

105. The Local Flood Risk Management Strategy is a statutory document which will impact on activities of all Flood Risk Management Authorities – i.e. Local Authorities, Natural Resources Wales, Highway Authorities and Internal Drainage Boards. The LFRMS determines the locally significant flood risk for the area, focusing mainly on flooding from surface water, groundwater and ordinary watercourses, and helps everyone affected to understand and manage flood risk. It also considers significant interactions with main rivers and sewers. The LFRMS must be consistent with what is stated in the Flood and Water Management Act 2010 and the national strategy for Flood and Coastal Erosion Risk Management in Wales. The main aim of the strategy is to reduce the risk of flooding and the social and economic damage that flooding causes, in a sustainable manner. The LFRMS outlines the legislation with regard to flood risk, the nature of flood risk, the objectives for managing flood risk and the range of actions that could be undertaken. It will also consider what funding is available and how flood risk management could be used to make this funding adequately deal with existing and future flood risks.

4 Understanding of Flood Risk

4.1 Likelihood and consequence

106. Flood risk is a combination of the likelihood of flooding and the potential consequences arising.

107. It is assessed using the source – pathway – receptor model, as shown in Figure **4-1**. This is a standard environmental risk model common to many hazards and should be the starting point of any flood risk assessment. However, it should be noted that flooding could occur from many different sources and pathways, and not simply those shown in the illustration below.

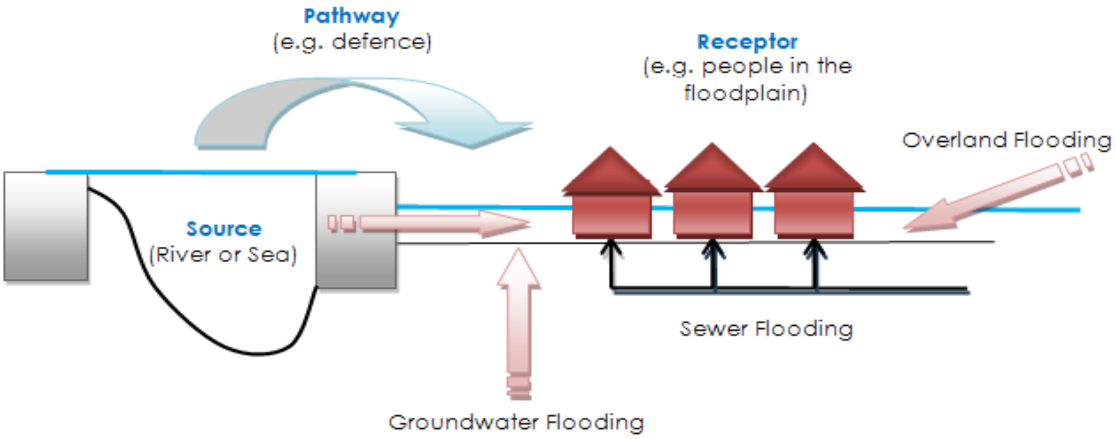

Figure 4-1 Source - Pathway - Receptor model

108. The principal sources are rainfall or higher than normal sea levels, the most common pathways are rivers, drains, sewers, overland flow and river and coastal floodplains and their defence assets; the receptors can include people, their property, and the environment. All three elements must be present for flood risk to arise. Mitigation measures have little or no effect on sources of flooding, but they can block or impede pathways or remove receptors.

109. The planning process is primarily concerned with the location of receptors, taking appropriate account of potential sources and pathways that might put those receptors at risk. It is therefore important to define the components of flood risk in order to apply this guidance in a consistent manner.

4.1.1 Likelihood

110. Likelihood of flooding is expressed as the percentage probability based on the average frequency measured or extrapolated from records over a large number of years. A 1% probability indicates the flood level that is expected to be reached on average once in one hundred years, i.e. it has a 1% chance of occurring in any given year, and not that it will occur once every one hundred years.

4.1.2 Consequence

111. The consequences of flooding can result in fatalities, damage to property, disruption to lives and businesses, with severe implications for people (e.g. financial loss, emotional distress, health problems). Consequences of flooding depend on the hazards caused by flooding (depth of water, speed of flow, rate of onset, duration, wave-action effects, water quality) and the vulnerability of receptors (type of development, nature, age structure of the population, presence and reliability of mitigation measures, etc).

4.1.3 Risk

112. Flood risk is expressed in terms of the following relationship:

Flood risk = Probability of flooding x Consequences of flooding

113. Flood risk is not static; it cannot be described simply as a fixed water level that will occur if a river overtops its banks or from a high spring tide that coincides with a storm surge. It is therefore important to consider the continuum of risk carefully. Risk varies depending on the severity of the event, the source of water, the pathways of flooding (such as the condition of flood defences) and the vulnerability of receptors as mentioned above.

4.1.4 Actual risk

114. This is the risk 'as is', taking into account any flood defences that are in place for extreme flood events (typically these provide a minimum Standard of Protection (SoP). Hence, if a settlement lies behind a fluvial flood defence that provides a 1 in 100 year SoP then the actual risk of flooding form the river in a 1 in 100 year event is generally low.

115. Actual risk describes the primary, or prime, risk from a known and understood source managed to a known SoP. However, it is important to recognise that risk comes from many different sources and that the SoP provided will vary within a river catchment. Hence, the actual risk of flooding from the river may be low to a settlement behind the defence but moderate from surface water, which may pond behind the defence in low spots and is unable to discharge into the river during high water levels.

4.1.5 Residual risk

116. Even when flood defences are in place, there is a likelihood that these could be overtopped in an extreme event or that they could fail or breach. Where there is a consequence to that occurrence, this risk is known as residual risk. Defence failure can lead to rapid inundation of fast flowing and deep floodwaters, with significant consequences to people, property, and the local environment behind the defence.

117. Whilst the actual risk of flooding to a settlement that lies behind a fluvial flood defence that provides a 1 in 100 year SoP may be low, there will be a residual risk from flooding if these defences overtopped or failed that must be taken into account. Because of this, it is never appropriate to use the term 'flood free'.

4.2 Sources of flooding

4.2.1 Fluvial flood risk

118. Flooding from rivers occurs when water levels rise higher than bank levels, causing floodwater to spill across adjacent land (floodplain). The main reasons that water levels can rise in rivers are:

- Intense or prolonged rainfall causing runoff rates and flow to increase in rivers, exceeding the capacity of the channel. This can be exacerbated by wet antecedent conditions and elevated groundwater tables
- Constrictions in the river channel causing floodwater to backup
- Blockage of structures or the river channel causing flood water to backup
- High water levels and / or locked flood (tide) gates preventing discharge at the outlet of the river.

119. The consequence of river flooding depends on how hazardous the flood waters are and what the receptor of flooding is. The hazard of river flood water is related to the depth and velocity which depends on the:

- Magnitude of flood flows

- Size, shape, and slope of the river channel, width and roughness of the floodplain; and
- Types of structures that cross the channel

120. Flood hazard can vary greatly throughout catchments and even across floodplain area. The most hazardous flows generally occur in steep catchments, which are common within South West Wales, and towards the bottom of large catchments. Hazardous river flows can pose a significant risk to exposed people, property, and infrastructure.

121. Whilst low hazard flows are less of a risk to life, they can disrupt communities, require significant post flood clean up and can cause superficial and possibly structural damage to property.

4.2.2 Tidal flood risk

122. Flooding from the sea occurs when water levels in the sea rise above ground levels of coastal land. This can occur during normal high tides, when there are extreme atmospheric effects, and when wind action causes water levels of the sea to rise. Tidal flooding can be particularly severe, with rapid inundation, the possibility of multiple overtopping events and the increased damage caused by saltwater. These effects can be even more severe if a breach of sea defences occurs.

123. The risks posed by wave action during storm events, including the risk of overtopping of defences should be considered when assessing tidal flood risk. Consideration should also be made to joint probability flooding events, such as when high tide levels may occur at the same time as large fluvial flows and can be an important consideration in many locations.

4.2.3 Surface water flood risk

124. Surface water flooding occurs when intense, often short duration rainfall is unable to soak into the ground or enter drainage systems and can be exacerbated when soils are saturated. The excess water then ponds in low points, overflows or concentrates in minor drainage lines that are usually dry. This type of flooding is usually short lived and associate with heavy downpours of rain. Often there is limited warning before this type of localised flooding occurs.

125. Drainage basins or catchments vary in size and shape, which has a direct effect on the amount of surface runoff. The amount of runoff is also a function of geology, slope, climate, rainfall, saturation, soil type, and vegetation. Geological considerations include rock and soil types and characteristics, as well as degree of weathering. Porous material (sand, gravel, and soluble rock) absorbs water more readily that fine-grained, dense clay or unfractured rock and has a lower runoff potential. Poorly drained material has a higher runoff potential and is more likely to cause flooding.

126. Water flowing over the ground surface that has not entered a natural channel or artificial drainage system is classified as surface water runoff or overland flow.

127. Flooding from land can occur in rural and urban areas, but usually causes more damage in the latter. Urban areas can be inundated by flow from adjacent farmlands. Flood pathways include the land and water features over which floodwater flows. These pathways include minor drainage lines, roads, and even flood management infrastructure.

128. Developments that include significant impermeable surfaces, such as roads and car parks may increase the occurrence of surface water runoff.

129. Surface water flooding can affect all forms of the built environment including property, infrastructure, agriculture, and the natural environment. It is usually short lived and will tend to last as long as the rainfall event. However, flooding may persist in low-lying areas where ponding occurs.

130. Flooding may occur as sheet flow or as rills and gullies causing increased erosion of agricultural land. This can result in 'muddy floods' where soil and other material are washed onto roads and properties, requiring extensive clean up. Both rural and urban land use changes are likely to alter the amount of surface water in the future. Future development is also likely to change the position and numbers of people and/or developments exposed to flooding.

4.2.4 Groundwater flood risk

131. Groundwater flooding is caused by the emergence of water originating from sub-surface permeable strata. Groundwater flooding can happen at point or diffuse locations, and it tends to be long in duration, developing over weeks or months and prevailing for days or weeks.

132. Given the extensive history of mining in Wales, mine water flooding also presents a risk to Welsh communities. Whilst not strictly defined as groundwater flooding, mine workings can create pathways for groundwater to more readily emerge at the surface, which can then lead to flooding.

133. This has been known to occur in Neath, as recently as 2021 following Storm Cristoph, where high volumes of rainfall on hillsides worked their way down to valley settlements before emerging at the surface and causing internal property flooding.

134. High groundwater levels can result from the combination of geological, hydrogeological, topographic, and recharge phenomena. Of the groundwater flooding mechanisms experienced in the SFCA area, rising groundwater levels in major aquifers as a result of long duration rainfall presents the greatest and most extensive level of risk. The most common causes of groundwater flooding are:

- Rising groundwater levels in response to prolonged extreme rainfall
- Rising groundwater levels due to leaking sewers, drains, and water supply mains
- Increased groundwater levels due to artificial obstructions
- Groundwater rebound owing to rising water table and failed or ceased pumping
- Upward leakage of groundwater driven by artisan head
- Inundation of trenches intercepting high groundwater levels
- Other: alluvial aquifers, sea level rise, etc

135. The main impacts of groundwater flooding are:

- Flood of basements of buildings below ground level – in the mildest case this may involve seepage of small volumes through walls, temporary loss of services, etc. In more extreme case larger volumes may lead to the catastrophic loss of stored items and failure of structural integrity.
- Overflowing of sewers and drains and surcharging of drainage networks leading to overland flows causing significant but localised damage to property.
- Flooding of buried services or other assets below ground level, or prolonged inundation of buried services, leading to interruption and disruption of supply.

4.2.5 Sewer flooding

136. Flooding from sewers occurs when rainfall exceeds the capacity of networks or when there is infrastructure failure. This includes combined and surface water sewers, sewer pumping stations and water treatment facilities.

137. The main causes of sewer flooding are:

- Lack of capacity in sewer drainage networks due to original under design or an increase in demand (such as from climate change or due to new developments)

- Lack of capacity in sewer drainage networks due to events larger than the system design event
- Lack of maintenance of sewer networks which leads to a reduction in capacity and can sometimes lead to sewer blockage
- Water mains bursting / leaking due to a lack of maintenance or as a result of damage
- Groundwater infiltration into poorly maintained or damaged pipe networks
- Restricted outflow from the sewer systems due to high water levels in receiving watercourses or the sea

138. The impact of sewer flooding is usually confined to relatively small, localised areas. However, flooding associated with blockage or failure of the sewer network can be rapid and unpredictable.

139. Drainage systems often rely on gravity assisted dendritic systems which covey water in trunk sewers located at the lower end of the catchment. Failure of these trunk sewers can have serious consequences as water from surcharged manholes will flow into low-lying land that may already be suffering from other sources of flooding.

140. Consequences for affected properties and individuals can be particularly severe for those affected by sewer flooding. Sewer flooding is likely to have a high concentration of solid, soluble, and insoluble contaminants. These contaminants can have serious health impacts on residents of flooded properties and are typically significantly more destructive to personal possessions. Flooding of sewers can also lead to contaminated water entering nearby watercourses, having an adverse effect on the biota in receiving environments.

4.2.6 Flooding from artificial sources

141. For the purpose of the SFCA, flooding from artificial sources has been defined as flooding from non-natural or artificial sources of flooding such as reservoirs, canals, and lakes where water is retained above natural ground level.

142. The spatial and temporal extent of flooding from artificial sources can be highly variable. For example, the likelihood of a new reservoir failing is very small compared to that of a canal embankment that is over one hundred years old. However, whilst the probability is low, the consequences of a reservoir failing could be catastrophic.

143. Reservoirs are artificially created ponds or lakes that are formed by building a dam across a watercourse. If a dam fails, then water can escape from the reservoir resulting in land or properties being flooded. In order to ensure that reservoirs are properly maintained and to minimise the possibility of reservoir failure, large reservoirs in Wales (those storing more than 10,000 cubic metres of water) are regulated under the Reservoirs Act 1975, where amended by the Flood and Water Management Act 2010. This legislation, which is enforced by Natural Resources Wales requires reservoirs to be routinely inspected and maintained to an appropriate standard.

144. Provided that a reservoir is properly maintained, the likelihood of it failing and causing flooding is extremely low. However, in the very unlikely event of a dam collapse, a large volume of water could be released, quickly flooding a large area and possibly causing significant property damage.

4.2.7 Impact of climate change

145. Coastal development is limited by risks including flooding, erosion, and land instability, with over 400 homes at risk due to coastal erosion in Wales. TAN-15 states that development should be avoided where coastal erosion presents a risk over the lifetime of development. Additionally, local planning policies for coastal areas should reflect Planning Policy Wales, Future Wales – the National Plan 2040, the Welsh National Marine Plan, the National Strategy for FCERM, and other relevant strategies. Where coastal erosion does present a risk, Risk Management Authorities must be consulted to provide advice.

146. Climate change is causing more frequent and more severe flooding to occur in Wales. The Climate Change Committee provides independent advice to the Welsh Government on setting and meeting carbon budgets and preparing for climate change. It has stated that it expects the climate in Wales to become warmer and wetter, with significant increases in the sea level around the coast and the frequency and intensity of storm events. this will increase the risk of flooding and it is also reasonable to expect the incidence and seriousness of flood events to increase.

147. Table **4**-**1** below shoes how Climate Change has been assessed for each source of flooding within the SFCA. Even if an area is currently not at flood risk, the impact of climate change on the extent of flooding should be considered.

Table 4-1 Assessment of Climate Change for all sources of flooding

Source	Data Source	Climate Change Allowance
Rivers	TAN-15 FMfP for Rivers	The FMfP displays predicted future flood risk under the central climate change estimate. Detailed Flood Consequences Assessments will be required to consider a range of climate change scenarios, including upper end estimates, making reference to the Welsh Government guidance on climate change allowances for planning purposes.
Sea	TAN-15 FMfP for the Sea	
Surface Water and Small Watercourses	TAN-15 FMfP for Surface Water and Small Watercourses	
Groundwater	No data sets available.	The impacts of climate change on groundwater flooding problems, and those watercourses where groundwater has a large influence on winter flood flows, is much more uncertain. Milder wetter winters may increase the frequency of groundwater flooding incidents in areas that are already susceptible, but warmer drier summers may counteract this effect by drawing down groundwater levels to a greater extent during the summer months. The effect of climate change on groundwater levels for sites in areas where groundwater is known to be an issue should be considered at the planning application stage.
Sewers	No data sets available.	Climate change is likely to result in an increase in sewer flooding incidences as a result of its interaction with other flood risk sources (including surface water and groundwater) where flooding from this source is increased as a result of climate change. Where sewer flooding is known to be an issue should be considered at the planning application stage.

Reservoirs	No data sets available.	Some reservoir functions (i.e. the use that the reservoir is put to) may be relatively vulnerable to climate change, particularly where they rely on existing yields, flood flows or water quality of source waters. However, there are a number of systems that are already in place (e.g. the Water Resources Management Plan) that contain methods for identifying impacts and adapting to climate change as part of the normal ownership and operation process. In most cases, the form of the dam is resilient to the effects of climate change if the reservoir structure is well engineered with an appropriate factor of safety.

4.3 Roles and responsibilities for managing flood risk

148. Flood and Coastal Erosion Risk Management in Wales involves a number of organisations. The roles and responsibilities of these organisations is outlines in the National Strategy for Flood and Coastal Erosion Risk Management in Wales12. There are 28 Risk Management Authorities (RMAs) These RMAs are:

- NRW
- The 22 Local Authorities as Lead Local Flood Authorities (LLFA) and highway authorities
- Two water companies
- The Welsh Government (as highway authority for trunk roads)

149. The basic responsibilities of key stakeholders in Wales are set out below in Figure **4**-**2**, taken from the National Strategy.

