Telford & Wrekin Level 1 Strategic Flood Risk Assessment

Final Report

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Telford & Wrekin COUNCIL

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Revision History

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Contract

This report describes work commissioned by Gavin Ashford on behalf of Telford & Wrekin Council, by a letter dated 4th September 2020. Hannah Booth and Ed Mumford of JBA Consulting carried out this work.

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Purpose

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Acknowledgements

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- Telford & Wrekin Council
- Environment Agency and
- Severn Trent Water

Executive summary

This report provides a comprehensive and robust evidence base on flood risk issues to support the production of the new Local Plan. This is a Level 1 Strategic Flood Risk Assessment (SFRA) and it will be used to inform decisions on the location of future development and the preparation of sustainable policies for the long-term management of flood risk.

Introduction

This Strategic Flood Risk Assessment (SFRA) provides an update to the 2007 Level 1 SFRA. This study provides a comprehensive and robust evidence base to support the new Telford & Wrekin Council Local Plan. The key objectives are:

- To update the Council's 2007 SFRA, considering the most recent policy and legislation in the National Planning Policy Framework (2019).
- To collate and analyse the latest available information and data for current and future (i.e. climate change) flood risk from all sources, and how these may be mitigated.
- To inform decisions in the emerging Local Plan, including the selection of development sites and planning policies.
- To provide evidence to support the application of the Sequential Test for the allocation of new development sites, to support the Council's preparation of the Local Plan.
- To provide a comprehensive set of maps presenting flood risk from all sources that can be used as evidence base for use in the emerging Local Plan.
- To provide advice for applicants carrying out site-specific Flood Risk Assessments and outline specific measures or objectives that are required to manage flood risk.

Summary of flood risk in Telford & Wrekin Borough

- Historic flooding incident records from Telford & Wrekin Council show the most affected areas are the southern areas of the Borough, particularly around the corridor along Ironbridge gorge. There has also been historic flooding recorded along the River Tern in the northwest of the catchment. Recently, Newport and some high-risk hotspots in Ketley have experienced severe flood events.
- The main rivers associated with fluvial flooding are the River Severn, which flows along the southern edge of the borough through the Ironbridge Gorge, the Coalbrook, which is a Rapid Response Catchment, and the River Tern, which flows through the north-west through Longdon-on-Tern and Marsh Green. There is also a history flooding of agricultural land associated with the River Strine and its tributaries.
- Owing to the low-lying nature of the land, large parts of the north of the Borough are susceptible to surface water flooding, although this predominantly affects fields and moorland. Within the Telford urban area, there are many areas susceptible to surface water flooding during an extreme event, including significant flows from Middle Pool down through the Wormbridge area, from Ketley through to Overdale and from Lawley Common through Lawley. Owing to the hilly terrain, there are however numerous significant surface water flows across the urban area and the Environment Agency's Risk of Flooding from Surface Water map should be consulted for full details.
- Telford & Wrekin has a long history of coal mining. Parts of Telford are subject to flooding from mine water emerging and some waterbodies' water quality are

affected by the discharge of polluting mine water. All areas with shallow mine workings have the potential to have mine water within them; however, the risk of high mine water and mine water emergence is more likely in lower lying areas with shallow workings, mine entries, and/or drainage features. The presence of shallow mine workings is also likely to impact the suitability of infiltration SuDS measures for particular sites.

- At the time of drafting this Level 1 SFRA, records of sewer flooding have not been provided by Severn Trent Water for inclusion within the SFRA.
- Areas at risk of flooding are likely to become at increasing risk in the future and the frequency of flooding will increase in such areas as a result of climate change. Flood extents will increase; in some locations, this may not be by very much, but flood depth, velocity and hazard may have more of an impact due to climate change. It is recommended that the Council works with other Risk Management Authorities to review the long-term sustainability of existing and new development in these areas when developing climate change plans and strategies for the Borough.
- In general, most of the southern part of the Borough is at negligible risk of groundwater flooding. The majority of the lower lying land north of Telford is at moderate risk of groundwater flooding with two small areas (around Arelston and Church Aston) identified as high risk.
- There are no navigable canals within Telford & Wrekin Borough.
- 12 reservoirs pose a potential risk of flooding to areas in the Borough. The level and standard of inspection and maintenance required by a Supervising Panel of Engineers under the Act means that the risk of flooding from reservoirs is very low.

How to use this report

Planners

The SFRA provides recommendations regarding all sources of flood risk in Telford & Wrekin Borough, which can be used to inform policy on flood risk within the Local Plan. This includes how the cumulative impact of development should be considered.

It provides the latest flood risk data and guidance to inform the Sequential Test and provides guidance on how to apply the Exception Test. The Council can use this information to apply the Sequential Test to strategic allocations and identify where the Exception Test will also be needed.

The SFRA provides guidance for developers, which can be used by development management staff to assess whether site specific Flood Risk Assessments meet the required quality standard.

Developers

For sites that are not strategic allocations, developers will need to use this SFRA to help apply the Sequential Test. For all sites, whether strategic allocations or windfall sites, developers will need to apply the Exception Test and use information in a site-specific Flood Risk Assessment to inform this test at planning application stage.

When assessing sites not identified in the Local Plan (windfall sites), developers should use evidence provided in this SFRA to apply the Sequential Test as well as providing evidence to show that they have adequately considered other reasonably available sites.

This SFRA provides guidance for the application of the Sequential and Exception Tests at a site level and for detailed site-specific Flood Risk Assessments.

This is a strategic assessment and does not replace the need for site-specific Flood Risk Assessments where a development is either within Flood Zones 2 or 3, greater than a hectare in Flood Zone 1, or where a significant risk from another source (such as surface water) has been identified. In addition, a Surface Water Drainage Strategy will be needed for all major developments in any Flood Zone to satisfy the Lead Local Flood Authority (LLFA).

Developers can use the information in this SFRA, alongside site-specific research to help scope out what additional work will be needed in a detailed Flood Risk Assessment. To do this, they should refer to Chapter 5, Appendix A (Mapping) and Appendix B (Data sources used in the SFRA). At the planning application stage, developers may need to undertake more detailed hydrological and hydraulic assessments of the watercourses to verify flood extent (including latest climate change allowances, last updated by the Environment Agency in 2020), inform master planning and prove, if required, whether the Exception Test can be passed. As part of the Environment Agency's updated guidance on climate change, which must be considered for all new developments and planning applications, developers will need to undertake a detailed assessment of climate change as part of the planning application process when preparing FRAs.

Developers need to ensure that new development does not increase surface water runoff from a site. Chapter 9 provides information on the surface water drainage requirements of Telford & Wrekin Council as the LLFA. Sustainable Drainage Systems should be considered at the earliest stages that a site is developed which will help to minimise costs and overcome any site-specific constraints.

Flood Risk Assessments will need to identify how flood risk will be mitigated to ensure the development is safe from flooding. In high risk areas, the Flood Risk Assessment will also need to consider emergency arrangements, including how there will be safe access and egress from the site.

Any developments located within an area protected by flood defences and where the standard of protection is not of the required standard (either now or in the future) should be identified and the use of developer contributions considered to fund improvements.

Neighbourhood plans

The SFRA provides information on the sources of flooding and the variation in the risk across the borough, which organisations are involved in flood risk management and their latest strategic plans, current plans for major flood defences, the requirements for detailed Flood Risk Assessments and to inform the site selection process.

Neighbourhood planners can use this information to assess the risk of flooding to sites within their community, using Chapter 5, the sources of flooding in Telford & Wrekin Borough and the flood mapping in the appendices. The SFRA will also be helpful for developing community level flood risk policies in high flood risk areas.

These maps highlight on a broadscale where flood risk from fluvial, surface water, groundwater and the effects of climate change are most likely. These maps are useful to provide a community level view of flood risk but may not identify if an individual property is at risk of flooding or model small scale changes in flood risk. Local knowledge of flood mechanisms will need to be included to complement this broadscale mapping. Similarly, all known recorded historical flood events for the borough are listed in Section 5.1 and this can be used to supplement local knowledge regarding areas worst hit by flooding. Ongoing and proposed flood alleviation schemes planned by Telford & Wrekin Council are outlined in Section 6.4 and Section 8.4 discusses mitigations, resistance and resilience measures which can be applied to alleviate flood risk to an area.

A cumulative impact assessment has been carried out which has identified which catchments in Telford & Wrekin borough are more sensitive to the cumulative impact of development and where more stringent policy regarding flood risk is recommended. Any development in these areas should seek to contribute to work that reduces wider flood risk in those catchments.

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Abbreviations and definitions

Term	Definition
1D model	One-dimensional hydraulic model
2D model	Two-dimensional hydraulic model
AEP	Annual Exceedance Probability – The probability (expressed as a percentage) of a flood event occurring in any given year.
Brownfield	Previously developed parcel of land
CC	Climate change - Long term variations in global temperature and weather patterns caused by natural and human actions.
CDA	Critical Drainage Area - A discrete geographic area (usually a hydrological catchment) where multiple and interlinked sources of flood risk (surface water, groundwater, sewer, Main River and/or tidal) cause flooding in one or more Local Flood Risk Zones during severe weather thereby affecting people, property or local infrastructure.
CFMP	Catchment Flood Management Plan- A high-level planning strategy through which the Environment Agency works with their key decision makers within a river catchment to identify and agree policies to secure the long-term sustainable management of flood risk.
CIRIA	Construction Industry Research and Information Association
Cumecs	A measure of flow rate. One cumec is shorthand for cubic metre per second; also, m^3/s.
Defra	Department for Environment, Food and Rural Affairs
Design flood	This is a flood event of a given annual flood probability, which is generally taken as "fluvial (river) flooding likely to occur with a 1% annual probability (a 1 in 100 chance each year)"
DTM	Digital Terrain Model
DPD	Development Plan Document
EA	Environment Agency
EU	European Union
Exception Test	Set out in the NPPF, the Exception Test is a method used to demonstrate that flood risk to people and property will be managed appropriately, where alternative sites at a lower flood risk are not available. The Exception Test is applied following the Sequential Test.
FCERM	Flood and Coastal Erosion Risk Management
FEH	Flood Estimation Handbook
Flood defence	Infrastructure used to protect an area against floods as floodwalls and embankments; they are designed to a specific standard of protection (design standard).
Flood Map for Planning	The Environment Agency Flood Map for Planning (Rivers and Sea) is an online mapping portal which shows the Flood Zones in England. The Flood Zones refer to the probability of river and sea flooding, ignoring the presence of defences and do not account for the possible impacts of climate change.
Flood Risk Area	An area determined as having a significant risk of flooding in accordance with guidance published by Defra and WAG (Welsh Assembly Government).
Flood Risk Regulations	Transposition of the EU Floods Directive into UK law. The EU Floods Directive is a piece of European Community (EC) legislation to specifically address flood risk by prescribing a common framework for its measurement and management.

Floods and Water Management Act	Part of the UK Government's response to Sir Michael Pitt's Report on the Summer 2007 floods, the aim of which is to clarify the legislative framework for managing surface water flood risk in England.
FWA	Flood Warning Area
Fluvial Flooding	Flooding resulting from water levels exceeding the bank level of a River
FRA	Flood Risk Assessment - A site-specific assessment of all forms of flood risk to the site and the impact of development of the site to flood risk in the area.
FRM	Flood Risk Management
FRMP	Flood Risk Management Plan
FSA	Flood Storage Area
FWMA	Flood and Water Management Act
FWS	Flood Warning System
GI	Green Infrastructure – a network of natural environmental components and green spaces that intersperse and connect the urban centres, suburbs, and urban fringe
Greenfield	Undeveloped parcel of land
Ha	Hectare
IDB	Internal Drainage Board
Indicative Flood Risk Area	Nationally identified flood risk areas based on the definition of 'significant' flood risk described by Defra and WAG.
JBA	Jeremy Benn Associates
LFRMS	Local Food Risk Management Strategy
LIDAR	Light Detection and Ranging
LLFA	Lead Local Flood Authority - Local Authority responsible for taking the lead on local flood risk management
LPA	Local Planning Authority
m AOD	metres Above Ordnance Datum
Main River	A watercourse shown as such on the Main River Map, and for which the Environment Agency has responsibilities and powers
NFM	Natural Flood Management
NPPF	National Planning Policy Framework
NPPG	National Planning Practice Guidance
NRD	National Receptor Database
NRIM	National Reservoir Inundation Mapping
NVZs	Nitrate Vulnerability Zones
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
Pitt Review	Comprehensive independent review of the 2007 summer floods by Sir Michael Pitt, which provided recommendations to improve flood risk management in England.
Pluvial flooding	Flooding as a result of high intensity rainfall when water is ponding or flowing over the ground surface (surface runoff) before it enters the underground drainage network or watercourse or cannot enter it because the network is full.

RBMP	River Basin Management Plan
RFCC's	Regional Flood and Coastal Committee
Resilience Measures	Measures designed to reduce the impact of water that enters property and businesses; could include measures such as raising electrical appliances.
Resistance Measures	Measures designed to keep flood water out of properties and businesses; could include flood guards for example.
Return Period	Is an estimate of the interval of time between events of a certain intensity or size, in this instance it refers to flood events. It is a statistical measurement denoting the average recurrence interval over an extended period.
Riparian owner	A riparian landowner, in a water context, owns land or property, next to a river, stream or ditch.
Risk	In flood risk management, risk is defined as a product of the probability or likelihood of a flood occurring, and the consequence of the flood.
Risk Management Authority	Operating authorities who's remit and responsibilities concern flood and / or coastal risk management.
RoFfSW	Risk of Flooding from Surface Water (formerly known as the Updated Flood Map for Surface Water (uFMfSW))
Sequential Test	Set out in the NPPF, the Sequential Test is a method used to steer new development to areas with the lowest probability of flooding.
Sewer flooding	Flooding caused by a blockage or overflowing in a sewer or urban drainage system.
SFRA	Strategic Flood Risk Assessment
SoP	Standard of Protection - Defences are provided to reduce the risk of flooding from a river and within the flood and defence field standards are usually described in terms of a flood event return period. For example, a flood embankment could be described as providing a 1 in 100-year standard of protection.
SPD	Supplementary Planning Document
SPZ	(Groundwater) Source Protection Zone
Stakeholder	A person or organisation affected by the problem or solution or interested in the problem or solution. They can be individuals or organisations, includes the public and communities.
SuDS	Sustainable Drainage Systems - Methods of management practices and control structures that are designed to drain surface water in a more sustainable manner than some conventional techniques
Surface water flooding	Flooding as a result of surface water runoff as a result of high intensity rainfall when water is ponding or flowing over the ground surface before it enters the underground drainage network or watercourse or cannot enter it because the network is full to capacity, thus causing what is known as pluvial flooding.
SWMP	Surface Water Management Plan - The SWMP plan should outline the preferred surface water management strategy and identify the actions, timescales and responsibilities of each partner. It is the principal output from the SWMP study.
WFD	Water Framework Directive – Under the WFD, all waterbodies have a target to achieve Good Ecological Status (GES) or Good Ecological Potential (GEP) by a set deadline. River Basin Management Plans (RBMPs) set out the ecological objectives for each water body and give deadlines by when objectives need to be met.