12 Welsh Government (2020) The National Strategy for Flood and Coastal Erosion Risk Management in Wales. Taken from: https://gov.wales/sites/default/files/publications/2021-03/the-national-strategy-for-flood-and-coastal-erosion-risk-management-in-wales.pdf

Figure 4-2 Overview of Roles and Responsibilities (taken from the National Strategy for Flood and Coastal Erosion Risk Management)

150. RMAs all have a duty to help deliver the objectives of the National Strategy as well as the powers and responsibilities in terms of the risks they manage. There are also places where these roles and responsibilities interact or are shared. The specific roles and responsibilities of each organisation are outlined in the National Strategy.

4.4 Sources of information used in preparing the SFCA

4.4.1 Historic flooding

151. The historic flood risk across the study area has been assessed using information of recorded incidents provided by the stakeholders of the SFCA, including flood reports from LLFA and DCWW, and NRW's 'Recorded Flood Extents' dataset. This has been supplemented with other information from the existing SFCAs, PFRAs, LFRMP, and Flood Investigation Reports which have either been provided by the stakeholders or are freely available to view.

4.4.2 NRW Flood Map for Planning

152. The NRW FMfP Flood Zones have been consulted for this SFCA and are described in Section 3.3.1. The FMfP has the following layers, which show the potential extent of flooding, assuming no defences are in place. The TAN-15 Defended Zones show areas that benefit from RMA flood defences with a minimum standard of protection of 1 in 100 year (present day) for rivers and 1 in 200 year (present day) for the sea.

4.4.3 Flood Defences

153. The NRW FMfP Flood Defences GIS data set has been consulted for this SFCA. The data set identifies flood defences that have been built to protect against flooding from rivers and the sea. The defences dataset provides information on standard of protection and condition of the asset. Engineered defences usually have a standard of protection (SoP), which is the return period of a flood event against which the defence should be effective.

154. Flood defence information has also been provided by some of the LLFA's in the study area and has been consulted as part of the SFCA.

4.4.4 Groundwater

155. JBA has developed a range of Groundwater Flood Map products at the national scale. The 5m resolution JBA Groundwater map has been used within the SFCA. The modelling involves simulating groundwater levels for a range of return periods (including 75, 100, and 200 years). Groundwater levels are then compacted to ground surface levels to determine the head difference in meters. The JBA Groundwater Map categorises the head difference (m) into five feature classes based on the 100-year model outputs. These are outlined in Table **4**-**2**.

Table 4-2 JBA Groundwater flood risk map categories

Flood depth range during a 1% AEP flood event	Groundwater flood risk
Groundwater levels are either at or very near (within 0.025m of) the ground surface.	Within this zone there is a risk of groundwater flooding to both surface and subsurface assets. Groundwater may emerge at significant rates and has the capacity to flow overland and/or pond within any topographic low spots.
Groundwater levels are between 0.025m and 0.5m below the ground surface.	Within this zone there is a risk of groundwater flooding to both surface and subsurface assets. There is the possibility of groundwater emerging at the surface locally.
Groundwater levels are between 0.5m and 5m below the ground surface.	There is a risk of flooding to subsurface assets but surface manifestation of groundwater is unlikely.
Groundwater levels are at least 5m below the ground surface.	Flooding from groundwater is not likely.
No Risk	This zone is deemed as having a negligible risk from groundwater flooding due to the nature of the local geological deposits.

156. It is important to note that the modelled groundwater levels are not predictions of typical groundwater levels. Rather they are flood levels i.e. groundwater levels that might be expected after a winter recharge season with 1% AEP, and so would represent an extreme scenario.

157. It should be noted that as the JBA Groundwater Flood Map is based on national modelling it should only be used for general broad scale assessment of the groundwater flood hazard in an area and is not explicitly designed for the assessment of flood hazard at the scale of a single property. In high-risk areas a site specific risk assessment for groundwater flooding is recommended to fully inform the likelihood of flooding.

4.4.5 Sewers

158. Historic records of sewer flooding have been taken from historic flooding records provided by DCWW and considered on a broad spatial scale.

4.4.6 Reservoirs

159. The risk of inundation due to reservoir breach or failure of reservoirs within the area has been assessed using the NRW's 'Flood Risk from Reservoirs dataset'. The shading on the map shows the worst-case scenario for the area that could be flooded if a large reservoir were to fail and release the water it holds.

160. Reservoir flooding is extremely unlikely to happen. There has been no loss of life in the UK from reservoir flooding since 1925. All large reservoirs must be inspected and supervised by reservoir panel engineers. As the enforcement authority for the Reservoirs Act 1975 in Wales, NRW ensure that reservoirs are inspected regularly, and essential safety work is undertaken.

161. The reservoir flood maps do not indicate the likelihood of a flood occurring.

4.4.7 Working with Natural Processes

162. Nature based solutions should be considered as a way of managing flood risk where possible. More information and mapping to help identify potential areas for working with natural processes to reduce fluvial flood risk have been developed as part of the research project 'Working with Natural Processes – the evidence base'. More information can be found in the mapping appendices and Section 8.3.

5 Flood Risk Review

163. Under Section 7.4 of TAN-15, the risk of flooding from all sources must be considered as part of an SFCA, including flooding from the sea, rivers, land, groundwater, sewers and artificial sources. Using the datasets identified in Section 4, this Section provides a strategic assessment of the flood risk across the study area from each source. For each source of flooding, details of any historical incidents are provided, and where appropriate, the impact of climate change on the source of flooding is described.

164. A high-level review of flood risk has been undertaken for each of the four local authorities in South West Wales. Flood risk across the National Park areas within South West Wales are included within the individual Local Authority reviews. The reviews can be found in the appendices and assess the risk of flooding from all sources for each area. These should be used in combination with the broad scale and individual area mapping for each authority. These appendices and the predominant flood risk for each Local Authority are summarised in Table **5**-**1**.

Table 5-1 Summary of flood risk information

Local Authority	Appendix	Predominant flood risks
Carmarthenshire	A	Fluvial and tidal flood risk
Neath Port Talbot	B	Fluvial and tidal flood risk
Swansea	C	Fluvial and tidal flood risk
Pembrokeshire	D	Fluvial and tidal flood risk

6 Further TAN-15 Guidance

6.1 Introduction

165. In accordance with the direction of the Minister for Climate Change, provided in guidance accompanying the decision notice to delay its implementation, this SFCA has been prepared in accordance with the updated TAN-15 due to be implemented from June 2023. Further clarifications and advice have subsequently been issued by Welsh Government and NRW. The following chapter seeks to capture the latest advice and understanding of the new TAN-15. Additionally, guidance is provided on how LPAs within the region intend to interpret and apply the new TAN-15.

166. The guidance and recommendations within this chapter is based on the following:

- Ministerial letter; 23rd November 2021. Announcement of the suspension of the new TAN-15 to 1st June 2023.
- Chief Planner letter; 15th December 2021. Advice to LPAs on the suspension of TAN-15, key implications and actions for LPAs.
- Various consultations with WG and NRW during the preparation of the SFCA.

6.2 Flood Map Challenge

167. The FMfP is routinely updated by NRW with best available information on flood risks from the sea and rivers. These updates are published every six months. While many updates are undertaken by NRW's modelling and mapping teams, there is an established process for other parties to submit their own flood risk modelling data where is provides a more accurate assessment of flood risk. This is referred to as the Flood Map Challenge (FMC) process.

168. NRW publish through their website comprehensive guidance on the FMC process16. This guidance includes detailed specifications for the FMfP Zones, hydraulic modelling standards and supporting documentation requirements. Nevertheless, is it advised that NRW are consulted before embarking on a FMC and it is likely that expert technical advice will be required to undertake most FMC's.

169. Currently there is no agreed process for challenging the flood map for small watercourses and surface water.

170. Where a FMC has been accepted by NRW, but not yet published online, NRW will respond to statutory planning consultations advising the LPA on the risks and consequences of flooding based on the best available information which would be the modelling from the FMC. This would include confirming what flood zone the site will be shown in from the next update. As such the LPA may give material weight to accepted FMC's when apply the justification tests of TAN-15.

6.3 Use of Defended Zones and Flood Defences

6.3.1 Definition of Defended Zones[13]

171. TAN-15 defended zones show areas of land that benefit from formal flood defences that are owned and maintained by Risk Management Authorities.

172. Flood defences built before 1 January 2016 must have the following level of protection:

- 1 in 100 (1% AEP) chance of occurring in any given year for rivers
- 1 in 200 (0,5% AEP) chance of occurring in any given year for the sea

13 Advice from NRW's website. https://naturalresources.wales/flooding/challenging-our-flood-maps/?lang=en (accessed 03/05/2022)

173. Flood defences built after 1 January 2016 must meet the previous level of protection but also include:

- An allowance for a design freeboard (an added allowance for defence height to cover uncertainty in modelling)
- An allowance for the effects of climate change (over a 100 year development lifetime)

174. The consequence of the above is that new Defended Zones will need to be of a higher standard than many existing Defended Zones. Furthermore, it may not be possible to assign a Defended Zone to new flood defence schemes that take a more adaptive approach to climate change, such as is commonly applied to coastal flood defence schemes.

175. Where new flood defences are planned for through a development, this will not result in a new or extended Defended Zone until NRW are satisfied that the qualifying defences provide an acceptable standard of protection, and it is strongly advised that NRW are consulted with at the earliest stage about the scheme.

6.3.2 Private flood defences

176. Private defences and other defences not managed by an RMA do not typically generate TAN-15 Defended Zones, but in some instances deliver a similarly robust standard of protection. Any Local Planning Authority seeking to recognise private defences must satisfy itself the defence is adequately designed, constructed, and operated, and appropriate long term maintenance arrangements are in place. These requirements must also be agreed with Welsh Government. It must also provide a standard of protection equivalent to the RMA defences that create the TAN-15 Defended Zones. The FMfP will only be updated if Welsh Government are satisfied that a private defence could be considered as a TAN-15 Defended Zone; however, it should be noted that this is only likely to take place in specific cases.

177. Where a Local Authority has confidence in the robustness of the defence and have aspirations for development in areas benefitting from those defences, they are encouraged to use their powers as an RMA as stated in the Flood and Water Management Act 2010: Using the Designation of 3rd Party Assets to take responsibility for the asset. Understanding of these defences can enable Local Authorities to take a policy approach to identifying localised defended zones, where they consider that an area benefits from the presence of defences that has not been taken into account in the Flood Map for Planning.

6.3.3 Adaptive pathways

178. Climate change induced sea level rise is predicted to have significant consequences for many coastal areas within the region. Risk Management Authorities often respond to this risk, the inherent uncertainties, and engineering investment challenges by taking a 'managed adaptive' approach to FCERM investment. This approach allows for staged investment in flood defences, planning for and implementing measures as sea levels increase. There are a range of economic, engineering, maintenance, and practical advantages to this approach.

179. Examples of this approach include Mumbles coastal sea defences (2021), in Swansea, Swansea Bay Shoreline Management Plan (March 2001), Lllanstadwell Sea Defence Works (Pembrokeshire), Aberavon Promenade (2019), Neath Port Talbot, Llanelli (2016). Further locations for future investment are identified through the Shoreline Management Plan (SMP).

180. It currently appears that no regard can be given to future investment plans for flood defence improvements as future FCERM investments cannot be assured. Consequently, it is recognised that it may be difficult to satisfy the Acceptability Criteria of TAN-15 over the lifetime of development in these areas. This has particular significance for residential development, with its 100-year lifetime of development.

181. Whilst TAN-15 is currently clear how this will impact on new development, an LPA may give consideration to probable FCERM improvement when considering the merits of change of use, conversions and replacement development (refer to Section 6.3).

6.3.4 Future flood defence

182. Welsh Government have advised local authorities that they should prepare a pipeline of likely works as part of the local flood strategy, with recognition of how the climate projections will bring more areas into flood risk and increase the depth and velocities of flooding in the future.

183. The Welsh Government flood and coastal erosion risk programme invites applications which reduce risk to communities as set out in the National Strategy and associated guidance. **The programme does not provide funding to enable new development in areas at high risk of flooding.** Furthermore, TAN-15 states that developments reliant on the defences must not commence prior to the completion of construction work and the new Defended Zones being in place.

184. It is however recognised that there is a need to develop resilience in town centres and for nationally significant infrastructure, where they face new or increased flood risks as a result of climate change. It is likely a multi-agency approach, with the support of the private sector where appropriate, will be required to deliver such outcomes, whilst remembering that new flood defences will have to satisfy the qualifying criteria for Defended Zones.

185. Policy 8 of Future Wales – the National Plan 2040 demonstrates the Welsh Government's support for the sustainable management of flood risk in national and regional growth areas. Enabling areas in Zones 2 or 3 (Rivers and Sea) to become Defended Zones through the use of new nature-based solutions or improvements to existing flood defences, or other solutions is supported. This will provide important protection to existing development and enable redevelopment and renewal to take place in a sustainable and responsible way.

186. The SFCA can play a valuable role in identifying existing investment FCERM plans, as well as identifying flood investment opportunities and priorities that might align with development aspirations.

Current pipeline of FCERM projects

187. NRW and LLFA's have been approached to provide details of any significant FCERM plans within the region that are likely to be delivered in the next five years. Details of the projects are summarised in Table **6**-**1**. Some of these projects may be in or nearing construction, whereas others may be in their infancy without secure funding. Any proposed development within these areas would be advised to contact the relevant RMA to obtain up to date information, however it should be noted that planning applications can only be assessed against defences currently in place, and aspirations to construct or improve defences would not be considered a material consideration.

Table 6-1 Pipeline of FCERM Projects

Project name	Location / extent	RMA	Timescales
Ammanford Flood Alleviation Scheme	Ammanford	NRW	Construction commencing 2022. Projection to complete in 2024.
Mwche Managed Realignment	Mwche	NRW	Construction to commence 2024. Projection to complete in 2026.
Canal Side Aberdulais	Aberdulais	NRW	Appraisal undergoing 2022-2024.
Ritec Culvert Assessment	Ritec	NRW	Appraisal undergoing 2023-2025. Construction programme TBC.

Future FCERM Opportunities and Priorities

188. LPA's and LLFA's have been contacted to identify a pipeline of potential FCERM projects that may support the setting of future FCERM investment opportunities, as summarised in Table **6-2**. Transparency in these priorities is hoped to bring forth investment and partnership working opportunities, and generally facilitate collaborative working. The list is not definitive, will change over time, and is commensurate with the high-level nature of a Stage 1 SFCA. Subsequent Stage 2 assessments may build on this list and provide additional details.

Table 6-2 Future FCERM Opportunities

Location	Local Authority	Description
Abergwili Telemetry Signs	Carmarthenshire	Development and Construction work likely in the next 10 years
Drefach Felindre - Initial Assessment	Carmarthenshire	Development and Construction work likely in the next 10 years
Johnstown - Initial Assessment	Carmarthenshire	Development and Construction work likely in the next 10 years
Llandeilo Junction Attenuation	Carmarthenshire	Development and Construction work likely in the next 10 years
Llanybydder - Initial Assessment	Carmarthenshire	Development and Construction work likely in the next 10 years
North Dafen - Initial Assessment	Carmarthenshire	Development and Construction work likely in the next 10 years
Cwmafan - Initial Assessment	Neath Port Talbot	Development and Construction work likely in the next 10 years
Cwmgwrach - Initial Assessment	Neath Port Talbot	Development and Construction work likely in the next 10 years
Glynneath - Initial Assessment	Neath Port Talbot	Development and Construction work likely in the next 10 years

Pontardawe - Initial Assessment	Neath Port Talbot	Development and Construction work likely in the next 10 years
Resolven - Initial Assessment	Neath Port Talbot	Development and Construction work likely in the next 10 years
Swansea (Tawe) - Initial Assessment	Swansea	Development and Construction work likely in the next 10 years
Swansea Tidal Defences - Initial Assessment	Swansea	Development and Construction work likely in the next 10 years

6.3.5 Flood defences for development

189. Development should generally not rely on construction of new flood defences that will remain in private ownership given the challenges of ensuring long term maintenance and renewal. However, there may be circumstances where an RMA may agree to adopt privately constructed defences if they provide a wider community benefit.

190. Development proposals may also be considered more favourably where they form part of a strategy of flood risk reduction to existing development. An example would be the redevelopment of previously developed riverside sites in such a way as to benefit existing properties set back further from the river.

191. Development within a flood zone will often require some form of flood mitigation. However, the approaches used should, wherever possible, be simple and passive, requiring little or no maintenance. Such approaches would include raising floor and ground levels, whilst recognising the need to not increase flood risk to others.

6.4 Urban centres and land-use – resilience of existing communities

6.4.1 Change of use and conversions

192. The redevelopment of existing buildings in flood risk areas can present decision makers with difficult decisions. There may be circumstances where the planning authority may be sympathetic to changes of use or conversion proposals which bring clear benefits to the area and the building14.

193. Change of use or conversion proposals that would introduce (or intensify) highly vulnerable development in Zone 3 (Rivers and Sea) must be considered carefully, and the risk of flooding to potential occupants and the property thoroughly assessed.

194. In assessing change of use and conversion proposals in any location outside Zone 1, decision makers should apply the section 11 test to satisfy themselves that the consequences of flooding have been considered and are acceptable. A Flood Consequence Assessment commensurate with the scale and nature of the proposal will be required to enable the planning authority to reach its decision. If the proposed change of use of or conversion is not resilient and there is an unacceptable risk from flooding to people, the planning application should be refused.

6.4.1 Replacement development

195. Like applications for change of use and conversion, there may be circumstances where the planning authority may be sympathetic to replacement development that will result in no intensification of vulnerability and an overall reduction in risk. Potential examples include a replacement dwelling that is designed to raise the property above predicted flood levels, or a replacement industrial unit that incorporates flood resilient design measures.

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14 TAN-15 para 14.10 & 14.11

196. In these cases, the justification tests will not be strictly applied. However, the sustainability of continuing development on the site must be comprehensively justified and the acceptability tests of Section 11 of TAN-15 applied in a manner commensurate with the scale and nature of the proposal.

6.5 Surface Water and Small Watercourses Risk

197. Recent advances in methods, data availability, and software have delivered significant improvements in the accuracy of surface water and small watercourse flood mapping in Wales. However, the intricacies of local topography, drainage, and small watercourse features means that the flood map for surface water and small watercourse flood risk is only indicative of the flood risk. On investigation the flood risk may be shown to be erroneous, exaggerated, or misleading. For this reason, the Justification Tests do not apply to the development proposals in surface water flood zones, although the risks should be taken seriously and appropriately investigated and managed.

198. In cases of more than the very most minor surface water flood risk the LPA will expect planning applications to be supported by a proportionate FCA. The LLFA will be able to provide advice on the requirement and scope of an FCA for surface water and small watercourse flood risk.

199. Where the flood risk is related directly to the ponding of rainfall on the surface of a site it may be appropriate to assess and manage this risk through a Drainage Statement as described in TAN-15. There is a requirement for all Drainage Statements to demonstrate compliance with the Statutory Standards for SuDS in Wales. It is advisable for developers to consult with individual SABs with regards to their requirements for SuDS across their Local Authority area.

200. Where the flood risk is attributed to a small watercourse, this is likely to require an assessment similar to if the flood risk were from a Main River.

6.5.1 Critical drainage areas

201. An LLFA may choose to identify areas that have particularly significant drainage and/or surface water flood risk issues. These areas will be identified as Critical Drainage Areas (CDAs). In these areas an FCA will always be required, and specific requirements or guidance may apply. CDAs may be identified in Stage 2 SFCAs or Local Flood Risk Management Plans. No CDAs are identified in this Stage 1 SFCA.

6.6 Climate Change – lifetime of development

202. The planning authority should be satisfied that any development it allocates will be resilient to flooding for the duration of its lifetime. Using the most up to date national climate change projections, planning authorities should ensure new dwellings will be safe places to live now and in the future.

203. Generally, it is appropriate to think of new dwellings as having a lifetime of 100 years. Lifetimes for other types of development will vary, but 75 years is considered a reasonable rule of thumb. Planning authorities should apply this principle in a precautionary manner in relation to all types of development15.

204. The FMfP has been prepared based on an assumed lifetime of development of 100 years. Consequently, in coastal areas development of a lower lifetime may have a flood risk quite different that indicated by the FMfP. In this case it may be appropriate for the LPA to give consideration to how the Flood Zone would appear with a matching lifetime of development when evaluation the Justification Tests, whilst always ensuring that development must be on previously developed land if in Zone 2 and 3. This is a particular issue for non-residential development in tidal areas.

15 TAN-15 para 7.15

7 Coastal Erosion Risk Management

7.1 Coastal erosion and flooding

205. It is acknowledged that coastal areas have unique characteristics which can provide opportunities for new development, this is particularly relevant to South West Wales where there are a number of major coastal settlements. However, opportunities for further development may be constrained by flooding, coastal erosion, ground stability and the impacts of climate change.

206. Considering the sensitivity of these areas and the important of development in coastal areas, this SFCA considers the role and integrity of coastal defences and provides an understanding of the risks posed by coastal flooding and erosion. Reference should also be made to the Shoreline Management Plan (SMP) policies set out in Section 3.4.3 and flood risk mapping in the appendices.

7.2 Coastal erosion and development

207. A stated in TAN-15, Local Development Plans should clearly define coastal areas suitable for development and those that are subject to significant constraints. Sites should not be allocated for development in areas where there are risks from flooding, ground instability or coastal erosion over the lifetime of the development. LPA's should ensure they have sufficient information and have considered all relevant technical advice.

208. In instances where sites are proposed by developers within coastal areas, during Development Plan preparation, the onus rests on the developer to provide sufficient and appropriate information to demonstrate that proposed sites can be safely developed without significant adverse effects. Upgraded or strengthened coastal defences may be required in coastal areas where a 'hold the line' approach is advised in the SMP and reflected in the Development Plan.

209. The National Coastal Erosion Risk Management mapping produced by the Natural Resources Wales covers the south-west region. This has been reviewed to understand the impacts of coastal erosion. Overall the most significant impacts over the long term will be in Pembrokeshire and Swansea, with 'No Active Intervention' be

210. Construction of sea defences often leads to increased development pressures in an area. Local Planning Authorities should be mindful that defences only reduce the risk of floods or erosion, and do not eliminate it. LPAs may wish to provide further detailed guidance in the form of Supplementary Planning Guidance where it may have a particular strategy for coastal areas.

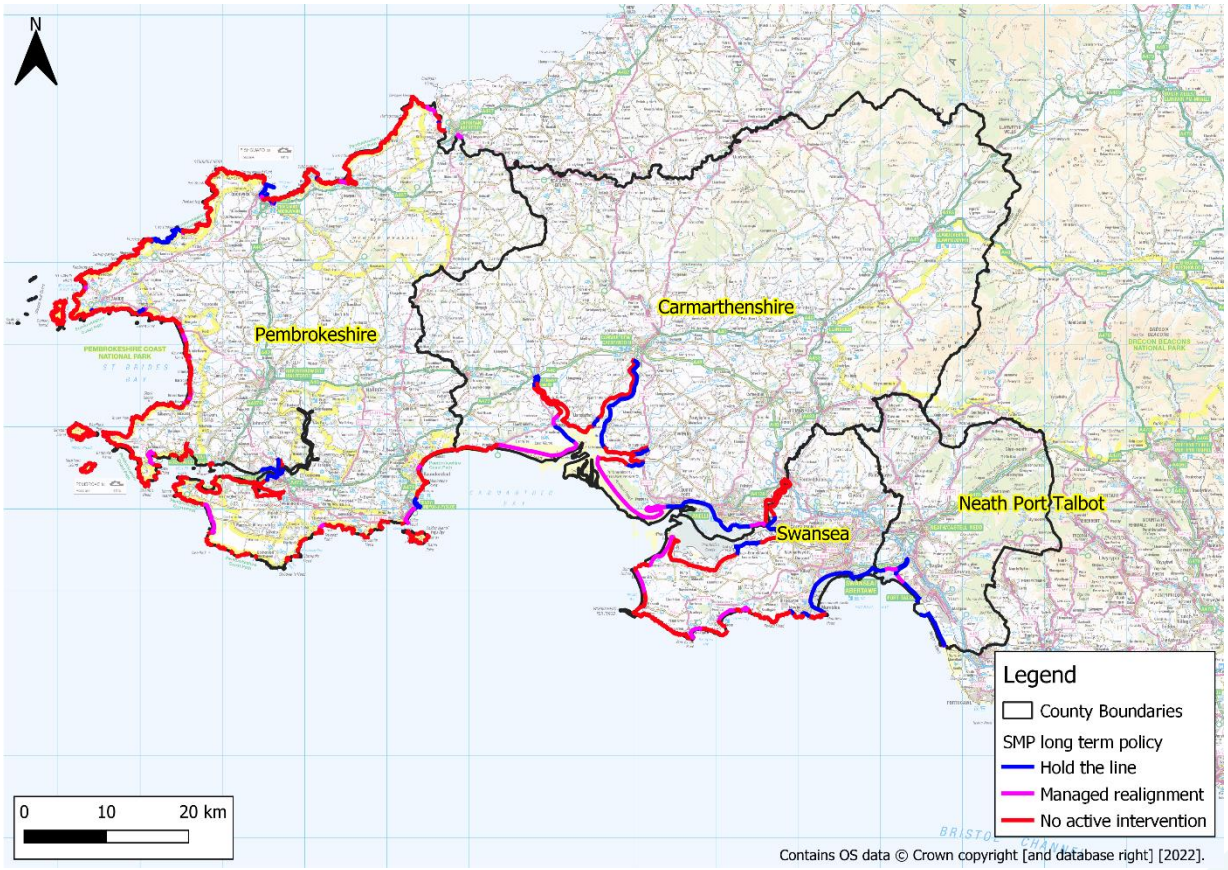

Figure 7-1: Long term SMP policy

8 Requirements for a Flood Consequence Assessment

8.1 What is site-specific FCA?

211. Site specific FCAs are carried out by (or on behalf of) developers to assess the risk and consequences of that development to the development itself and third party land.

212. FCAs are submitted with planning applications to demonstrate how the requirements of TAN-15 have been satisfied. An FCA should demonstrate how flood risk will be managed over the development's lifetime, taking into account climate change and the vulnerability of site users. The assessment can also be used to establish whether appropriate avoidance or mitigation measures can be incorporated within the development design. This ensures that over its lifetime, development minimises risk to life, damage to property and disruption to people living and working on the site, as well as not increasing flood risk elsewhere.

8.2 When are site-specific FCA's required?

213. Site specific FCAs are required in the following circumstances:

- Proposals for development (including minor development and change of use) in Flood Zones 2 and 3 of the FMfP, with the exception of highly vulnerable development in Flood Zone 3 which is not permitted;
- Proposals for development within TAN-15 Defended Zones;
- Proposal for development within critical drainage areas identified by the LLFA or LPA; and
- At the request of the LPA, NRW, or LLFA where there and reasonably flood risk concerns to proposed development not otherwise covered by the triggers above

214. In the case of minor flood risk from Surface Water and Small Watercourses, the LLFA may waive the requirement for an FCA although there remains a requirement to consider flood risk in a SuDS approval application.

215. An FCA may also be required by the LLFA for Ordinary Watercourse Consent or by NRW for a Flood Risk Activity Permit for main river watercourses. In these circumstances the Justifications Tests do not apply and the LLFA or NRW will be able to provide guidance on their requirements for a proportionate FCA.

8.3 Requirements of a Site Specific FCA

216. Section 12 of TAN-15 sets out the requirements of an FCA.

217. The assessment of flood risk in the FCA should help the planning authority determine whether the risk and consequences of flooding are acceptable and can be appropriately managed over the lifetime of development. An assessment of a range of potential flooding scenarios up to and including the 0.1% AEP flood event should be included with an allowance for climate change in line with current Welsh Government guidance.

218. FCAs for development sites should follow the approach set out in Figure 9 of TAN-15 and guidance provided by NRW16. It would be prudent for developers to contact NRW and the LLFA to gather further information on any specific flood risks to the proposed development site.

16 https://naturalresources.wales/flooding/modelling-for-flood-consequence-assessments/?lang=en

9 Flood Risk Mitigation and Flood Resilience

9.1 Flood risk mitigation

219. TAN-15 outlines the complementary role that planning and building regulations have in flood management, and the requirement for the use of flood mitigation and damage resistant measures to ensure the consequences of flooding are acceptable if the development can be justified. Any new development in Zones 2 and 3 and the TAN-15 Defended Zones must have resilience to flooding built in at site and property level, as stated in TAN-15 Section 13.2 (Resilient Design). Where possible, development should still be directed to Flood Zone 1 (where there is a lower flood risk of flooding).

220. Measures to help mitigate flood risk on a site are outlined below. Although it should be recognised that even with these measures it will not be possible to develop all sites in compliance with TAN-15.

9.1.1 Site level flood risk mitigation

221. Flood risk from all sources should be considered at an early stage in deciding the layout and design of a site to provide an opportunity to reduce flood risk within the development. Site level resistance and resilience measures should have the twin aim of reducing the amount of flood water that can enter the site and effectively managing any water that does reach the site so it does not impact on households and other occupiers/users.

222. Flood mitigation and resilience can involve the use of blue and green infrastructure and SuDS to deliver wider benefits alongside flood mitigation such as water quality, amenity, and biodiversity.

Site layout and design

223. A sequential, risk-based approach should be applied to try and locate more vulnerable development use away from flood zones to higher ground, while more flood compatible development (e.g. landscaping, recreational space) is located in higher risk areas. However, water compatible development or less vulnerable uses in floodplains should consider the nature of the development, flood depths and hazard including evacuation procedures and flood warning. The nature of risk of water quality may also need to be considered and mitigated in some cases, particularly with parking areas so accumulated hydrocarbons and other vehicle related pollutants are not released to the aquatic environment.

224. Waterside areas, or areas along known flow routes, can be incorporated into the masterplan as multi-functional green infrastructure, being used for recreation, amenity and environmental purposes, allowing the preservation of flow routes and flood storage, and at the same time providing valuable social and environmental benefits contributing to other sustainability objectives. Landscaping should ensure safe access to higher ground from these areas and avoid the creation of isolated islands as water levels rise.

Raised floor levels

225. When designing the layout for a development, consideration should be given to the potential effects of flood risk and great care must be taken so that development is safe and there are no adverse effects elsewhere, including existing land, property, or people. In areas potentially at risk from surface water flooding particular attention should be given to proposed ground levels, drainage design, and provisions for exceedance flows. Where there is a residual risk of flooding (from any source) to properties within a development the measures to address the effects would normally include raising internal floor levels above the minimum level specified by the building regulations so that potential risks are addressed. The raising of internal floor levels and threshold levels within a development reduces the risk of damage occurring to the interior, furnishings, and electrics in times of flood.

226. Section 11 of TAN-15 provides guidance on the frequency thresholds in which development must be flood free and the tolerable conditions for extreme flood events. The floor levels of development which is proposed within an area at risk of flooding should be set based on these requirements.

227. The design flood level should be the level taking account of residual risks (i.e. the risk that remains should flood defences be breached or fail as well as any undefended risk).

228. The additional height that the floor level is raised above the maximum water level is referred to as the 'freeboard'. Additional freeboard may be required because of risks relating to blockages to the channel, culverts, or bridges. This should be considered as part of a site specific Flood Consequence Assessment.

229. Single storey buildings such as ground floor flats or bungalows are especially vulnerable to rapid rise of water (such as that experienced during a breach). Figure 7 within TAN-15 displays the tolerable conditions in an extreme flood event (0.1% AEP), below which development may be acceptable. This risk can be reduced by use of multiple storey construction and raised areas that provide an escape route. However, access and egress can still be an issue, particularly when flood duration covers many hours or days. Similarly, the use of basements in areas at risk of flooding should be avoided.

Modification of ground levels

230. Modifying ground levels to raise the land above the design flood level is an effective way of reducing flood risk to a particular site in circumstances where the land does not act as conveyance for flood waters. However, care must be taken at locations where raising ground levels could adversely affect existing communities and property as this can result in significant changes to how flood water moves around the site, introducing flood risk to areas that were not at flood risk previously. Where ground levels are modified, mitigation measures must be considered to stop the introduction of new flood risk or off-site effects.

231. In most areas of fluvial risk, raising land above the floodplain would reduce or alter conveyance or flood storage in the floodplain and would likely impact flood risk downstream or on neighbouring land. Compensatory flood storage should be provided, and would normally be on a level for level, volume for volume basis on land that does not currently flood but is adjacent to the floodplain (in order for it to fill and drain). It should be in the vicinity of the site and ideally within the red line of the planning application boundary.

232. Compensatory flood storage may not be required for tidal inundation given the effectively infinite volume of the sea. However, it must be demonstrated that the tidal flooding is not affected by volume or conveyance changes, and this may require hydraulic modelling.

Buffer strips

233. The provision of a buffer strip to 'make space for water' allows additional capacity to accommodate climate change and ensure access to the watercourse, structures, and defences is maintained for future maintenance purposes. Additionally, keeping an open space alongside a development to segregate the built development from the watercourse is supported as it removes the responsibility from property owners to maintain (physically and financially) riverbanks. It also enables the avoidance of disturbing riverbanks, adversely impacting ecology and having to construct engineered riverbank protection. Building adjacent to riverbanks can also cause problems to the structural integrity of the riverbanks and the building itself, making future maintenance of the river much more difficult.

234. It is recommended that an undeveloped buffer strip alongside main rivers and ordinary watercourses is for maintenance purpose and that developers would explore opportunities for riverside restoration or public open space as part of any development.

235. A flood risk activity permit may be required for all works:

- On or near a main river
- On or near a flood defence structure
- On or near a sea defence
- In a floodplain

236. Further guidance on obtaining a flood risk activity permit and activities requiring a flood risk activity permit are available from the NRW website17. Buffer strips are also likely to apply in relation to land drainage consenting for ordinary watercourses and LLFAs may have similar requirements.

Surface Water Management

237. Suitable surface water management measures should be incorporated into new development designs in order to reduce and manage surface water flood risk to and posed by the proposed development. This should be achieved by incorporating SuDS. SuDS are typically softer engineering solutions inspired by natural drainage processes such as ponds and swales which manage water as close to its source as possible.

238. The integration of SuDS into developments is an opportunity to achieve multiple positive outcomes, by combining crucial drainage and flood defence assets with green infrastructure and high-quality public realm. All new developments are now required to include Sustainable Drainage Systems which comply with National Statutory SuDS Standards. Developers must gain approval for their drainage from a SuDS Approval Body (SAB) before construction can begin. Further guidance on SuDS is available from the Welsh Government website[18].

9.2 Flood Response Planning

239. Flood response planning is one option to help manage flood related incidents. From a flood risk perspective, flood response planning can be broadly split into three phases: before, during, and after a flood. These measures involve developing and maintaining arrangements to reduce, control or mitigate the impact and consequences of flooding and to improve the ability of people and property to absorb, respond to, and recover from flooding. TAN-15 (Section 7.6) states that development plans must be based on a sound understanding of the emergency services' ability to respond to flooding, therefore key stakeholders and the emergency services should be consulted at SFCA stages 2 and 3 when considering specific allocations and policies.