1 Introduction

1.1 Purpose of the Strategic Flood Risk Assessment

> ***"Strategic policies should be informed by a strategic flood risk assessment and should manage flood risk from all sources. They should consider cumulative impacts in, or affecting, local areas susceptible to flooding, and take account of advice from the Environment Agency and other relevant flood risk management authorities, such as lead local flood authorities and internal drainage boards.".***

JBA Consulting were commissioned by Telford & Wrekin Council to prepare a Level 1 Strategic Flood Risk Assessment (SFRA). This study provides a comprehensive and robust evidence base to support the Local Plan review. This document provides an update to the 2007 SFRA for Telford & Wrekin Council.

This 2021 SFRA will be used to inform decisions on the location of future development and the preparation of sustainable policies for the long-term management of flood risk.

1.2 Local Plan Review

The Telford & Wrekin was adopted in 2018 and runs to 2031. The Local Plan review will update the existing Local Plan and will look forward to at least 2040. The aim of the Local Plan is to establish a planning framework for future development, identifying how much land is available and where such land should be provided for new homes and employment, alongside associated infrastructure.

1.3 Levels of SFRA

The **National Planning Practice Guidance** (NPPG) identifies the following two levels of SFRA:

- **Level 1:** where flooding is not a major issue in relation to potential site allocations and where development pressures are low. The assessment should be of sufficient detail to enable application of the Sequential Test.
- **Level 2:** where land outside Flood Zones 2 and 3 cannot appropriately accommodate all necessary development, creating the need to apply the National Planning Policy Framework's (NPPF) Exception Test. In these circumstances the assessment should consider the detailed nature of the flood characteristics within a Flood Zone and assessment of other sources of flooding.

This Level 1 SFRA is intended to aid Telford & Wrekin Council in applying the Sequential Test for their site allocations and identify where the application of the Exception Test may be required via a Level 2 SFRA.

1.4 SFRA outputs

- Identification of policy and technical updates.
- Identification of any strategic flooding issues which may have cross boundary implications.
- Appraisal of all potential sources of flooding, including main river, ordinary watercourse, surface water, sewers, groundwater, reservoirs and canals.
- Review of historic flooding incidents.
- Reporting on the standard of protection provided by existing flood risk management infrastructure.
- Mapping showing distribution of flood risk across all Flood Zones from all sources of flooding including climate change allowances.

- Assessment of the potential increase in flood risk due to climate change.
- Flood Risk Assessment guidance for developers.
- Assessment of surface water management issues, how these can be addressed through development management policies and the application of Sustainable Drainage Systems.
- Recommendations of the criteria that should be used to assess future development proposals and the development of a Sequential Test and sequential approach to flood risk.
- Assessment of strategic flood risk solutions that can be implemented to reduce risks.

1.5 SFRA study area

Telford & Wrekin Council's administrative area covers an area of approximately 290km^2 and has a population of approximately 175,800; more than 80% of which reside within the Telford conurbation.

Telford & Wrekin Borough is bounded by Shropshire Council, South Staffordshire District Council and Stafford Council authority areas.

Telford & Wrekin's land use varies with the town of Telford significantly urbanised and the remainder of the borough predominantly rural. The Borough's major settlement is Telford, a new town designated in the 1960s incorporating the existing towns of Dawley, Ironbridge, Ketley, Madeley, Oakengates and Wellington. The town of Newport is in the north west of the Borough and the town of Ironbridge is to the south.

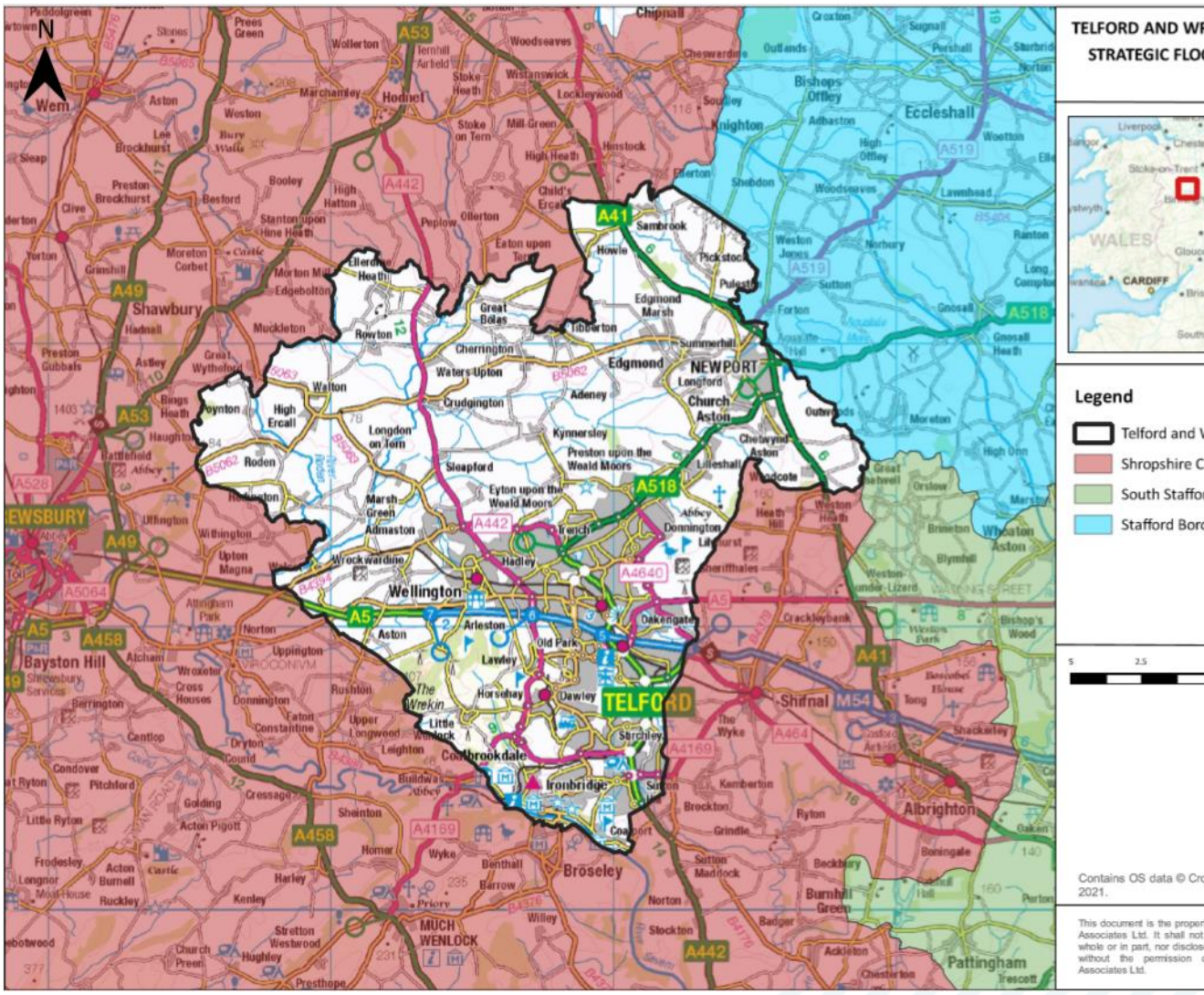

Figure 1-1 shows the study area and the neighbouring Local Authorities.