240. Safety is a key consideration for any new development and includes residual risk of flooding, the availability of adequate flood warning systems for the development, safe access and egress routes, and evacuation procedures.

241. Further guidance on incorporating resistance and resilient into development through design is available from the Construction Industry Research and Information Association (CIRIA), including a Code of Practice and Guidance for Property Flood Resilience[19].

9.2.1 Property Level Flood Risk Mitigation

242. Property Flood Resilience (PFR) measures can be used to reduce the impact of flooding to a development where traditional flood defence schemes are not a viable option. PFR takes two forms, resistance and resilience measures. Resistance measures focus on trying to

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17 https://naturalresources.wales/permits-and-permissions/flood-risk-activity-permits/environmental-permits-for-flood-risk-activities/?lang=en
18 https://naturalresources.wales/guidance-and-advice/business-sectors/planning-and-development/advice-for-developers/sustainable-drainage-systems-suds/?lang=en
19 The CIRIA Code of practice for property flood resilience C790 is available from www.ciria.org/Resources/Free_publications/CoP_for_PFR_resource.aspx

keep water out of a property using door barriers, flood doors, automatic airbricks, pumps and non-return valves. It is acknowledged that these measures do have a seepage allowance and so a small volume of water is still likely to enter a property with PFR measures, this is where resilience comes in. Resilience measures focus on accepting that water will enter the property and looks at ways to quickly return the property back to normal after a flood. This can include raising white goods and boilers above floor level, raising kitchen units and electric sockets, and using tiles for flooring instead of carpets.

243. Property Flood Resilience measures may be acceptable as a form of mitigation, but only in the context that the development passes the justification test and meets the acceptability criteria, as set out in the new TAN-15.

244. Developers should consider PFR measures for any new developments which flood in the 0.1% AEP plus climate change event and to ensure safety and security of residents. Further information on PFR can be found on the BeFloodReady[20] website and the National Flood Forum[21].

9.2.2 Access and egress

245. TAN-15 requires safe access and egress to and from the development in all modelled scenarios. This should consider all sources of flood risk including surface water. As a minimum safe access and egress routes should comply with the tolerable conditions (0.1% AEP plus climate change) of TAN-15 Figure 7. For any development where there is a flood risk to the development or the associated highways a flood response plan should be compiled to inform site occupants of a safe access and egress route to and from the site.

9.2.3 Emergency Plans

246. A flood response plan should be created for any development where there is a flood risk to the development itself or the surrounding highways. The plan should detail the flood risk to the development, the actions occupants of the site should take before, during, and after flooding and the safe access and egress routes available during a flood under all conditions. The plan should always take a proactive rather than reactive approach i.e. if buildings on the site are at risk of flooding, occupants should have already left their properties before flood water enters. The plan should be easy to follow giving clear instructions on what actions should be taken before, during, and after a flood.

9.2.4 Flood Alerts and Warnings

247. NRW operates a Flood Warning Service22 for some areas deemed to be at risk of fluvial or coastal flooding. This service covers approximately 60% of properties at risk from these sources of flood risk, and NRW is continually working to extend this service. These warnings have been designed to give the public advance notice of flooding. Figure **9-1** shows the areas across South West Wales that fall into flood alert and flood warning areas. Each flood alert and warning area is assigned an individual code to allow NRW to make flood alerts and warnings specific to areas at risk. The NRW FRAW mapping23 can be used to show the specific codes that cover a potential development site.

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20 https://www.befloodready.uk/
21 National Flood Forum
22 https://naturalresources.wales/flooding/preparing-for-a-flood/?lang=en
23 https://maps.cyfoethnaturiolcymru.gov.uk/Html5Viewer/Index.html?configBase=https://maps.cyfoethnaturiolcymru.gov.uk/Geocortex/Essentials/REST/sites/Flood_Risk/viewers/Flood_Risk/virtualdirectory/Resources/Config/Default&layerTheme=0

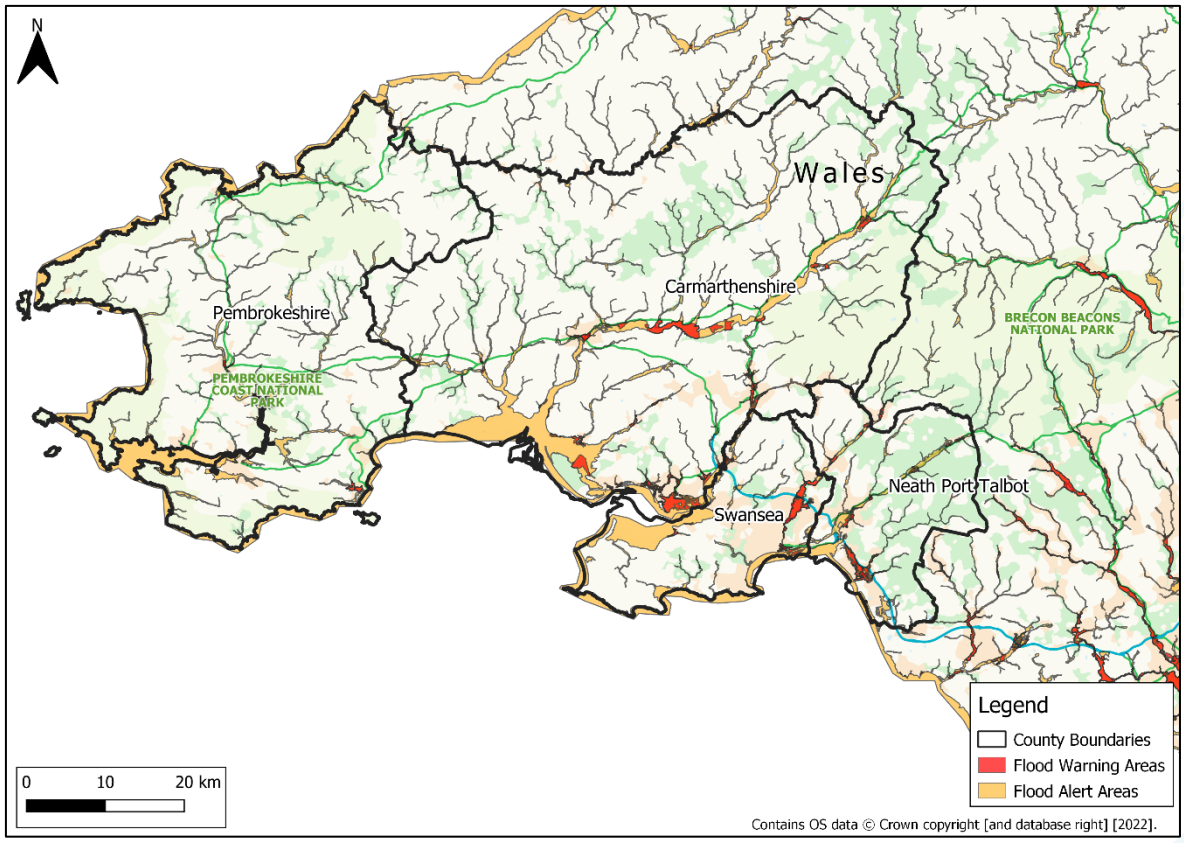

Figure 9-1 Flood alert and flood warning areas across South West Wales

248. A requirement of TAN-15 is that for proposed developments that are at risk of flooding, effective warning is provided. Therefore, occupants of these sites should be encouraged to sign up and receive Flood Alerts, Flood Warnings, and Severe Flood Warnings is available. If a flood event is forecast, alerts and warnings are issues by landline, mobile, text, or email using a set of four easily recognisable codes, as shown in the table below. Generic advice and examples of actions to be taken on receipt of the alert or warning are shown in the table below. Using these warnings, along with local knowledge, site occupants are able to take effective action, to reduce the consequence of flooding.

249. More information on how to register for flood alerts and warnings is available from the Natural Resources Wales website at: **https://naturalresources.wales/flooding/sign-up-to-receive-flood-warnings**

250. Alternatively, occupants can register by calling the 24-hour Floodline on: 0345 988 1188

251. It should be noted that the flood warning service is continually reviewed. It is recommended that site occupants check annually that they are signed up to receive the correct warnings by checking the website above.

9.3 Working With Natural Processes and Natural Flood Management

252. It should be noted that there are several terms for measures involving natural solutions to managing flood and coastal erosion risk, for clarity these are:

- Nature Based Solutions (NBS) – broad terms referring to the sustainable management and use of natural features to tackle socio-economical challenges.
- Working With Natural Processes (WWNP) – terms for reducing flood and coastal erosion risk through implementing measures to protect, restore and emulate the natural functions of catchments, floodplains, rivers and the coast.

- Natural Flood Management (NFM) – use of natural processes to reduce the risk of flooding and coastal erosion.

253. This SFCA will focus on specific measures that can be used to manage flood and coastal erosion risk and will refer to the use of WWNP and NFM in the SW Wales region. This section will provide an overview of different WWNP/NFM measures that can be implemented and will provide a review of the WWNP mapping to understand the potential for using these techniques in each Local Authority area.

254. Working with Natural Processes (WWNP) aims to protect, restore and emulate the natural functions of catchments, floodplains, rivers, and the coast. This includes the use of Natural Flood Management (NFM) techniques. NRW has worked in partnership with the Welsh Government, Department for Environmental Food & Rural Affairs (DEFRA) and other public bodies to build an evidence base24 setting out the current state of evidence for WWNP and outlining the effectiveness of different measures with regard to managing flood risk and delivering other benefits. Further research has been undertaken since the publication of this evidence report, leading to the development of knowledge and understanding around WWNP.

255. Nature-based solutions such as Natural Flood Management Techniques (NFM) are part of WWNP and can be used to retain water and attenuate flows that can otherwise contribute to flooding, Installation of temporary detention features such as leaky dams and large woody debris in watercourses across a catchment can help mitigate flood risk and improve the capability of the catchment to manage more extreme events. Some of these techniques are displayed below in Table **9**-**1**.

256. NFM techniques can also involve restoring floodplains and river channels to a more natural state and retaining water in catchment headlands. These techniques often deliver multiple benefits such as habitat creation and improving water quality, making them sustainable solutions. Reference should be made to the CIRIA Natural Flood Management Manual (C802F)[25]. NFM techniques can include:

- Floodplain restoration and reconnection
- Re-naturalising rivers and removing redundant in-channel structures
- Daylighting of culverts and restoration of open channels
- Installing run-off attenuation features such as large woody debris and leaky dams and cross slope hedges
- Planting riparian or catchment woodlands
- Land and soil management measures
- Restoring moorland, peatland, and woodland habitats in the headwaters
- Restoration and management of sand dunes, saltmarshes and mudflats

24 https://www.gov.uk/flood-and-coastal-erosion-risk-management-research-reports/working-with-natural-processes-to-reduce-flood-risk
25 https://www.ciria.org/ItemDetail?iProductCode=C802F&Category=FREEPUBS&WebsiteKey=a054c7b1-c241-4dd4-9ec1-38afd4a55683

Table 9-1 Examples of WWNP and NFM[26]

	
Leaky dam	Riparian woodlands
	
River restoration	Floodplain storage

9.3.1 WWNP in Wales

257. Policy 8 of Future Wales – the National Plan 2040 demonstrates the Welsh Government's support for nature-based solutions. The National FCERM Strategy for Wales27 emphasises the use of NFM and WWNP as a sustainable, catchment based approach to managing flood risk in a more sustainable way.

258. The new TAN-15 also acknowledges that natural flood and water management schemes can provide opportunities to slow and store water, along with appropriate land management. It recognises that this will become increasingly important with regard to the impacts of climate change and that options such as managed coastal realignment and floodplain restoration can contribute to the sustainable management of natural resources, mitigate future flood risk, and protect and enhance natural heritage.

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26 https://assets.publishing.service.gov.uk/media/6036c730d3bf7f0aac939a47/Working_with_natural_processes_one_page_summaries.pdf
27 https://gov.wales/national-strategy-flood-and-coastal-erosion-risk-management-wales

259. The Minister for Environmental and Rural Affairs announced in her written statement of 3rd April that there would be at least £1m funding for NFM schemes in Wales that Risk Management Authorities could apply for. The aim of these pilot studies is to encourage both the understanding and delivery of NFM and provide a learning opportunity for RMAs and the Welsh Government.

9.3.2 WWNP for new development

260. Developments can provide opportunities to work with natural processes of catchments, floodplains, rivers, and the coast to reduce flood and erosion risk, benefit the natural environment, and reduce the costs of schemes. Natural flood management requires integrates catchment management and involves those who use and shape the land. It also requires partnership working with neighbouring authorities, organisations and water management bodies.

261. It should be acknowledged that the use of NFM/WWNP techniques in isolation are unlikely to fundamentally alter flood risk at a given site. However, when implemented on a catchment scale NFM/WWNP may be effective in combination with other measures.

262. Local Authorities can set their own local policies on the use of nature based solutions, this could be done through the Local Plan or through the Local Flood Risk Management Strategy. Consideration could be made to WWNP more generally, for example through implementing policies on daylighting of culverts or through achieving multiple benefits in new developments such as nature conservation and biodiversity.

263. Conventional flood prevention schemes may be preferred, but consideration of 're-naturalising' rivers and land upstream could provide cost efficiencies as well as considering multiple sources of flood risk; for example, reducing peak flows upstream such as through felling trees into streams or building earth banks to capture runoff, could be cheaper and smaller-scale measures than implementing flood walls for example. It should be noted that in some locations traditional flood defence schemes may be required where conventional schemes are most appropriate; however, WWNP can and should complement conventional schemes where possible.

9.3.3 WWNP Opportunity Mapping

264. As part of the WWNP evidence base, opportunity mapping28 has been developed to help identify opportunities for WWNP and NFM. The maps are intended to be used alongside the Working with Natural Processes Evidence Directory to help RMAs, developers, and planners think about the types of measures that may work best and potentially the best place to locate them. These maps require further work and development; however initially they are to be used as a starting point for consideration towards WWNP opportunities.

265. The maps cover a range of different WWNP measures, including:

- Floodplain reconnection
- Run-off attenuation and gully blocking
- Woodland planting covering, floodplain planting, riparian planting, and wider catchment woodland

266. The WWNP maps are based entirely on open data and highlight the potential for WWNP derived from national fluvial, tidal, and surface water flood risk datasets. As such, further work and studies would still be required to support the use of NFM at a particular location and the understanding of WWNP potential should be supplemented by local knowledge. The maps also do not cover all measures for working with natural processes, and users may wish to refer to other relevant information sources when identifying areas of opportunity.

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28 http://wwnp.jbahosting.com/BrowserUnsupported.aspx

9.3.4 Using the WWNP opportunity mapping

Floodplain reconnection map

267. The floodplain reconnection map identifies areas of the floodplain that have become disconnected from their river and are no longer capable of, or have a reduced ability to, store water during times of flood. Areas suitable for floodplain reconnection tend to be rural areas at low risk of flooding (using the Risk of Flooding from Rivers and Seas map) close to a watercourse.

Run-off attenuation features and gully blocking map

268. The run-off attenuation features map identifies areas where surface water naturally flows or accumulates and could help identify locations to temporarily hold back and intercept the flow using soft engineering approaches.

269. The run-off attenuation feature locations identified on the mapping are based on the premise areas of high flow accumulation in the Surface Water Flooding maps are areas where the run-off hydrograph may be influenced by temporary storage (if designed correctly).

270. The gully blocking potential is based on run-off attenuation features on steeper ground with a gradient >6%. These areas where leaky barriers may be more beneficial than a deepened pond, raised bund, or grip blocking.

9.3.5 Tree Planting

271. Catchment woodland can intercept, slow, store, and filter water. This can help reduce flood peaks, flood flows (from 3 to 70%) and flood frequency.

272. Interventions involving tree planting seek to:

- Slow overland flow through the development of rougher ground surfaces
- Largely eliminate overland flow through enhanced infiltration rates via increased topsoil permeability and enhanced soil drying from enhanced evapotranspiration
- Remove water from the streamflow generating system via enhanced wet canopy evaporation (‘interception loss’) and enhanced transpiration

9.3.6 Areas of working with Natural Processes in the South West Wales

273. Maps showing the WWNP are provided in the appendices for each Local Authority area.

Carmarthenshire

274. The maps show areas across the county, particularly along the River Towy, are suitable for runoff attenuation features during the 1% AEP event. Areas suitable for Riparian Woodland Planting Potential are present along tributaries of the Afon Teifi, Afom Cothi, River Towy, River Taf. These areas are predominantly on small watercourses and tributaries of the Main Rivers.

275. The River Towy has the most potential for Floodplain Woodland Planting. This includes the middle reaches which cover areas such as Dryslwyn, Llandeilo, Llangadog, and Llandovery. Along the Afon Cofi there is potential for Floodplain Woodland Planting in the north of the county.

276. Areas suitable for Wider Catchment Woodland Planting Potential are present across Carmarthenshire, particularly in the southern vicinity, and along the tributaries of the River Towy. The projected locations suitable for Wider Catchment Woodland Planting Potential also extend into the Brecon Beacons National Park, within the north east of Carmarthenshire. Additionally, within the overlapping area of the Brecon Beacons National Park into Carmarthenshire, there is potential for Riparian and Woodland Floodplain Planting Potential along the Afon Brân which is a tributary to the River Towy.

Neath Port Talbot

277. The maps show that there are areas across the county borough that are suitable for runoff attenuation features during the 1% AEP event. Areas suitable for Riparian Woodland Planting Potential are located along the main tributaries of the River Tawe and River Neath, more frequently in the north of the county. These areas are predominantly on small watercourses and tributaries of the Main Rivers.

278. The River Tawe presents potential for Floodplain Woodland Planting in areas between Pontardawe and Ystalyfera. Along the River Neath, locations near to Glyn Neath and downstream to Aberdualais are potential areas for Floodplain Woodland Planting.