The Telford & Wrekin Borough is also covered solely by Severn Trent Water as a water and sewerage provider, and hence this is not shown on the mapping.

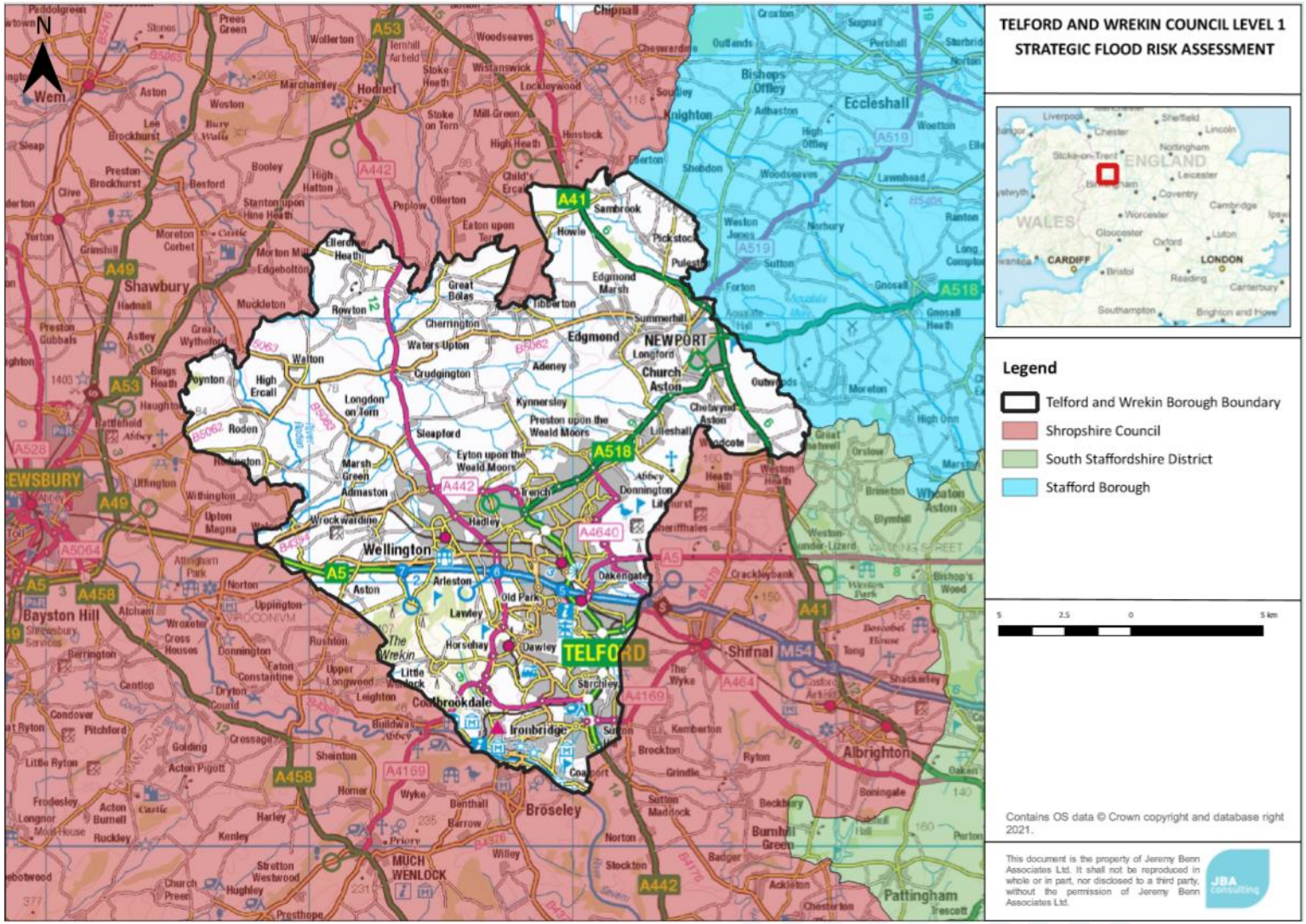

Figure 1-1: Telford & Wrekin Council study area and neighbouring authorities

The main rivers that fall within Telford & Wrekin Borough are:

- River Meese
- River Strine/Strine Brook
- River Roden
- River Tern
- River Severn
- Coalbrook (also referred to on some maps as Loamhole/Lyde Brook)

The River Tern is the main watercourse draining the north of the Borough, with the Rivers Meese, Strine, and Roden joining it along its run. It rises north east of Market-Drayton, entering the Borough north of Great Bolas, crosses the north east of the borough past Longdon on Tern, and leaves the Borough at Upton Magna, flowing on towards its confluence with the River Severn near Atcham.

The River Meese drains a predominantly rural catchment, flowing along the northern edge of the Borough, eastward from Aqualate Mare past Sambrook and Tibberton toward its confluence with the River Tern south of Great Bolas in the north of Borough.

The River Strine and the Strine Brook flows through the Weald Moors area and are joined by numerous smaller watercourses as they flow eastward toward their confluence with the Tern south of Crudington.

The Commission Drain and the separate drainage systems drain the Weald Moors area and are included as part of the Strine IDB.

The River Roden rises near Wem Moss and flows southward through rural land, entering the Borough near Great Wytherford. It continues south, past Poynton and Rodington, joining the River Tern at Walcot.

The River Severn flows along the southern edge of the Borough, through Ironbridge Gorge, a World Heritage Site. The river Severn is the longest River in the UK, rising in the Cambrian Mountains and draining predominantly rural land before flowing through Shrewsbury just upstream of the confluence with the River Tern. Downstream of Ironbridge, the River Severn flows through several major urban centres including Worcester, Tewkesbury, and Gloucester, before draining into the Severn Estuary north of Bristol.

The Coalbrook flows out of Loamhole Dingle, through Coalbrookdale, joining the River Severn near Dale End. The catchment is a designated Rapid Response Catchment. The channel is heavily modified throughout Coalbrookdale, including being culverted along several sections.

Figure 1-2 shows a map of the key watercourses within Telford & Wrekin Borough.