279. The north western area of Neath Port Talbot appears to be the most suitable location for Wider Catchment Woodland Planting Potential, particularly around Forest Goch, Clydach, and Bryncoch. In the north west of Neath Port Talbot, there is potential in Seven Sisters, and areas round Glyn Neath for Wider Catchment Woodland Planting. In the south west of Neath Port Talbot, areas to the east of Neath and Briton Ferry show potential for Wider Catchment Woodland Planting.

Pembrokeshire

280. The maps show that there are very small areas across the county that are suitable for runoff attenuation features during the 1% AEP event.

281. Areas suitable for Riparian Woodland Planting Potential are present along tributaries of the River Cleddau. These areas are predominantly located along small watercourses and tributaries of the Main Rivers within Pembrokeshire. This includes areas within the Pembrokeshire Coast National Park such as in and surrounding areas of St David's and Tenby.

282. The River Cleddau, north of Haverfordwest and north of Narberth has the most potential for Floodplain Woodland Planting.

283. Areas with the greatest potential for Wider Catchment Woodland features are in the north west of Pembrokeshire, in areas between Fishguard and St Davids. There are also some locations in Pembrokeshire Coast National Park that have potential for Wider Catchment Woodland features, along with areas south of Narberth and Whitland in the south east of Pembrokeshire. Within Pembrokeshire Coast National Park there is some potential for Wider Catchment Woodland features particularly in the north west of Pembrokeshire between St David's and Tresinwen.

Swansea

284. The maps show that there are very few locations distributed across the county that are suitable for runoff attenuation features during the 1% AEP event.

285. Areas suitable for Riparian Woodland Planting Potential are predominantly located in the Gower, and in the north of Swansea County. These areas are predominantly on small watercourses and tributaries of Main Rivers.

286. In Llangenith there is a localised area that has been identified for Floodplain Woodland Planting Potential. To the north east of Llangenith, areas along Burry Pill have also been identified. The greatest potential for Floodplain Woodland Planting is located in the north of the county, along the River Tawe near to Clydach.

287. Potential areas for Wider Catchment Woodland Planting are distributed across Swansea County, although do not cover areas in and around Swansea City or more rural areas to the north of the county.

10 Conclusion and Recommendations

10.1 Conclusion

288. This Stage 1 SFCA delivers a strategic assessment of all sources of flooding across the South West Wales region. It also provides an overview of policy and guidance for planners, developers, and other stakeholders. This SFCA provides a robust evidence base to inform the Council's individual Local Development Plans (LDP) and will inform the development of LDP policies and land allocation decisions.

289. The Stage 1 SFCA also sets out flood risk to each of the four Local Authority areas in South West Wales (Appendices A-D), this is based on the best available information such as the Flood Map for Planning and the latest climate change projections. It identifies ways of mitigating flood risk where appropriate and identifies opportunities to slow and store water through utilising WWNP/NFM techniques.

10.2 Recommendations

290. It is anticipated that many of the Local Authorities in the South West Wales region will need to progress to a Stage 2 or Stage 3 SFCA to provide a sufficiently robust evidence base to support their Local Development Plans.

291. A Stage 2 SFCA will provide an assessment of LDP Candidate Sites which have been identified as being at risk of flooding. The assessment considers the application of the Justification Test, including the potential for a site to satisfy the acceptability criteria. This may be informed by detailed flood risk information on flood depths, velocities and probability of flooding, as well as the risk of a flood defence structure breaching or overtopping.

292. The Stage 3 SFCA will involve testing whether the flood risk to any proposed LDP Candidate Sites can be managed to an acceptable level and that the site itself will not exacerbate flooding elsewhere over the lifetime of the development. It should also be shown that practicable mitigation measures can be implemented to manage flood risk. This stage is likely to be carried out by the proposer of the site to support development proposals in high or complex flood risk areas.

293. It is anticipated that the majority of Local Planning Authorities in the region are likely to require a Stage 2 assessment but not all mat need to progress to a Stage 3 assessment.

Appendices

Offices at

Coleshill
Doncaster
Dublin
Edinburgh
Exeter
Haywards Heath
Isle of Man
Limerick
Newcastle upon Tyne
Newport
Peterborough
Saltaire
Skipton
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Appendix A1 - Carmarthenshire Flood Risk Review

1.1 Historic flooding

Carmarthenshire has a history of recorded flood events caused by multiple sources of flooding. Significant flood events within the Carmarthenshire County Council authority area (which have been taken from NRW's recorded flood outlines dataset and Carmarthenshire County Council records and reports on historic flood incidents) are recorded below in Table *0-1*.

No records of groundwater flooding or flooding from artificial sources were made available at the time of writing. A summary of the spatial distribution of historic sewer flooding incidents by electoral ward is summarised in Table *0-2*.

Table 0-1 Flooding Incidents by year

Year of flood event	Location	Flood Incident
November 1929	Carmarthen	Camarthen quay and Pensarn area flooded. Defences and natural banks over topped.
November 1977	Whitland	NRW's Historic flooding dataset – channel capacity exceeded.
December 1979	Whitland	NRW's Historic flooding dataset – channel capacity exceeded. Ground floor flats located on St David's Avenue, Whitland, flooded to 1ft throughout. Other significant locations to have been affected by the flood event were properties along Velfry Road, which flooded up to 3ft, and Riverlea Tractors Ltd along the B4328 which also had internal flood waters up to 3ft.
	Ammanford	The River Loughor overtopped its banks causing significant flooding of Pen-y-Banc Road, Ammanford. The flood event also impacted Pontarddulais, where flood waters were recorded to be more than 3ft deep near to Pontarddulais Station.
	Johnstown	NRW's Historic flooding dataset – channel capacity exceeded.
	Llangunnor	NRW's Historic flooding dataset – channel capacity exceeded.
March 1981		Flooding from the River Cerdin to a maximum depth of 15 inches.
	Whitland	NRW's Historic flooding dataset – channel capacity exceeded.
	St Clears	NRW's Historic flooding dataset – channel capacity exceeded.
	Newcastle Emlyn	Various flooded properties and multiple events on 8th, 11th and 22nd March 1981.
	Newcastle Emlyn	1 property flooded to a depth of 6 inches on 11th March when the Teifi flooded and water entered through the rear of the property. The

Year of flood event	Location	Flood Incident
		gardens of the 2 adjacent properties were also flooded.
	Cenarth	Flooding in the Cenarth area from the River Teifi. Road at Glancorwg flooded 22 March 1981.
1986	St Clears	St Clears 1986 flood event. 20 properties affected.
October 1987	Carmarthen	Carmarthen Quay flooded along with the floodplain on the left hand bank as a result of exceedance of channel capacity.
	Johnstown	Johnstown flooded as a result of exceedance of channel capacity.
	Abergwili	Land surrounding Abergwili flooded as a result of exceedance of channel capacity.
	Pont-Ar-Gothi	Pont-ar-Gothi flooded as a result of exceedance of channel capacity.
	Dryslwyn	Dryslwyn area flooded as a result of exceedance of channel capacity.
	Ffairfach	No information held.
	Llangadog	Llangadog flooded as a result of overtopping of the River Tywi and Afon Bran.
	Lanwrda	No information held.
	Lampeter	Lampeter and Cwmann areas flooded (8 properties in Lampeter and 3 properties in Cwmann).
	Llanybydder	Station Terrace flooded including shops. 9 properties at Highmead Terraces flooded internally. Total properties affected known to be 10 cellars, 16 houses and 5 businesses.
	Llandysul	Llandysul area flooded as a result of exceedance of channel capacity.
	Cenarth	Cenarth area flooded as a result of exceedance of channel capacity.
	Llechryd	Water supply intake works and pumping station affected. Water supply disrupted, mainly due to quality problems.
	Newcastle Emlyn	Newcastle Emlyn flooded and the old railway bridge collapsed.
	Newcastle Emlyn	Newcastle Emlyn and Adpar flooded as a result of exceedance of channel capacity
	Llangunnor	Pensarn flooded directly from the River Towy as the flood defence wall was overtopped.
October 1998	Llandovery	Flood in Llandovery caused by the Afon Bran overtopping defences. Flood waters of 0.7m and less than 0.5m recorded across the town.

Year of flood event	Location	Flood Incident
2000	Llannon	Flooding in Cross Hands as a result of a blocked culvert at Cwm-y-Glo.
2005	Ammanford	Flooding to Margaret Street as a result of a blocked culvert. Flooding resulted in collapse of boundary walls which had dammed the floodwater.
November 2009	Llanddowror	During this flood event a total of 30 properties were flooded, with 6 of these internal. The pumping station upstream of Llanddowror Lower Road Bridge also flooded.
2011	Llangennech	Station Road flooded as a result of a partial blockage of the Mwrwg River.
2013	Glanymor	Surface water sewer flooding at Hoel Morfa.
2014	Llangennech town	Station Road due to tidal flooding overtopping the railway line.
2018	Llangunnor	2018 saw significant flooding as a result of Storm Callum. The flood defence wall at the north of Pensarn leaked then overtopped as the River Towy rose.

Additional flood history across Carmarthenshire was also provided however has not been included in this table as the date of flooding is unknown. For more information, contact the Lead Local Flood Authority.

Table 0-2 Sewer Flooding Incidents by Electoral Ward

Electoral Ward	Number of sewer flooding incidents
Carmarthenshire Local Authority Area	
Abergwili	3
Ammanford	2
Betws	2
Bigyn	16
Burry Port	4
Bynea	11
Carmarthen Town North	3
Carmarthen Town South	10
Carmarthen Town West	2
Cenarth	12
Cilycwm	1
Crymych	1
Cynwyl Elfed	4
Cynwyl Gaeo	3
Dafen	5
Elli	7

Garnant	3
Glanamman	4
Glanymor	4
Glyn	2
Gorslas	14
Hengoed	5
Kidwelly	7
Laugharne Township	10
Llanddarog	4
Llandeilo	5
Llandovery	2
Llandybie	4
Llanegwad	5
Llanfihangel Aberbythych	1
Llanfihangel-ar-Arth	4
Llangadog	4
Llangeler	8
Llangennech	3
Llangunnor	5
Llangyndeyrn	4
Llannon	3
Llansteffan	3
Llanybydder	10
Lliedi	6
Llwynhendy	5
Lower Brynamman	2
Maenclochog	6
Manordeilo and Salem	5
Pembrey	10
Penygroes	6
Pontamman	4
Pontyberem	3
Saron	8
St. Clears	12
St. Ishmael	4
Swiss Valley	2
Trelech	1
Trimsaran	4
Tycroes	3
Tyisha	5

Whitland	4
Brecon Beacons National Park	
Quarter Bach	2

1.2 Fluvial Flood Risk

The River Twyi, River Teifi, River Loughor, River Taf, and River Gwendraeth are the main watercourses in the Carmarthenshire County Council area. These watercourses are all classified as NRW Main Rivers. Maps showing the extent of the flood outlines from the NRW FMfP – Rivers in Carmarthenshire are provided in Appendix A2.

The River Twyi is sourced in the Cambrian Mountains and flows in a south westerly direction to the sea at Carmarthen Bay. Tributaries of the River Twyi (from upstream to downstream) are Afon Bran, Afon Dulais, Afon, Sawdde, Afon Cothi and Afon Gwili. The floodplain of the River Twyi in its upper reaches is reasonably extensive, with Flood Zone 2 and 3 forming areas within proximity to the watercourse. A significant area of Llandovery is located within Flood Zone 3, where the Afon Bran joins. In the middle reach of the river catchment the floodplain extends to areas of development that are located within approximately 500 metres of the watercourse. This includes the east of Llangadog, surrounding areas of Llandeilo, Abergwili, and the town of Carmarthen. NRW fluvial flood defences are located along the River Twyi in Abergwili and Carmarthen, providing a standard protection of 1 in 100 years. Along the River Bran, fluvial flood defences are located in Llandovery. Areas behind these defences are classified as a TAN-15 Defended Zone.

The River Loughor is sourced in the Black Mountains and flows through Ammanford where its main tributary, the River Amman, is met. The River Amman is sourced in the Black Mountains within the Brecon Beacons National Park. The river's estuary flows around Llanelli and into sea to the east of Carmarthen Bay. Tributaries of the River Loughor include the River Marlas, River Lash and River Cathan. Where the River Loughor meets its tributaries at Ammanford, Flood Zone 2 and 3 are fairly extensive and cover developed areas of Ammanford and surrounding areas. Further downstream, Pontardulais is also partially located within Flood Zone 2 and 3.

NRW fluvial flood defences are present along the River Loughor in Pontardulais, and along its tributaries, the River Amman and River Gwili in Ammanford and west of Pontardulais. In the downstream reach fluvial tidal defences are located to the west of Loughor along both banks of the River Loughor. Fluvial flood defences have a standard of protection of 1 in 100 years. With the exception of the Ammanford defences along the River Amman, areas located behind the fluvial flood defences are classified as a TAN-15 Defended Zone.

The River Taf flows from the Preseli Hills in Pembrokeshire to the sea at Laugharne, covering approximately 35km in length. Where the River Marlais and River Gronw joins the River Taf at Whitland, the fluvial floodplain significantly increases in its extent, covering development in Whitland. Fluvial flood defences are located along the River Gronw in the east of Whitland, providing a standard 1 in 100 year level of protection. The area behind these defences is classified as a TAN-15 Defended Zone.

The River Gwendraeth consists of two watercourses which converge in the estuary at Kidwelly. The Gwendraeth Fawr is 18km in length and flows from its source in Maesybont to the estuary south of Kidwelly. The Gwendraeth Fach is 24km in length and flows further north from its source in Llyn Llech Owain Country Park to the estuary. In the downstream reach, to the south of Kidwelly, Flood Zone 3 covers an extensive area due the tidal influence. Fluvial flood

defences are located along the River Gwendraeth, and as a result the area behind the defence is classified as a TAN-15 Defended Zone.

Rivers Dafen and Lleidi are sourced to the north of Llanelli, and flow in a southerly direction through the largest town of Carmarthenshire, discharging in the River Loughor estuary before joining the sea at Carmarthen Bay. Areas of Llanellu in proximity to these watercourses are located within fluvial Flood Zone 2 and 3. No NRW fluvial flood defences are present in or nearby Llanelli; however, due to the presence of tidal flood defences it is classified as TAN-15 Defended Zone.

The River Teifi flows in a westerly direction from its source at Llyn Teifi, north Ceredigion, and flows into the sea at Cardigan Bay. The River Teifi generates a boundary between Carmarthenshire and neighbouring county Ceredigion.

Flood Defence Schemes involving localised drainage improvement and Property Flood Resilience (PFR) measures have not been included. Information on any local authority managed or private flood defences was not available at the time of writing.

Fluvial Flood Risk & TAN-15

Due to the nature of the topography in Carmarthenshire, flood plains are wide and flat, allowing water to cover large areas. Larger settlements such as Llanelli, Carmarthen, and Llandovery are mainly located within Flood Zone 3.

There is very little fluvial flood risk present within the Brecon Beacons National Park area, due to the valley like characteristics present such as the higher gradient of the topography. The majority of the area is located within Flood Zone 1. In the northern vicinity of the area which overlaps into Carmarthenshire, there is some fluvial risk in areas east of Llangadog via the tributaries of the Afon Twyi, although the risk is predominantly shown to be confined to watercourses.

Flood defences found along the River Twyi, River Loughour and River Taf, are maintained by NRW. As a result of these flood defences, parts of the fluvial floodplain are categorised as a TAN-15 Defended Zone. Therefore, all forms of development are possible subject to satisfying the requirements of the Justification Tests. The flood defences have a 1% AEP event standard of protection, making areas behind the flood defences favourable to the requirements of TAN-15.

There are very few existing settlements located within Flood Zone 3 without defences. New highly vulnerable development within undefended areas of Flood Zone 3 is unlikely to be possible, as Flood Zone 3 is not suitable for highly vulnerable development. Less vulnerable development shall only be possible subject to the stringent Justification Tests outlined in TAN-15. Development in these areas shall be subject to site specific assessment and detailed flood modelling shall be required. Due to the lack of protection from NRW flood defences, any proposed development is likely to require flood mitigation considerations and may be more challenging to meet TAN-15 requirements.

1.3 Tidal flood risk

Carmarthen Bay is a potential source of tidal flooding to southern parts of Carmarthenshire. Tidal flooding is most likely to occur during storm surge conditions that is characterised by wind-driven waves and low atmospheric pressure and high spring tides. In areas protected from flooding by sea defences, tidal flooding can occur as a result of a breach in the defences, failure of a mechanical barrier or overtopping of defences.

The NRW FMfP – Sea, shown in Appendix A2, identifies that the River Taf, River Gwendraeth, River Loughor and River Twyi are tidally influenced rivers within Carmarthenshire; therefore, areas within the lower reaches are the main locations at risk of tidal flooding. Laugharne, St Clears, Carmarthen, Kidwelly, Burry Port, and Llanelli, are located or partially located within Flood Zone 3. NRW fluvial tidal defences are located in Carmarthen and Kidwelly, and NRW tidal flood defences are present in Llanelli, providing a standard protection of 1 in 200 years. The flood defences form part of the TAN-15 Defended Zone for the sea in these locations.

Tides may affect flooding much further inland during extreme events, especially if sea levels rise as predicted in the future.

Tidal Flood Risk & TAN-15

Flood defences found along the tidal rivers in Carmarthenshire and around its coastline are maintained by NRW. As a result of these flood defences, part of the tidal floodplain – Kidwelly, Carmarthen, and Llanelli, is categorised as a TAN-15 Defended Zone. Therefore, all forms of development are possible if the requirements of the Justification Test can be satisfied.