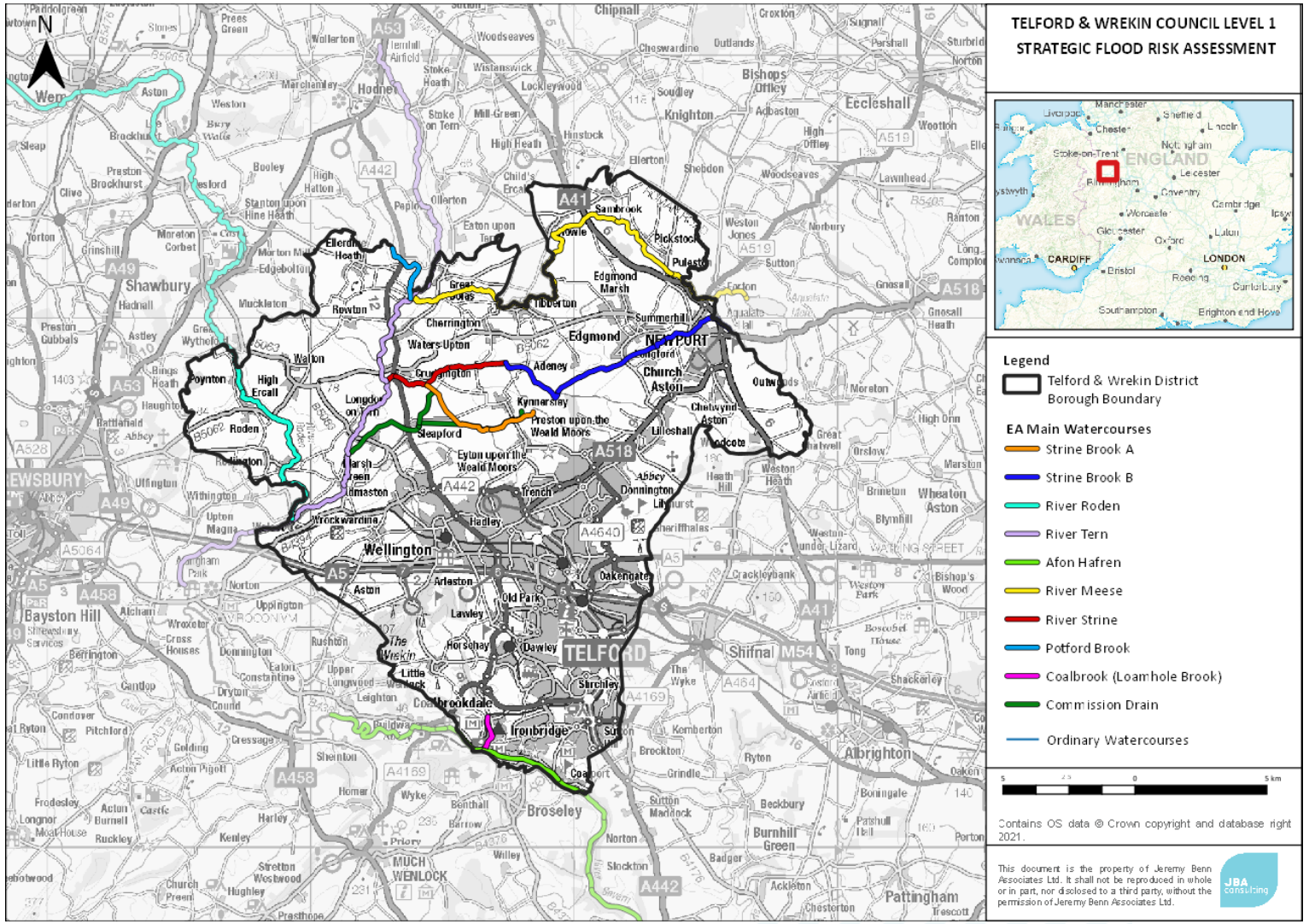

Figure 1-2 Map of the main rivers and other watercourses within and around Telford & Wrekin Council area

1.6 Consultation

The following parties (external to Telford & Wrekin Council) were consulted to inform the SFRA:

- Environment Agency
- Severn Trent Water

1.7 Use of SFRA data

Level 1 SFRAs are high-level strategic documents and do not go into detail on an individual site-specific basis. The primary purpose is to provide an evidence base to inform the Local Plan and any future flood risk policies.

Developers will still be required to undertake site-specific Flood Risk Assessments to support Planning Applications. Developers will be able to use the information in the SFRA to scope out the sources of flood risk that will need to be explored in more detail at site level.

Appendix C presents a SFRA User Guide, further explaining how SFRA data should be used, including reference to relevant sections of the SFRA, how to consider different sources of flood risk and recommendations and advice for Sequential and Exception Tests.

Key reference material such as external guidance documents/ websites are provided in **purple** throughout the SFRA, with the weblink in brackets afterwards.

Advice to users has been highlighted in **amber boxes** throughout the document.

On the date of publication, the SFRA contains the latest flood risk information. Over time, new information will become available to inform planning decisions, such as updated hydraulic models (which then update the Flood Map for Planning), flood event information, new defence schemes and updates to policy and legislation. Developers should check the online **Flood Map for Planning** (https://flood-map-for-planning.service.gov.uk/) in the first instance to identify any major changes to the Flood Zones.

1.8 Structure of this report

Section	Contents	How to use
Executive Summary	Focuses on how the SFRA can be used by planners, developers and neighbourhood planners	Summarises the Level 1 findings and recommendations.
1. Introduction	Provides a background to the study, the Local Plan stage the SFRA informs, the study area, the roles and responsibilities for the organisations involved in flood management and how they were involved in the SFRA Provides a short introduction to how flood risk is assessed and the importance of considering all sources Includes this table of the contents of the SFRA	For general information and context.
2. Flood risk policy and strategy	Sets out the relevant legislation, policy and strategy for flood risk management at a national, regional and local level.	Users should refer to this section for any relevant policy which may underpin strategic or site-specific assessments.
3. Planning policy for flood risk management	Provides an overview of both national and existing Local Plan policy on flood risk management This includes the Flood Zones, application of the Sequential Approach and Sequential/Exception Test process. Provides guidance for the Council and Developers on the application of the Sequential and Exception Test for both allocations and windfall sites, at allocation and planning application stages.	Users should use this section to understand and follow the steps required for the Sequential and Exception Tests.
4. Impact of climate change	Outlines the latest climate change guidance published by the Environment Agency and how this was applied to the SFRA Sets out how developers should apply the guidance to inform site specific Flood Risk Assessments	This section should be used to understand the climate change allowances for a range of epochs and conditions, linked to the vulnerability of a development.
5. Understanding flood risk in Telford & Wrekin Borough	Provides an overview of the characteristics of flooding affecting the study area and key risks including historical flooding incidents, flood risk from all sources and flood warning arrangements.	This section should be used to understand all sources of flood risk in the Borough, including where has flooded historically. This section may also help identify any data gaps, in conjunction with Appendix B.
6. Flood alleviation schemes and assets	Provides a summary of current flood defences and asset management and future planned schemes. Introduces actual and residual flood risk.	This section should be used to understand if there are any defences or flood schemes in a particular area, for further detailed assessment at site-specific stage.
7. Cumulative	This section provides a summary of the	Planners should use this section

impact of development and strategic solutions	catchments with the highest flood risk and development pressures, considers opportunities for strategic flood risk solutions and makes recommendations for local planning policy based on these.	to help develop policy recommendations for the cumulative impact of development.
8. Flood risk management for developers	Guidance for developers on Flood Risk Assessments, considering flood risk from all sources	Developers should use this section to understand requirements for FRAs and what conditions/ guidance documents should be followed, as well as mitigation options.
9. Surface water management and Sustainable Drainage Systems	An overview of Sustainable Drainage Systems, Guidance for developers on Surface Water Drainage Strategies, considering any specific local standards and guidance for Sustainable Drainage Systems (SuDS) from the Lead Local Flood Authority.	Developers should use this section to understand what national, regional and local SuDS standards are applicable. Hyperlinks are provided.
10. Summary and recommendations	Summarises sources of flood risk in the study area and outlines planning policy recommendations	Developers and planners should use this as a summary of the SFRA. Developers should refer to the Level 1 SFRA recommendations when considering requirements for site-specific assessments.
Appendices	Appendix A: Maps Appendix B: Data sources used in the SFRA Appendix C: SFRA User Guide Appendix D: Flood Alert and Flood Warning Areas Appendix E: Summary of flood risk across the borough	Planners should use these appendices to understand what data has been used in the SFRA, to inform the application of the Sequential and Exception Tests, as relevant, and to use these maps and tabulated summaries of flood risk to understand the nature and location of flood risk.