Undefended areas within Carmarthenshire are unlikely to allow highly vulnerable development to be permitted. In these areas at risk it is likely that the application of climate change results in a large tidal flood extent with significant depths of flooding. This increase in flood risk may make it difficult to meet the requirements of the acceptability criteria of TAN-15.

Less vulnerable development should only be considered in Flood Zone 3 subject to the application of the Justification Test and acceptability of consequences. It is likely that flood mitigation measures will be required for developments in these areas. Development in these areas shall be subject to site specific assessment and detailed modelling shall be required. Opportunities for highly vulnerable development should be located in areas outside of Flood Zone 3.

1.4 Surface water flood risk

Maps showing the extent of the flood outlines for the surface water in Carmarthenshire are provided in Appendix A2.

The NRW FMfP – Surface Water and Small Watercourses shows surface water flooding is predicted to follow topographical flow paths of existing watercourses or dry valleys. Along the River Loughor to the south of Ammanford, and River Gwendraeth to the north east of Kidwelly, a significant surface water flow path is evident characterising the floodplains and tributaries to these watercourses.

East of Kidwelly, and South of Ammanford are areas that appear to be at the greatest risk, with areas located in Flood Zone 3. Predominantly, flooding is limited to areas outside of the main settlements.

Surface water and small watercourse flooding is predicted to occur in urban areas such as Ammanford and Llanelli, with some localised areas located in Flood Zone 3, including road infrastructure.

Within the Brecon Beacons National Park the risk of surface water and small watercourse flooding is predominantly very low, with areas at risk being confined to existing watercourses. The area at highest risk within this boundary is located at Usk Reservoir.

Surface water flow paths within urban areas are shaped by urban infrastructure and topographic depressions. Surface water is channelled by the roads around the city, pooling in areas of wide open spaces and topographic depressions.

Disposal of surface water runoff is a key consideration, whether a development site falls within a flood risk area or not. Intense development within a catchment could result in increased runoff which if not appropriately managed could result in increased flooding within and downstream of the study area. New developments can also increase pressure on sewer systems and urban drainage. It is therefore important to manage the impact of developments in a sustainable manner. Developers should also be aware of the Burry Inlet Supplementary Planning Guidance (Section 1.6). Whilst all proposed surface water drainage schemes shall be required to comply with the Statutory Standards for SuDS in Wales and the discharge hierarchy, it is unlikely that any proposed development site shall be permitted to discharge surface water into the public sewerage system, even where priority levels 1-3 (rainwater harvesting, infiltration, and discharge to a waterbody) are not viable.

Surface Water Flood Risk & TAN-15

All development types are permissible in Flood Zone 2 and 3 provided that the acceptability criteria in TAN-15 can be met. Development in these areas shall be subject to site specific assessment which should consider flow pathways, potential ground levelling for topographic depressions and how SuDS can be used to manage surface water flow across a development site. Developers should consult the LLFA for any specific knowledge related to surface water and small watercourse flooding at a proposed development site. Where there is localised surface water flooding, developments should be located outside of Zones 2 and 3 where possible.

1.5 Groundwater flood risk

The bedrock geology across Carmarthenshire County is varied but predominantly comprised of Mudstone, Siltstone, and Sandstone. Mudstone tends to have low porosity and permeability whilst sandstone is regarded as more permeable and allows for the storage and movement of groundwater. As a result, upward percolation of groundwater and subsequent flooding should be considered in these areas.

Areas of superficial deposits in Carmarthenshire are limited and predominantly present around the rivers of the county and along the coastline. The superficial deposits are clay, silt, sand, and gravel. Clay is impermeable, and other deposits are generally permeable. The variation of superficial deposits across the county suggests that groundwater flooding could present a localised risk to some areas. Maps showing the indicative groundwater flood depth in Carmarthenshire are provided in Appendix A2.

The majority of the county has groundwater that is at least 5m below the ground surface or lower. In the north eastern (Llandovery) and southern (Kidwelly, Ammanford, Burry Port) areas of the county groundwater levels are between 0.025m and 0.5m below the ground surface, indicating that there is a greater risk of groundwater flooding in these areas.

Within the Brecon Beacons National park, the main groundwater flood risk is located in the south, near to Brynamman. Within this area groundwater is predominantly at least 5m below the ground surface; however, there some small, localised areas where groundwater levels are either at or very near (within 0.025m) of the ground surface. These locations at higher risk are mostly within close proximity to a watercourse and in some cases very close to the source of the watercourse where high groundwater might be expected.

Groundwater Flood Risk & TAN-15

TAN-15 does not specify any requirements for groundwater flood risk, other than the risk of groundwater flooding should be considered as part of an FCA. However, it would be advisable to locate developments away from areas where groundwater is less than 0.025m below the ground surface without further groundwater monitoring and detailed assessment being undertaken.

1.6 Sewer flooding

DCWW is responsible for sewer infrastructure across the study area, and recording sewer flooding incidents.

DCWW have provided detail of historic incidents and active risk areas. Historical flooding incidents are recorded relating to public foul, combined, or surface water sewers. These records display the number of properties that experience internal and/or external flooding. A summary of the spatial distribution of historic sewer flooding incidents by electoral ward is summarised in Table *0-2* of Section 1.1. This data shows that the ward with the highest number of flood incidents is Bigyn with 16 incidents of sewer flooding. Gorslas also has a high number of recorded incidents of flooding (14).

DCWW are working to reduce the number of sewer flood incidents by investing in maintenance and improvements to the sewer network.

DCWW has not provided any information regarding the predicted flood risk from the sewerage network.

Some areas of Carmarthenshire, including Burry Port and Llanelli are subject to the Burry Inlet Supplementary Planning Guidance[1] (SPG) which provides specific guidance in relation to the consideration of relevant development proposals located within the Llanelli Waste Water Treatment Works (WWTW) catchment area. Whilst Burry Port and Llanelli are identified as a focus for growth within the existing Local Development Plan, they are also subject to high environmental considerations including the water quality of the Carmarthen Bay and Estuaries European Marine Site (CBEEMS). The SPG outlines concerns with the introduction of foul flows leading to the overloading of the WWTW, and an increase in frequency of discharges from storm sewage overflows out to the CBEEMS during significant rainfall. The SPG therefore outlines a scheme of compensatory surface water required across the SPG area. The SPG should be consulted and utilised to guide development proposals across the SPG catchment area. It is recommended that DCWW and the LPA are consulted on implications for proposed development sites within this area.

Flood Risk from Sewers & TAN-15

TAN-15 does not specify any requirements for sewer flood risk, other than that it should be considered as part of an FCA. The LLFA and DCWW should be consulted to provide specific advice on any known history of sewer flooding and any remedial action taken.

Developers should be aware of the Burry Inlet SPG and it is recommended that the LLFA and DCWW are consulted in relation to proposed developments within the Llanelli WWTW catchment area.

[1] Burry Inlet Supplementary Planning Guidance: https://www.carmarthenshire.gov.wales/media/1221563/burry-inlet-draft-spg-january-2020.pdf

1.7 Flooding from artificial sources

Artificial sources of flooding include reservoirs upstream of the county which pose a flood risk to Carmarthenshire. Maps showing the potential flood risk from reservoirs are provided in Appendix A2. The reservoirs which pose a flood risk to the county are:

- Llyn Brianne
- Lliw Upper & Lower
- Afon Dafen Crossing
- Lliedi Upper & Lower

The NRW FMfP – Reservoirs mapping indicates that Llandovery and Llanelli are identified as the areas most affected due to a reservoir breach or overtopping.

The failure of a reservoir can cause catastrophic damage due to the sudden release of large volumes of water. Reservoirs in the UK have an excellent safety record, and NRW is the enforcement authority for the Reservoirs Act 1975 in England and Wales. All large reservoirs must be inspected and supervised by reservoir panel engineers. It is assumed that these reservoirs are regularly inspected, and essential safety work is carried out. Therefore, these reservoirs present minimal risk.

1.8 Changes on understanding of flood risk

FCERM Capital Investment

NRW have appointed engineering consultants to develop a new Flood Alleviation Scheme for **Ammanford, Carmarthenshire**. The construction of the scheme will be taking place between 2022-2024.

Additionally, **Mwche Managed Realignment, Carmarthenshire**, has been proposed and is undergoing its appraisal between 2022-2023. The construction stage of this investment is programmed to take place starting 2024.

Future FMfP improvements

The locations listed below are covered by existing detailed NRW flood models which are expected to be incorporated into the Flood Map for Planning through future routine updates. Where NRW have provided an indication of timescales for these updates, this is provided in brackets.

- Ammanford (date unknown)
- Cwnffrwrdd (date unknown)
- Laugharne (date unknown)
- Llandeilo (date unknown)
- Llandovery (date unknown)
- Llandysul Pentre Cwrt (date unknown)
- Llanelli (date unknown)
- Llangennech (date unknown)
- Pontyates (date unknown)
- St Clears (date unknown)
- Whitland (date unknown)

1 Appendix B1 – Neath Port Talbot Flood Risk Review

1.1 Historic Flooding

Neath Port Talbot has a history of recorded flood events caused by multiple sources of flooding. Significant flood events within Neath Port Talbot Council authority area (which have been taken from NRW's recorded flood outlines dataset and Neath Port Talbot Council records and reports on historic flood incidents) are recorded below in Table *1-1*.

No records of groundwater flooding or flooding from artificial sources were made available at the time of writing.

A summary of the spatial distribution of historic sewer flooding incidents by electoral ward is summarised in Table *1-2*.

Table 1-1 Flooding Incidents by year

Year of flood event	Location	Flood Incident
January 1938	Neath Valley	Flooding of Neath catchment wide, including Glynneath, Resolven and Cwmgwrach.
December 1979	Neath	Large areas of farm and general agricultural land were flooded when the River Neath overtopped its banks in Neath. Multiple locations were flooded including Llanwit Road, Neath, Lock House, Tonna, Ynys-y-Gerwyn Farm.
	Tawe	Extensive flooding along Tawe Valley particularly downstream of Ynysmeudwy. Areas particularly affected include Pontardawe Industrial Estate, Herbert street, Pontardawe, Inco Nickel works at Clydach.
October 1998	Pontardawe	Town centre and industrial estate flooded due to Swansea canal breach.
	Aberdulais	Overtopping of the River Neath and a build up of debris reduced flow under the nearby aqueduct. Right hand bank overtopped defences.
January 2021	Skewen	Release of floodwaters from nearby mineshaft following period of heavy rain. Likely due to blockage of drainage adit which led to disused mine shaft 'burst'. Resulted in flooding of approximately 80 residential properties. The Coal Authority are said to be constructing a new mine water system to help prevent future flooding from this source.

Table 1-2 Sewer Flooding Incidents by Electoral Ward (1990 – 2021)

Electoral Ward	Number of sewer flooding incidents
Aberavon	8
Aberdulais	1
Allt-wen	8
Baglan	13
Blaengwrach	2
Briton Ferry East	6
Briton Ferry West	7
Bryn and Cwmavon	13

Bryn-coch North	3
Bryn-coch South	7
Cadoxton	3
Cimla	4
Coedffranc Central	6
Coedffranc North	3
Coedffranc West	3
Crynant	2
Cwmllynfell	3
Cymmer	8
Dyffryn	6
Glyncorrwg	1
Glynneath	6
Godre'r graig	5
Gwaun-Cae-Gurwen	3
Hendy	1
Lower Brynamman	1
Margam	5
Neath East	7
Neath North	5
Neath South	7
Onllwyn	3
Pelenna	4
Penyrheol	1
Pontardawe	12
Pontardulais	6
Port Talbot	8
Resolven	8
Rhos	4
Sandfields West	7
Seven Sisters	5
Tai-bach	9
Tonna	3
Trebanos	2
Ystalyfera	4

1.2 Fluvial Flood Risk

The River Neath, River Afan, and River Tawe are the main watercourses within the Neath Port Talbot County Council area. These watercourses are classified as NRW Main Rivers. Maps showing the extent of the flood outlines from the NRW FMfP – Rivers in Neath Port Talbot are provided in Appendix B2.

The River Tawe rises in the upper region of the Swansea Valley and flows through Ystalyfera and Pontardawe in a south westerly direction, discharging into the sea at Swansea Bay. Tributaries of the River Tawe include the Lower and Upper Clydach Rivers, converging at Pontardawe and Clydach, in the northwestern vicinity of the county.

The floodplain of the River Tawe is present between Ystalyfera and Pontawdawe, with some areas of existing development located within Flood Zone 2 and 3. NRW fluvial flood defences, with a standard protection of 1 in 100 years, are present along the River Tawe in Ystalyfera and Pontardawe. As a result of these defences, an area of Ystalyfera is classified as a TAN-15 Defended Zone.

The River Neath rises in the Brecon Beacons National Park at Fan Nedd and flows in a south westerly direction to the sea at Baglan Bay. The River Neath is joined by a number of tributaries including the Afon Melte at Pontneddfechan, Dulias at Aberdulias, and the River Clydach to the south of Neath. In the upper reaches of the river catchment the floodplain is refined to proximity to the watercourse. In the middle and lower reaches Flood Zone 2 and 3 extend into existing settlement areas. Flood Zone 3 extends into Glyn-Neath, and further downstream into the village of Resolven. One of the main settlements, Neath, is partially located within Flood Zone 2 and 3 with residential development and infrastructure within the flood extent. NRW fluvial flood defences, with a standard of protection of 1 in 100 years, are present in Glyn-Neath and Resolven. As a result of the presence of fluvial flood defences, both these areas are classified as a TAN-15 Defended Zone.

The River Afan rises to the east of Blaengwynfi and flows in a south westerly direction through Port Talbot before discharging into the sea south of Swansea Bay. The Afon Corrwg converges with the River Afan at Cymmer, and the Pelenna River joins at Pontrhydyfen. In the upper and middle reaches the floodplain is fairly confined to the watercourse. Port Talbot, located in the lower reach of the River Afan, is partially located within Flood Zone 3. NRW fluvial flood defences are located along both riverbanks, and have a standard of protection of 1 in 100 years. As a result, areas behind the flood defences in Port Talbot are categorised as a TAN-15 Defended Zone.

Schemes involving localised drainage improvement and Property Flood Resilience (PFR) measures have not been included. Information on any local authority managed or private flood defences was not available at the time of writing.

Fluvial Flood Risk & TAN-15

Fluvial flood defences located along the River Tawe, River Neath, and River Afan are maintained by NRW. As a result of these flood defences, parts of the fluvial floodplain are categorised as a TAN-15 Defended Zone. Therefore, all forms of development are possible subject to satisfying the requirements of the Justification Tests. The flood defences have a 1% AEP event standard of protection, making areas behind the flood defences favourable to the requirements of TAN-15.

There are existing settlements located within Flood Zone 3 that are undefended, such as parts of Neath, and areas within Glyn-Neath. New highly vulnerable development in these areas is unlikely to be possible. Less vulnerable development will only be possible subject to the stringent Justification Tests outlined in TAN-15. Development in these areas will be subject to a site-specific assessment and detailed flood modelling will be required. Due to lack of protection from NRW flood defences, any proposed development is likely to require flood mitigation considerations and may be more challenging to meet TAN-15 requirements.

1.3 Tidal flood risk

Baglan Bay and Swansea Bay are potential sources of tidal flooding within the Neath Port Talbot County. Tidal flooding is most likely to occur during storm surge conditions that is characterised by wind driven waves and low atmospheric pressure and high spring tides. In areas protected from flooding by sea defences, tidal flooding can occur as a result of breach in the defences, failure of mechanical barrier or overtopping of defences.

The NRW FMfP – Sea, shown in Appendix B2 identifies that areas of Port Talbot, Briton Ferry, and Neath are at risk of tidal flooding in the Neath Port Talbot County due to their location in Flood Zone 3. NRW flood defences are present in Port Talbot and are identified

as tidal defences. The flood defences have a design standard of protection of 1 in 200 years.

Tidal Flood Risk & TAN-15

All forms of development are possible in TAN-15 Defended Zones subject to satisfying the requirements of the Justification Test. It is unlikely that undefended areas within Flood Zone 3 will allow highly vulnerable development. In these tidal areas it is known that the application of climate change results in a large tidal flood extent with significant depths of flooding. This increase in flood risk may make it difficult to meet the requirements of the acceptability criteria of TAN-15. Less vulnerable development should only be considered in Flood Zone 3 subject to application of the Justification Test and acceptability of consequences. It is likely that flood mitigation measures will be required for development in these areas. Development in these areas will be subject to site specific assessment and detailed modelling will be required. Opportunities for highly vulnerable development should be located in areas outside of Flood Zone 3.

1.4 Surface water flood risk

Maps showing the extent of the flood outlines for surface water in Neath Port Talbot County area are provided in Appendix B2.

The NRW FMfP – Surface Water and Small Watercourses shows surface water flooding is predicted to predominantly follow topographical flow paths of existing watercourses or dry valleys in rural parts of the county.

The town of Neath and locations within close proximity to the River Neath – between Neath and Glyn-Neath, are at greatest risk of surface water and small watercourse flooding, with some localised areas of flooding in Port Talbot as a result of being located within Flood Zone 3. In urban areas such as Neath and Port Talbot surface water flow paths are shaped by urban infrastructure and topographic depressions. Surface water is channeled by the roads around the town, pooling in areas of wider open spaces and topographic depressions.

Surface Water and Small Watercourse Flood Risk & TAN-15

All development types are permissible in Surface Water and Small Watercourses Flood Zone 2 and 3 provided the acceptability criteria in TAN-15 can be met. Development in these areas will be subject to site specific assessment which should consider flow pathways, potential ground levelling for topographic depressions, and how SuDS can be used to manage surface water flows across a development site. Developers should consult the LLFA for any specific knowledge related to surface water and small watercourse flooding at a proposed development site. Due to the flood risk in areas such as Neath, developments should be located outside of Flood Zone 2 and 3 where possible.