1.9 Understanding flood risk

This section provides useful background information on how flooding arises and how flood risk is determined.

1.9.1 Sources of flooding

Flooding is a natural process and can happen at any time in a wide variety of locations. It constitutes a temporary covering of land not normally covered by water and presents a risk when people and human or environmental assets are present in the area that floods. Assets at risk from flooding can include housing, transport and public service infrastructure, commercial and industrial enterprises, agricultural land and environmental and cultural heritage. Flooding can occur from many different and combined sources and in many different ways, as illustrated in Figure 1-3. Major sources of flooding include:

- Fluvial (rivers) - inundation of floodplains from rivers and watercourses; inundation of areas outside the floodplain due to influence of bridges, embankments and other features that artificially raise water levels; overtopping or breaching of defences; blockages of culverts; blockages of flood channels/corridors.
- Surface water - surface water flooding covers two main sources including direct run-off from adjacent land (pluvial) and surcharging of piped drainage systems (public sewers, highway drains, etc.)

- Groundwater - water table rising after prolonged rainfall to emerge above ground level remote from a watercourse; most likely to occur in low-lying areas underlain by permeable rock (aquifers); groundwater recovery after pumping for mining or industry has ceased.
- Minewater- flooding as a result of water emerging from shallow mine workings.
- Infrastructure failure - reservoirs; canals; industrial processes; burst water mains; blocked sewers or failed pumping stations.

Different types and forms of flooding present a range of different risks and the flood hazards of speed of inundation, depth and duration of flooding can vary greatly. With climate change, the frequency, pattern and severity of flooding are expected to change and become more damaging.

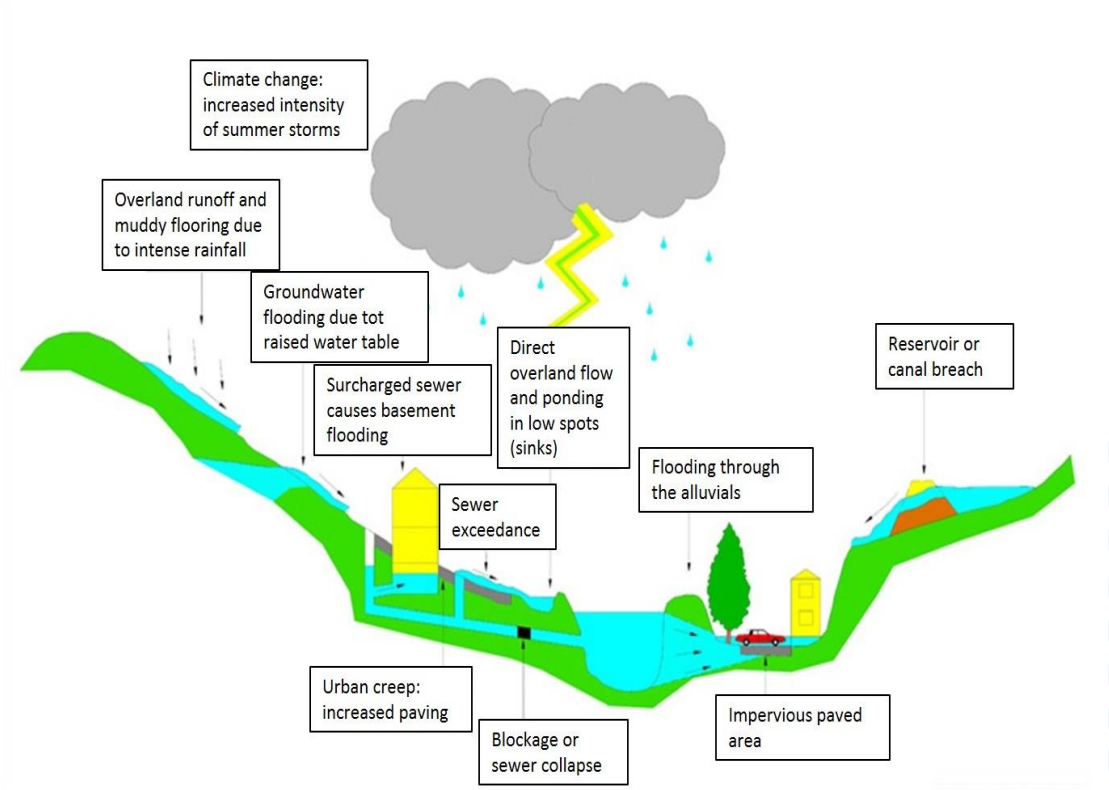

Figure 1-3: Flooding from all sources

1.10 Likelihood and consequence

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

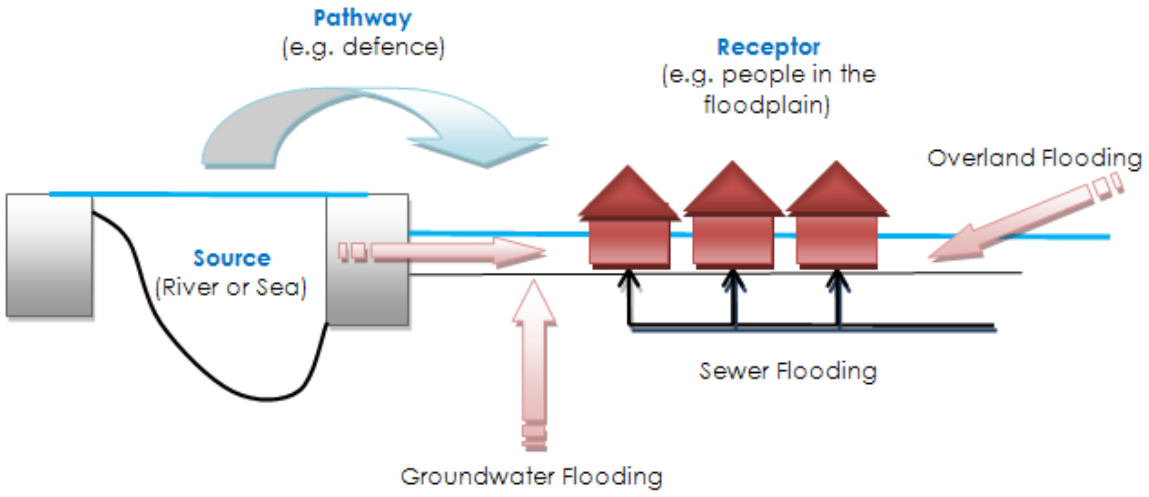

Figure 1-4: Source-Pathway-Receptor Model

The principal sources are rainfall and rivers; the most common pathways are rivers themselves, drains, sewers, overland flows, floodplains and defence assets (for example through overtopping or breach). Receptors can include people, their property and the environment. All these 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.

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 to apply this guidance in a consistent manner.

1.11 Likelihood

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 a hundred years, i.e. it has a 1% chance of occurring in any one year, not that it will occur once every hundred years.

Considered over the lifetime of development, such an apparently low frequency or rare flood has a significant probability of occurring. For example:

- A 1% flood has a 26% (1 in 4) chance of occurring at least once in a 30-year period - the period of a typical residential mortgage
- And a 49% (1 in 2) chance of occurring in a 70-year period - a typical human lifetime

1.12 Consequence

The consequences of flooding include fatalities, property damage, 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, e.g. age-structure, of the population, presence and reliability of mitigation measures etc). Flood risk is then expressed in terms of the following relationship:

Flood risk = Probability of flooding x Consequences of flooding

1.13 Risk

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 the water, the pathways of flooding (such as the condition of flood defences) and the vulnerability of receptors as mentioned above.

2 Flood risk policy and strategy

This section sets out the flood risk management roles and responsibilities for different organisations and relevant legislation, policy and strategy.

2.1 Roles and responsibilities for Flood Risk Management in Telford & Wrekin Borough

There are different organisations that cover Telford & Wrekin Borough that have responsibilities for flood risk management, known as Risk Management Authorities (RMAs). These are shown on Table 2-1, with a summary of their responsibilities.

It is important to note that land and property owners are responsible for the maintenance of watercourses either on or next to their properties. Property owners are also responsible for the protection of their properties from flooding as well as other management activities, for example by maintaining riverbeds/ banks, controlling invasive species, and allowing the flow of water to pass without obstruction. More information can be found in the Environment Agency publication **'Owning a Watercourse' (2018)** (https://www.gov.uk/guidance/owning-a-watercourse).

When it comes to undertaking works to reduce flood risk, the Environment Agency and Telford & Wrekin Council as LLFA have permissive powers and limited resources are prioritised and targeted to where they can have the greatest effect. Permissive powers mean that Risk Management Authorities are permitted to undertake works on watercourses but are not obliged.

Table 2-1: Roles and responsibilities for Risk Management Authorities

Risk Management Authority	Strategic Level	Operational Level	Planning role
Environment Agency	• Strategic overview for all sources of flooding • National Strategy • Reporting and general supervision	• Main rivers • Reservoirs	• Statutory consultee for development in Flood Zones 2 and 3
Telford & Wrekin Borough as Lead Local Flood Authority (LLFA)	• Preliminary Flood Risk Assessment • Local Flood Risk Management Strategy	• Surface Water • Groundwater • Ordinary Watercourses (consenting and enforcement) • Ordinary watercourses (works)	• Statutory consultee for major developments
Telford & Wrekin Council as Local Planning Authority	• Local Plans as Local Planning Authorities	• Determination of Planning Applications as Local Planning Authorities • Strategic management of open spaces under Council ownership	• As left
Severn Trent Water	• Asset Management Plans, supported by Periodic Reviews	• Public sewers	• Non-statutory consultee

	(business cases) • Develop Drainage and Wastewater management plans		
Highways Authorities Highways England (motorways and trunk roads) Telford & Wrekin Council (for non-trunk roads)	• Highway drainage policy and planning	• Highway drainage	• Internal planning consultee regarding highways design standards and adoptions ○ Highways Development Control (consultee) ○ Highways & Engineering (asset management)
Strine IDB	• Watercourse consenting	• Maintenance of all ordinary watercourses within the Strine IDB boundary	• Statutory consultee for any alterations to ordinary watercourses within the Strine IDB

2.2 Relevant legislation

The following legislation is relevant to development and flood risk in the Telford & Wrekin Borough:

Flood Risk Regulations (2009) - these transpose the European Floods Directive (2000) into law and require the Environment Agency and LLFAs to produce Preliminary Flood Risk Assessments and identify where there are nationally significant Flood Risk Areas. For the Flood Risk Areas, detailed flood maps and a Flood Risk Management Plan is produced; this is done in a six-year cycle. There are currently no nationally significant Flood Risk Areas located within the Borough.

- **Town and Country Planning Act (1990), Water Industry Act (1991), Land Drainage Act (1991) , Environment Act (1995) , Flood and Water Management Act (2010)** – as amended and implanted via secondary legislation. These set out the roles and responsibilities for organisations that have a role in FRM.
- The **Land Drainage Act (1991, as amended)** and **Environmental Permitting Regulations (2018)** also set out where developers will need to apply for additional permission (as well as planning permission) to undertake works to an Ordinary Watercourse or Main River.
- **The Water Environment Regulations (2017)** – these transpose the European Water Framework Directive (2000) into law and require the Environment Agency to produce River Basin Management Plans (RBMPs). These aim to ensure that the water quality of aquatic ecosystems, riparian ecosystems and wetlands reaches 'good' status.
- Other environmental legislation such as the Habitats Directive (1992), Environmental Impact Assessment Directive (2014) and Strategic Environmental Assessment Directive (2001) also apply as appropriate to strategic and site-specific developments to guard against environmental damage.

2.3 Relevant flood risk policy and strategy documents

Table 2-2 summarises relevant national, regional, and local flood risk policy and strategy documents and how these apply to development and flood risk. Hyperlinks are provided to external documents. These documents may:

- Provide useful and specific local information to inform Flood Risk Assessments within the local area.
- Set the strategic policy and direction for Flood Risk Management (FRM) and drainage – they may contain policies and action plans that set out what future flood mitigation and climate change adaptation plans may affect a development site. A developer should seek to contribute in all instances to the strategic vision for FRM and drainage in the Borough.
- Provide guidance and/or standards that informs how a developer should assess flood risk and/or design flood mitigation and SuDS.

Scale	Document, lead author and date	Information	Policy and measures	Development design requirements	Next update due
National	National Flood and Coastal Management Strategy (see section 2.5.1) (Environment Agency) 2020	No	Yes	No	Due to be reviewed in 2026
	National Planning Policy Framework and Guidance (MHCLG) 2018/2015) (see section 3.1)	No	No	Yes	2019 updates to PPG
	Building Regulations Part H (MHCLG) 2010 (see section 2.5.8)	No	No	Yes	-
Regional	Severn River Basin Catchment Flood Management Plan (Environment Agency) 2009 (see section 2.5.5)	Yes	Yes	No	-
	Severn River Basin District Management Plan (Environment Agency) 2016 (see section 2.5.3)	No	Yes	No	2022
	Severn River Basin District Flood Risk Management Plan (Environment Agency) 2016 (see section 2.5.4)	No	Yes	No	2021
	Drainage and Wastewater Management Plan (Severn Trent Water) due 2022/23	Yes	Yes	Yes	2022/23
	Climate Change guidance for development and flood risk (see section 4.1) (Environment Agency) 2019	No	No	Yes	2020 for fluvial and rainfall allowances
Local	Sustainable urban Drainage Systems (SuDS) Handbook (Telford & Wrekin Council/Arcadis) (2019)	Yes	No	Yes	-
	Telford & Wrekin Local Flood Risk Management Strategy (TWCC) 2015	Yes	Yes	No	2021-2022
	Telford & Wrekin Water Cycle Study (2014, updates 2015)	Yes	Yes	Yes	-

Table 2-2: National, regional and local flood risk policy and strategy documents

2.4 Key legislation for flood and water management

2.4.1 Flood Risk Regulations (2009)

The **Flood Risk Regulations 2009** translate the EU Floods Directive into UK law. The EU requires Member States to complete an assessment of flood risk (known as a Preliminary Flood Risk Assessment (PFRA)) and then use this information to identify areas where there is a significant risk of flooding. For these Flood Risk Areas, States must then undertake Flood Risk and Hazard Mapping and produce Flood Risk Management Plans.