1.5 Groundwater flood risk

Commented [ST1]: "Should this include assessment of mine water risk?"

Bedrock geology is predominantly South Wales Upper Coal Measures with some areas of Pennine Middle Coal Measures Formation and South Wales Middle Coal Measures Formation. These are all comprised of mudstone, siltstone, sandstone, and coal. Mudstone tends to have low porosity and permeability whilst sandstone is regarded as more permeable and allows for the storage and movement of groundwater. As a result, upward percolation of groundwater and subsequent flooding should be considered in

these areas. Where bedrock is made up of sandstone, there is a higher level of permeability, and the storage and movement of groundwater is possible.

Areas of superficial deposits in Neath Port Talbot are limited, and predominantly present around the rivers in the county where the composition is alluvium. Other records are shown to be Till, which is generally permeable. The variation in superficial deposits suggests that groundwater flooding could present a localised risk in some areas. Maps showing the indicative Groundwater flood depth in Neath Port Talbot are provided in Appendix B2. The majority of the county has groundwater that is at least 5m below ground surface or lower. In the south western area of the county, along the coastline, and within close proximity to watercourses, groundwater levels are predominantly between 0.5m -0.025m below the ground surface. This indicates that groundwater flooding in these areas is more likely to occur. Groundwater emergence is also more likely to occur in areas with historic mine workings, with workings forming new pathways between the groundwater body and the surface. This has been known to occur in Neath, as recently as 2021 following Storm Cristoph, where high volumes of rainfall on hillsides worked their way down to valley settlements before emerging at the surface and causing internal property flooding.

Groundwater Flood Risk & TAN-15

TAN-15 does not specify any requirements for groundwater flood risk, other than the risk of groundwater flooding should be considered as part of an FCA. However, it would not be advisable to locate developments in areas where groundwater is less than 0.025m below the ground surface without further groundwater monitoring and detailed assessment being undertaken.

1.6 Sewer flooding

DCWW is responsible for sewer infrastructure across the study area and recording sewer flooding incidents.

DCWW have provided detail of historic incidents and active risk areas. Historical flooding incidents are recorded relating to public foul, combined, or surface water sewers. These records display the number of properties that experiences internal and/or external flooding. A summary of the spatial distribution of historic sewer flooding incidents by electoral ward is summarised in Table *1-2* of Section 1.1. This data shows that the wards with the highest number of flood incidents are Baglan, and Bryn and Cwmavon, both with 13 recorded incidents of sewer flooding. Pontardawe also has 12 recorded incidents of flooding.

DCWW are working to reduce the number of sewer flood incidents by investing in maintenance and improvements to the sewer network.

DCWW has not provided any information regarding the predicted flood risk from the sewerage network.

Flood Risk from Sewers & TAN-15

TAN-15 does not specify any requirements for sewer flood risk, other than that it should be considered as part of an FCA. The LLFA and DCWW should be consulted to provide specific advice on any known history of sewer flooding and any remedial action taken.

1.7 Artificial flooding

Artificial sources of flooding include three reservoirs within the county which pose a flood risk to Neath Port Talbot. Maps showing the potential flood risk from reservoirs are provided in Appendix B2. The reservoirs which pose a flood risk to the county are:

- Eglwys Nunydd
- Cwmwernderi
- Ystradfellte
- BP Llandarcy North Site

The NRW FRAW Flood Risk from Reservoirs mapping indicates that Port Talbot, Margam, and Neath to Glyn Neath, are identified as the areas likely to be affected due to a reservoir breach or overtopping.

The failure of a reservoir can cause catastrophic damage due to the sudden release of large volumes of water. Reservoirs in the UK have an excellent safety record, and NRW is the enforcement authority for the Reservoirs Act 1975 in England and Wales. All large reservoirs must be inspected and supervised by reservoir panel engineers. It is assumed that these reservoirs are regularly inspected, and essential safety work is carried out. These reservoirs, therefore, present minimal risk.

1.8 Changes in understanding of flood risk

FCERM Capital Investment

NRW has appointed engineering consultants to develop a new flood defence scheme for Canal Side, Aberdulais. The proposals are to be confirmed, and the appraisal process is being carried out between 2022-2024.

Future FMfP improvements

The locations listed below are covered by existing detailed NRW flood models which are expected to be incorporated into the Flood Map for Planning through future routine updates. Where NRW have provided an indication of timescales for these updates, this is provided in brackets.

- Blaengwrach (date unknown)
- Chain Road Glyn-Neath (date unknown)
- Cwntwrch (date unknown)
- Glanamman (date unknown)
- Glyncorrwyg (date unknown)
- Margam (date unknown)
- Neath (date unknown)
- Port Talbot (date unknown)
- Ystradgynlais (date unknown)

1 Appendix C1 – Pembrokeshire Flood Risk Review

1.1 Historic flooding

Pembrokeshire has a history of recorded flood events caused by multiple sources of flooding. Significant flood events within the Pembrokeshire County Council authority area (which have been taken from NRW's recorded flood outlines dataset and Pembrokeshire County Council records and reports on historic flood incidents) are recorded below in Table *1-1*.

No records of groundwater flooding or flooding from artificial sources were made available at the time of writing. A summary of the spatial distribution of historic sewer flooding incidents by electoral ward is summarised in Table *1-2*.

Table 1-1 Flooding Incidents by year

Year of flood event	Location	Flood Incident
August 1977	Cartlett Brook	Cartlett Brook, Haverfordwest 1977 flood event. 26 properties affected in total including: sewage treatment works, Avert Scales Ltd depot and residential gardens backing onto the Cartlett Brook. Known flood level for this event is 6.13mAOD.
August 1986	Cartlett Brook	26 properties affected.
	St Clears	20 properties affected.
October 1987	Llawhaden	Area surrounding Llawhaden Bridge flooded, including the Old Mill.
	Solva	Lower Solva area flooded.
	Llechryd	Water supply intake works and pumping station affected. Water supply disrupted, mainly due to quality problems.
	Haverfordwest	52 properties affected.
	Goodwick	Flooding due to Pant-yr-Ychain stream overtopping its banks near Spring Gardens, Clement Road.
	Nevern	Area near Nevern flooded.
	Fishguard	Lower town area of Fishguard flooded.
March 1989	Laugharne	Extensive flooding to 22 properties and highways. Caused by high tide and strong winds, surcharged sewer outfalls. Situation aggravated by highway flooding from Stoneway Road.
December 1989	Dale (Pembrokeshire Coast National Park)	Overtopping of waves and spray at Dale beach. Defences also breached and washed away.
February 2002	Amroth	Wave overtopping resulted in flooding
March 2008	Beach, Broad Haven	Flooding of grounds reported
October 2011	Angle Village	Flooding was caused as a result of surface water runoff, the surface water system at capacity, and surcharging of culverts. 10 properties, including a school, were affected
December 2012	Tenby (Pembrokeshire Coast National Park)	Tenby flooding December 2012 event for the River Ritec.

	Llawhaden	Llawhaden flooding December 2012 from Eastern Cleddau.
January 2013	Solva (Pembrokeshire Coast National Park)	Approximately 20 buildings/properties had internal flooding. Main Street through Solva was closed.
January 2013	Angle Village	Highways and property flooding attributed to a combination of blocked grains/gullies and tidal sources.
January 2014	The Parrog, Newport	Internal property flooding reported as a result of a combination of flood sources.
November 2018	Angle Village	Six separate reports of highways, property and grounds flooding. Sources of flooding given were a combination of tidal, pluvial and blocked drainage infrastructure.
November 2018	Havens Head, Liddeston	Six reports of property flooding attributed to blocked culverts, blocked/overflowing watercourse and tidal influences.
November 2018	Lower Priory, Milford Haven	Seven reports of property flooding with additional reports of grounds and highways flooding. Source of flooding thought to be associated with blocked culverts, blocked/overflowing watercourse and tidal influences.
December 2020 October 2021	Wern Road, Goodwick	Highways flooding reported. Cause of flooding attributed to blocked drains/gullies.

Table 1-2 Sewer Flooding Incidents by Electoral Ward

Electoral Ward	Number of sewer flooding incidents
Pembrokeshire Local Authority Area	
Burton	3
Camrose	7
Cilgerran	3
Clydau	5
Crymych	2
East Williamston	2
Fishguard North East	7
Goodwick	3
Haverfordwest: Castle	10
Haverfordwest: Garth	1
Haverfordwest: Portfield	8
Haverfordwest: Prendergast	3
Haverfordwest: Priory	3
Hundleton	5
Johnston	4
Kilgetty/Begelly	6
Lamphey	4
Letterston	9
Maenclochog	1
Merlin's Bridge	3
Milford: Central	3
Milford: East	4
Milford: Hakin	3
Milford: Hubberston	4
Milford: North	5

Milford: West	3
Narberth	6
Newport	4
Neyland: East	2
Neyland: West	3
Pembroke Dock: Llanion	5
Pembroke Dock: Market	2
Pembroke Dock: Pennar	1
Pembroke: Monkton	1
Pembroke: St. Mary North	1
Pembroke: St. Mary South	3
Pembroke: St. Michael	2
Penally	5
Rudbaxton	3
St. Dogmaels	4
Pembrokeshire Coast National Park	
Carew	2
Dinas Cross	1
Llangwm	10
Llanrhian	1
Manorbier	7
Saundersfoot	2
Solva	6
St. David's	2
St. Ishmael's	5
Tenby: North	1
Tenby: South	3
The Havens	1

1.2 Fluvial Flood risk

Pembrokeshire has a number of main watercourses including the River Cleddau, River Solva, River Gwaun, River Teifi and River Nevern. These watercourses are classified as NRW Main Rivers. Maps showing the extent of the flood outlines from the NRW FMfP – Rivers in Pembrokeshire are provided in Appendix C2.

The River Cleddau is the largest watercourse in Pembrokeshire and rises in the Preseli Mountains. The River Cleddau flows in a southerly direction and has three main tributaries throughout its course. The Western Cleddau joins to the west of Landshipping. Further south the Cresswell River and Carew River converge (to form the Black Mixen Pool) and join the River Cleddau to the west of Lawrenny Village. The River Cleddau flows into the Milford Haven Estuary, and passes through Pembrokeshire Coast National Park, before discharging into the sea. The tidal limit of the Western Cleddau reaches inland as far as Haverfordwest.

Flood Zones 2 and 3 are present in the upper reaches of the Cleddau although the extent of these zones is within the watercourse corridor. In the middle and lower reaches of the River Cleddau, where rivers converge and enter Pembrokeshire Coast National Park, the extent of the Flood Zones are greater and extend into settlements such as Haverfordwest and Pembroke Dock. NRW fluvial tidal defences are present along the River Cleddau in Haverfordwest. Fluvial flood defences have a standard protection of 1 in 100 years, and the area behind the defences in Haverfordwest are classified as a TAN-15 Defended Zone.

The River Ritec is sourced near St Florence, in the south of Pembrokshire, and flows in an easterly direction before discharging via a culvert at Tenby South Beach. Flood Zones 2 and 3 extend into the west of Tenby, within Pembrokeshire Coast National Park, overlapping areas of existing commercial development. There are no NRW flood defences present.

Pembroke River is sourced at Mill Pond and discharges into the Milford Haven Estuary. Its flood extents are present in Pembroke; however, developed areas are situated outside of the Flood Zone.

The River Solva is located in the north west of Pembrokeshire and is sourced southeast of Croesgoch, flowing southwesterly and entering Pembrokeshire Coast National Park just east of the village of Caerfarchell, before reaching St Brides Bay. The River Alun is located in a similar location, rising near Tretio Common within the Pembrokeshire Coast National Park and flowing southwester via St Davids, and discharging into St Brides Bay.

The River Gwaun is located in the north of Pembrokeshire and rises in Pembrokeshire Coast National Park, flowing in a north westerly direction before discharging into the sea at Fishguard. The River Nevern is also located in the north of Pembrokeshire, sourced to the north of the village of Crymych. It flows in a north westerly direction to the estuary at Newport before flowing into the sea.

Fluvial flood extents in Pembrokeshire, including Pembrokeshire Coast National Park, are fairly refined, generally remaining within close proximity to watercourses.

Schemes involving localised drainage improvement and Property Flood Resilience (PFR) measures have not been included. Information on any local authority managed or private flood defences was not available at the time of writing.

Fluvial Flood Risk & TAN-15

Flood defences found in Haverfordwest are maintained by NRW. As a result of these flood defences, parts of the fluvial floodplain are categorised as a TAN-15 Defended Zone. Therefore, all forms of development are possible subject to satisfying the requirements of the Justification Tests. The flood defences have a 1% AEP event standard of protection, making areas behind the flood defences favourable to the requirements of TAN-15. New highly vulnerable development within undefended areas of Flood Zone 3 are unlikely to be possible, as Flood Zone 3 is not suitable for highly vulnerable development. Less vulnerable development shall only be possible subject to site specific assessment and detailed flood modelling shall be required. Due to lack of protection from NRW flood defences, any proposed development is likely to require flood mitigation considerations and may be more challenging to meet TAN-15 requirements.

1.3 Tidal flood risk

Areas within Pembrokeshire Coast National Park are predominantly those at risk of tidal flooding. Newport Bay, Fishguard Bay, Milford Haven, and west of Carmarthen Bay (near Tenby) are potential sources of tidal flooding around the coastline of Pembrokeshire. Tidal flooding is most likely to occur during storm surge conditions that is charactersied by wind-driven waves and low atmospheric pressure and high spring tides. In areas protected from flooding by sea defences, tidal flooding can occur as a result of a breach in the defences, failure of a mechanical barrier or overtopping of defences.

The NRW FMfP – Sea, shown in Appendix C2, identifies that Tenby, Pembroke, Haverfordwest, and Milford Haven are the main areas at risk of flooding from the sea within Pembrokshire, due to their overlap into Flood Zone 3. NRW tidal / fluvial flood defences are present in Haverfordwest. Tidal flood defences have a standard protection of 1 in 200 years.

Tides may affect flooding much further inland during extreme events, especially if sea levels rise as predicted in the future.

Tidal Flood Risk & TAN-15

Flood defences found along the tidal rivers of Pembrokeshire, including Pembrokeshire Coast National Park, are maintained by NRW. As a result of these flood defences part of the tidal floodplain in Haverfordwest is categorised as TAN-15 Defended Zone. Therefore, all forms of development are possible if the requirements of the Justification Test can be satisfied.

It is unlikely that undefended areas within Flood Zone 3 will allow highly vulnerable development. In these tidal areas it is known that the application of climate change results in a large tidal flood extent with significant depths of flooding. This increase in flood risk may make it difficult to meet the requirements of the acceptability criteria of TAN-15.

Less vulnerable development should only be considered in Flood Zone 3 subject to the application of the Justification Test and acceptability of consequences. It is likely that flood mitigation measures will be required for developments in these areas. Development in these areas shall be subject to site specific assessment and detailed modelling shall be required. Opportunities for highly vulnerable development should be located in areas outside Flood Zone 3.

1.4 Surface Water flood risk

Maps showing the extent of flood outlines for the surface water in the Pembrokeshire authority area are provided in Appendix C2.

The NRW FMfP – Surface Water and Small Watercourses shows surface water flooding is predicted to predominantly follow topographical flows paths of existing watercourses or dry valleys in rural parts of the county.

There are localised areas at risk of surface water flooding and small watercourses in Tenby and Pembroke, although generally the Flood Zone 3 extent avoids developed areas. In urban areas surface water flow paths are shaped by urban infrastructure and topographic depressions. Surface water is channeled by roads around the city, pooling in areas of wider open spaces and topographic depressions.

Surface Water Flood Risk & TAN-15

All development types are permissible in Flood Zone 2 and 3 provided the acceptability criteria in TAN-15 can be met. Development in these areas shall be subject to site specific assessment which should consider flow pathways, potential ground levelling for topographic depressions, and how SuDS can be used to manage surface water flows across a development site. Developers should consult the LLFA for any specific knowledge related to the surface water and small watercourse flooding at a proposed development site. Due to the localised surface water flooding in Tenby and Haverfordwest, developments should be located outside of Flood Zone 2 and 3 where possible.

1.5 Groundwater flood risk

Bedrock geology across Pembrokeshire is varied throughout the county, and comprised of mudstone, sandstone, siltstone, and limestone. Limestone and sandstone tend to have a high porosity and allows for storage and movement of groundwater, whilst mudstone tends to have high porosity and low permeability. As a result of the limestone composition in areas throughout Pembrokeshire, upward percolation of groundwater and subsequent flooding should be considered in these areas.

Records show that alluvium, and glacial sand and gravel are present throughout Pembrokeshire. Alluvium, comprised of clay silt and sand, is relatively permeable. Groundwater flooding could present a local risk to some areas. Maps showing the indicative Groundwater flood depth in Pembrokeshire are provided in Appendix C2.

The north east of Pembrokeshire (Moylgrove), within Pembrokshire Coast National Park, generally has groundwater that is between 0.025m and 0.5m below the ground surface. Further towards the coastline the groundwater flood depths increase, and are predicted to be at least 5m below the ground surface. In the south of Pembrokeshire, including areas of Pembrokshire Coast National Park (south of Hill Mountain), groundwater is predominantly between 0.025m and 5m below ground level. However, there are some areas that are shown to have groundwater levels either at or very near (within 0.025m) to the ground surface. This indicates that there is a greater risk of groundwater flooding in these areas. For the remaining areas of the county, groundwater levels are largely at least 5m below the ground surface.

Groundwater Flood Risk & TAN-15

TAN-15 does not specify any requirements for groundwater flood risk, other than the risk of groundwater flooding should be considered as part of an FCA. However, it would be advisable to locate developments away from areas where groundwater is less than 0.025m below the ground surface without further groundwater monitoring and detailed assessment being undertaken.

1.6 Sewer flooding

DCWW is responsible for sewer infrastructure across the study area, and they record incidents of sewer flooding across Wales.

DCWW have provided detail of historic incidents and active risk areas. Historical flooding incidents are recorded relating to public foul, combined, or surface water sewers. These records display the number of properties that experience internal and/or external flooding. A summary of the spatial distribution of historic sewer flooding by electoral ward is summarised in Table *1-2* of Section 1.1. This data shows that the ward with the highest number of flood incidents are Llangwm and Haverfordwest: Castle, with 10 incidents of sewer flooding.

DCWW are working to reduce the number of sewer flooding incidents by investing in maintenance and improvements to the sewer network.

DCWW has not provided any information regarding the predicted flood risk from the sewerage network.

Flood Risk from Sewers & TAN-15

TAN-15 does not specify any requirements for sewer flood risk, other than that it should be considered as part of an FCA. The LLFA and DCWW should be consulted to provide specific advice on any known history of sewer flooding and any remedial action taken.

1.7 Flooding from artificial sources

Artificial sources of flooding include reservoirs upstream of the county which pose a flood risk to the Pembrokeshire area. Maps showing the potential flood risk from reservoirs are provided in Appendix C2. The reservoirs which pose a flood risk to the county are:

- Pont-Y-Cerbyd Reservoir
- Rosebush (Prescelly)
- Llys-y-Fran
- Carew Mill Pond
- Skim Ponds
- Crude Impounding Basin

- Texaco West
- Castle Pond
- Mill Pond
- West Orielton
- Bosherston Lake (AKA Stackpole)

The NRW FRAW Flood Risk from Reservoirs mapping indicates that a small area to the north west of Milford Haven and an area of Pembroke is at most risk of flooding due to a reservoir breach or overtopping. The Flood Risk from Reservoirs throughout the county is otherwise confined to watercourses such as the River Cleddau.

The failure of a reservoir can cause catastrophic damage due to the sudden release of large volumes of water. Reservoirs in the UK have an excellent safety record and NRW is the enforcement authority for the Reservoirs Act 1975 in England and Wales. All large reservoirs must be inspected and supervised by reservoir panel engineers. It is assumed that these reservoirs are regularly inspected, and essential safety work is carried out. Therefore, these reservoirs present minimal risk.

1.8 Changes on understanding of flood risk

FCERM Capital Investment

Pembrokeshire County Council have the **Ritec Culvert Assessment, Tenby** which is undergoing appraisal between 2022-2024. It is programmed to undertake construction of this project from 2025.

Future FMfP improvements

The locations listed below are covered by existing detailed NRW flood models which are expected to be incorporated into the Flood Map for Planning through future routine updates. Where NRW have provided an indication of timescales for these updates, this is provided in brackets.

- Begelly (date unknown)
- Haverfordwest (date unknown)
- Lower Gwaun (date unknown)

1 Appendix D1 – Swansea Flood Risk Review

1.1 Historic flooding

The City and County of Swansea Council has a history of recorded flood events caused by multiple sources if flooding. Significant flood events within the City and County of Swansea Council authority area (which have been taken from NRW's recorded flood outlines dataset and City and County of Swansea Council records and reports on historic flood incidents) are recorded below in Table *1-1*.

No records of groundwater flooding or flooding from artificial sources were made available at the time of writing.

A summary of the spatial distribution of historic sewer flooding incidents by electoral ward is summarised in Table *1-2*.

Table 1-1 Flooding Incidents by year

Year of flood event	Location	Flood Incident
December 1979	Lliw	Properties on A484 Gorseinon Road and B4296 Victoria Road were affected. Properties affected: Windsor Terrace, Whittington Terrace, Gwalia Crescent, Chapel street, South View, Bryn Terrace, Gorseinon Road, Spring Terrace and Eynon street
	Tawe	Extensive flooding along Tawe valley particularly downstream of Ynysmeudwy. Areas particularly affected include Pontardawe industrial estate, Herbert Street, Pontardawe, Inco Nickel Works at Clydach. Flooding to an area north of Capel Road and Pontardawe road likely to be caused by poor road drainage or culverts been inadequate.
October 1998	Ynysforgan	Caravan Park and traveller site flooded from main and non-main rivers via private embankment.
	Clydach	Gardens and playing fields flooded. Main roads linking communities served.
February 2020	Swansea	Approximately 100 properties were affected by internal flooding as the result of Storm Dennis with the following areas considered the worst affected communities: Birchgrove, Clydach, Gorseinon, llansamlet, Penllergaer and many other parts of Swansea.

Table 1-2 Sewer Flooding Incidents by Electoral Ward

Electoral Ward	Number of sewer flooding incidents
Bishopston	3
Bonymaen	4
Castle	5
Clydach	4
Cockett	10
Cwmbwrla	9
Cwmllynfell	1
Dunvant	5
Fairwood	8
Gorseinon	9

Gower	14
Gowerton	5
Killay North	1
Killay South	2
Kingsbridge	6
Landore	4
Llangyfelach	1
Llansamlet	17
Lower Loughor	2
Morriston	15
Mynyddbach	2
Newton	5
Oystermouth	9
Penclawdd	10
Penderry	3
Penllergaer	1
Pennard	5
Penyrheol	3
St. Thomas	16
Sketty	4
Townhill	1
Uplands	9
Upper Loughor	6
West Cross	5

1.2 Fluvial flood risk

The River Tawe and the River Loughor are the main watercourses in the City and County of Swansea Council Borough. These watercourses are classified as NRW Main Rivers. Maps showing the extent of the flood outlines from the NRW FMfP – Rivers in Swansea are provided in Appendix D2.

The River Tawe rises in the Brecon Beacons National Park, above Pen-y-Cae and enters the City and County of Swansea Council boundary from the east, flowing through Clydach in a southerly direction. The River Tawe flows through Swansea City Centre and discharges into the sea at Swansea Bay. Tributaries of the River Tawe include the Lower and Upper Clydach Rivers, converging at Pontardawe and Clydach, in the eastern vicinity of the county. Flood Zone 3 covers an extent to the east of Clydach and extends downstream into Morriston (Swansea Enterprise Park), a large commercial area of Swansea. Areas to the west of the River Tawe in Swansea are also located within the floodplain. NRW fluvial flood defences, with a standard protection of 1 in 100 years, are present along the River Tawe, in Clydach and to the south at Swansea Enterprise Park. Swansea Vale Enterprise Park forms part of the TAN-15 Defended Zone as a result of the flood defences.

The River Loughor is sourced in the Black Mountains and enters the City and County of Swansea Council to the north of Pontarddulais. The River Loughor flows in a southerly direction to meet the sea. The main tributaries of the River Loughor are located in the neighboring county of Carmarthenshire and converge with the River Loughor in Ammanford. The Afon Marlas and Afon Lash join to the north of Ammanford, and the River Amman to the south. The River Gwili joins the River Loughor to the southwest of Pontarddulais. In the lower reaches areas of Flood Zone 3 are extensive, and areas in and around Pontarddulais are located within the floodplain. NRW fluvial/tidal flood defences are located in the northwest of Pontarddulais, and to the west of Loughor along the River Loughor. These fluvial flood defences have a standard protection of 1 in 100 years, and as a result a significant area of Pontarddulais is categorised as a TAN-15 Defended Zone.

The Afon Lliw is located to the south of Loughor and is sourced from the Upper and Lower Lliw Reservoirs which are located in the north of the county. The Afon Lliw flows in a south westerly direction to meet the River Loughor south of Loughor and discharges into the sea. The main tributary is the Afon Lian which joins to the north of Gowerton.

Where the Afon Lliw and Afon Lian meet, Flood Zone 3 extends in, and to the south of, Gorseinon. NRW fluvial flood defences are located along both river banks of the River Lliw in Gorseinon, and along the River Lian to the north of Gowerton. These fluvial flood defences have a standard protection of 1 in 100 years, and areas located behind these defences are categorised as TAN-15 Defended Zones.

Schemes involving localised drainage improvement and Property Flood Resilience (PFR) measures have not been included. Information on any local authority managed or private flood defences was not available at the time of writing.

Fluvial Flood Risk & TAN-15

Flood defences found along the River Tawe, River Loughor, Afon Lliw, and Afon Lian are maintained by NRW. As a result of these flood defences, parts of the fluvial floodplain are categorised as a TAN-15 Defended Zone. Therefore, all forms of development are possible subject to satisfying the requirements of the Justification and Acceptability Tests. The flood defences have a 1% AEP event standard of protection, making areas behind the flood defences favourable to the requirements of TAN-15. However, Defended zones such as those in the Lower Swansea valley/Swansea Vale, have been shown to not comply with the acceptability tests.

There are very few existing settlements located within Flood Zone 3 without defences against fluvial flood risk. Though there are a number of established and allocated regeneration areas which are undefended. New highly vulnerable development within undefended areas of Flood Zone 3 are unlikely to be possible, as Flood Zone 3 is not suitable for highly vulnerable development. Less vulnerable development shall only be possible subject to site specific assessment and detailed flood modelling shall be required. Due to the lack of protection from NRW flood defences, any proposed development is likely to require flood mitigation considerations and may be more challenging to meet TAN-15 requirements.

1.3 Tidal flood risk

Swansea Bay and Carmarthen Bay / Llanrhidan Sands (River Loughor estuary) are the primary sources of tidal flooding to the City and County of Swansea area. Tidal flooding is most likely to occur during storm surge conditions that is characterised by wind-driven waves and low atmospheric pressure and high spring tides. In areas protected from flooding by sea defences, tidal flooding can occur as a result of a breach in the defences, failure of a mechanical barrier or overtopping of defences.

The NRW FMfP – Sea, shown in Appendix D2, identifies that the River Loughor, and Afon Lliw are tidally influenced rivers; therefore, areas in the lower reaches are the main areas at risk of flooding from the sea. Areas of Swansea city are also at risk of tidal flooding due to its partial location in Flood Zone 3. In the west of the county, Penclawwdd and Crofty are located within Flood Zone 3; although, tidal flood defences are present in front of developed areas. The flood defences have a design standard of protection of 1 in 200 years. The flood defences form part of the TAN-15 Defended Zone for the sea in these areas.

Tides may affect flooding much further inland during extreme events, especially if sea levels rise as predicted in the future.

Tidal Flood Risk & TAN-15

Flood defences found along the tidal rivers in Swansea County are maintained by NRW. As a result of these flood defences, part of the tidal floodplain in the west (Crofty and Pen-clawdd) are categorised as TAN-15 Defended Zones. Therefore, all forms of development are possible if the requirements of the Justification and acceptability test can be satisfied.

It is unlikely that undefended areas within Flood Zone 3 (including Swansea city centre) will allow highly vulnerable development. In these tidal areas it is known that the application of climate change results in a large tidal flood extent with significant depths of flooding. This increase in flood risk may make it difficult to meet the requirements of the acceptability criteria of TAN-15.

No tidal TAN-15 Defended Zones are present in Swansea, making highly vulnerable development in these areas challenging. Less vulnerable development should only be considered in Flood Zone 3 subject to application of the Justification test and acceptability of consequences. It is likely that flood mitigation measures will be required for developments in these areas. Development in these areas shall be subject to site specific assessment and detailed modelling shall be required. Opportunities for highly vulnerable development should be located in areas outside Flood Zone 3.

1.4 Surface Water flood risk

Maps showing the extent of the flood outlines for the surface water in the City and County of Swansea Council authority area are provided in Appendix D2.

The NRW FMfP – Surface Water and Small Watercourses shows surface water flooding is predicted to predominantly follow topographical flow paths of existing watercourses or dry valleys in rural parts of the county.

The City of Swansea has the greatest risk of surface water and small watercourse flooding, with some localised areas located in Flood Zone 3. Flooding in Swansea is predicted to occur within urban areas, including road infrastructure across the city. Areas north of Swansea and Gorseinon are located within Flood Zone 3, as a result of urbanisation, with predicted areas of surface water ponding.

Surface water flow paths within urban areas such as Swansea and Gorseinon are shaped by urban infrastructure and topographic depressions. Surface water is channelled by the roads around the city, pooling in areas of wide open spaces and topographic depressions.

Surface Water Flood Risk & TAN-15

All development types are permissible in Flood Zone 2 and 3 provided the acceptability criteria in TAN-15 can be met. Development in these areas shall be subject to site specific assessment which should consider flow pathways, potential ground levelling for topographic depressions, and how SuDS can be used to manage surface water flows across a development site. Developers should consult the LLFA for any specific knowledge related to surface water and small watercourse flooding at a proposed development site. Due to the localised surface water flooding in the main settlement of Swansea, developments should be located outside of Flood Zone 2 and 3 where possible.

1.5 Groundwater flood risk

Bedrock geology within the south of Swansea County is varied but predominantly comprised of limestone with areas of sandstone and mudstone. In the north of the county the bedrock geology is comprised of South Wales Upper Coal Measures – mudstone, sandstone, siltstone, and coal. Limestone and sandstone tends to have a high porosity and allows for storage and movement of groundwater, whilst mudstone tends to have low porosity and permeability. As a result of the limestone composition in the south, and

sandstone composition in the north of the county, upward percolation of groundwater and subsequent flooding should be considered in these areas.

Areas of superficial deposits in Swansea are predominantly comprised of Till with some areas of alluvium in close proximity to watercourses near to Swansea and The Gower. Till and alluvium are both relatively permeable. Superficial deposits to the south of Swansea along the coastline are comprised of peat which has a medium to low permeability. The variation of superficial deposits throughout the Swansea County suggests that groundwater flooding could present a localised risk to some areas. Maps showing the indicative Groundwater flood depth in Swansea County are provided in Appendix D2.

The majority of the county has groundwater that is at least 5m below the ground surface or lower. In the north of the county where there are rural areas and valley characteristics, there are some areas that have groundwater levels either at or within 0.025m of the ground surface. Along the coastline in the southern region of the county, and particularly between Swansea and Mumbles, groundwater levels are also at or very near to (within 0.025m) the ground surface; this indicates that there is a greater risk of groundwater flooding in these areas.

Groundwater Flood Risk & TAN-15

TAN-15 does not specify any requirements for groundwater flood risk, other than the risk of groundwater flooding should be considered as part of an FCA. However, it would be advisable to locate developments away from areas where groundwater is less than 0.025m below the ground surface without further groundwater monitoring and detailed assessment being undertaken.

1.6 Sewer flooding

DCWW is responsible for sewer infrastructure across the study area, and they record incidents of sewer flooding across Wales.

DCWW have provided detail of historic incidents and active risk areas. Historical flooding incidents are recorded relating to public foul, combined, or surface water sewers. These records display the number of properties that experience internal and/or external flooding. A summary of the spatial distribution of historic sewer flooding incidents by electoral ward is summarised in Table *1-2* of Section 1.1. This data shows that the ward with the highest number of flood incidents is Llansamlet with 17 incidents of sewer flooding. Gower, Morriston, and Sketty also have between 14-16 recorded incidents of flooding.

DCWW are working to reduce the number of sewer flood incidents by investing in maintenance and improvements to the sewer network.

DCWW has not provided any information regarding the predicted flood risk from the sewerage network.

Flood Risk from Sewers & TAN-15

TAN-15 does not specify any requirements for sewer flood risk, other than that it should be considered as part of an FCA. The LLFA and DCWW should be consulted to provide specific advice on any known history of sewer flooding and any remedial action taken.

1.7 Flooding from artificial sources

Artificial sources of flooding include reservoirs upstream of the county which pose a flood risk to the City and County of Swansea Council area. Maps showing the potential flood

risk from reservoirs are provided in Appendix D2. The reservoirs which pose a flood risk to the county are:

- Lliw Lower & Upper
- Nant-y-Fendrod (Lake Fendrod)
- Brynmill Park
- Fairwood

The NRW FRAW Flood Risk from Reservoirs mapping indicates that areas to the east of Loughor and north east of Swansea are identified as the areas most affected due to a reservoir breach or overtopping.

The failure of a reservoir can cause catastrophic damage due to the sudden release of large volumes of water. Reservoirs in the UK have an excellent safety record, and NRW is the enforcement authority for the Reservoirs Act 1975 in England and Wales. All large reservoirs must be inspected and supervised by reservoir panel engineers. It is assumed that these reservoirs are regularly inspected, and essential safety work is carried out. Therefore, these reservoirs present minimal risk.

1.8 Changes on understanding of flood risk

FCERM Capital Investment

The City and County of Swansea Council has a number of current FCERM investment projects that are likely to go into construction in the next 5 years (e.g. the Mumbles Coastal Protection Scheme). However, there are also 2 development and construction works that will need to go ahead within the next 10 years. These are for the River Tawe which is one of the main rivers in the county, and for Swansea Tidal Defences.

The City and County of Swansea have a pipeline of schemes which are supported by Welsh Government FCERM Grant awards to undertake Business Cases for the following flood affected areas which have incurred significant and repeated flooding from local sources/surface water flooding.

- Brockhole Stream Blackpill;
- Birchgrove Road Llansamlet;
- Sway Road/Llys Ddol Morriston;
- Capel Road Clydach;
- Kingrosia Park Clydach;
- Killay Square Killay; and
- West Street Gorseinon.

It is anticipated that these areas will required significant capital investment to reduce flood risk in these communities with the timing for construction being subject to available funding.

The locations listed below are covered by existing detailed NRW flood models which are expected to be incorporated into the Flood Map for Planning through future routine updates. Where NRW have provided an indication of timescales for these updates, this is provided in brackets.

- Penclawdd/Crofty (date unknown)
- Fendrod Bran (date unknown)
- Pontardulais (date unknown)
- Swansea Bay Tidal (date unknown)
- Lower Swansea Valley/Tawe Vale (date unknown)