The Flood Risk Regulations direct the Environment Agency to do this work for river, sea and reservoir flooding. LLFAs must do this work for surface water, Ordinary Watercourse and Groundwater flooding. This is a six-year cycle of work and the second cycle started in 2017.

The **Telford & Wrekin Council PFRA** was published in 2011 and reviewed in 2017. In the 2011 PFRA, no areas within the Telford & Wrekin Borough have been identified as Nationally Significant Flood Risk Areas, however many areas were identified as Locally Significant Flood Risk Areas, based on a trigger of 3 or more properties at risk of surface water flooding within a 250m^2 area. Detailed reports for each area were produced by 2014, although these are not published.

For the 2017 review there was no change to Telford & Wrekin Council's assessment of risk following the review of the PFRA. No new areas of significant risk have been identified, and no new information has been created or received to change their understanding of risk. Further guidance on Climate Change was however received which is to be incorporated into Council policy.

The **PFRA for England (2018)** provides information on significant past and future flood risk from river and sea flooding across all of England, including the Telford & Wrekin Borough. No nationally significant Flood Risk Areas for river flooding have been identified in the Telford and Wrekin Borough.

2.4.2 Flood and Water Management Act (FWMA) 2010

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

The FWMA has created clearer roles and responsibilities and helped to define a more risk-based approach to dealing with flooding. This included the creation of a lead role for LAs, as LLFAs, designed to manage local flood risk (from surface water, ground water and ordinary watercourses) and to provide a strategic overview role of all flood risk for the EA.

The content and implications of the FWMA provide considerable opportunities for improved and integrated land use planning and flood risk management by LAs 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 regeneration and growth.

2.4.3 Water Framework Directive & Water Environment Regulations

The purpose of the Water Framework Directive (WFD), which was transposed into English Law by the Water Environment Regulations (2003), is to deliver improvements across Europe in the management of water quality and water resources through a series of plans called River Basin Management Plans (RBMP), which were last published in 2015 and are currently being updated.

Telford and Wrekin Borough lies within the Severn River Basin District.

2.5 Key national, regional, and local policy documents and strategies

2.5.1 The National Flood and Coastal Erosion Risk Management Strategy for England (2020)

The **National Flood and Coastal Erosion Risk Management Strategy** (FCERM) for England provides the overarching framework for future action by all risk management authorities to tackle flooding and coastal erosion in England. The new Strategy has been in preparation since 2018. The Environment Agency brought together a wide range of stakeholders to develop the strategy collaboratively. The Strategy is much more ambitious than the previous one from 2011 and looks ahead to 2100 and the action needed to address the challenge of climate change.

The emphasis of The Strategy is on developing resilient places and communities. The Strategy has been split into three high level ambitions: climate resilient places, today's growth and infrastructure resilient in tomorrow's climate, and a nation ready to respond and adapt to flooding and coastal change. Measures include:

- updating the national river, coastal and surface water flood risk mapping and the understanding of long-term investment needs for flood and coastal infrastructure,
- trialling new and innovative funding models,
- flood resilience pilot studies,
- developing an adaptive approach to the impacts of climate change,
- seeking nature based solutions towards flooding and erosion issues,
- integrating natural flood management into the new Environmental Land Management scheme, considering long term adaptive approaches in Local Plans,
- maximising the opportunities for flood and coastal resilience as part of contributing to environmental net gain for development proposals,
- investing in flood risk infrastructure that supports sustainable growth,
- aligning long term strategic planning cycles for flood and coastal work between stakeholders,
- mainstreaming property flood resilience measures and 'building back better' after flooding, consistent approaches to asset management and record keeping,
- updating guidance on managing high risk reservoirs in light of climate change,
- critical infrastructure resilience,
- education, skills, and capacity building,
- research, innovation and sharing of best practise,
- supporting communities to plan for flood events,
- developing world leading ways of reducing the carbon and environmental impact from the construction and operation of flood and coastal defences,
- development of digital tools to communicate flood risk and transforming the flood warning service and increasing flood response and recovery support.

The Strategy was completed in 2020 and published alongside a New National Policy Statement for Flood and Coastal Erosion Risk Management. The statement sets out five key commitments which will accelerate progress to better protect and better prepare the country for the coming years:

1. Upgrading and expanding flood defences and infrastructure across the country,
2. Managing the flow of water to both reduce flood risk and manage drought,

3. Harnessing the power of nature to not only reduce flood risk, but deliver benefits for the environment, nature, and communities,
4. Better preparing communities for when flooding and erosion does occur, and
5. Ensuring every area of England has a comprehensive local plan for dealing with flooding and coastal erosion.

2.5.2 Updated Strategic Flood Risk Assessment guidance

There was an update to the **'How to prepare a Strategic Flood Risk Assessment guidance'** in August 2020, which had some key additions to both Level 1 and Level 2 assessments. The Level 1 assessment is undertaken in accordance with this guidance.

2.5.3 River Basin Management Plans

The **Severn River Basin District River Basin Management Plan** (RBMP) managed by the EA, has been updated since the first cycle in 2009. The latest version was published in February 2016. Water quality and flood risk can go hand in hand in that flood risk management activities can help to deliver habitat restoration techniques. The Severn RBMP includes such examples whereby land management techniques have been designed to reduce flood risk whilst also reducing sediment loss and improving water quality. The plans include an assessment of river basin characteristics, a review of the impact on human activity, statuses of water bodies, and an economic analysis of water use and progress since the first plan in 2009.

2.5.4 Flood Risk Management Plans

Flood Risk Management Plans (FRMPs) are part of the six-year cycle of assessment, mapping and planning required under the Flood Risk Regulations. The Environment Agency led the development of the **Severn River Basin District Flood Risk Management Plan** (FRMP), which was published in March 2016. The FRMPs summarise the flooding affecting the area and describes the measures to be taken to address the risk in accordance with the Flood Risk Regulations. The FRMP for the River Severn is currently being updated.

2.5.5 Catchment Flood Management Plans

Catchment Flood Management Plans (CFMPs) are a high-level strategic plan providing an overview of flood risk across each river catchment. The Environment Agency use CFMPs to work with other key-decision makers to identify and agree long-term policies for sustainable flood risk management.

Telford & Wrekin Borough sits within the **River Severn Catchment Flood Management Plan** and is part of the following sub-areas:

- **Shropshire Tributaries** – The Shropshire Tributaries sub-area is split into two parts, north and south of Shrewsbury. The Northern area contains Oswestry, Wem, Market Drayton, Gobowen and Newport, whilst the southern area is predominantly rural. Flooding from fluvial sources within the catchment is relatively low and this is not expected to change significantly even when accounting for climate change. There is a greater risk of surface water flooding in some areas, particularly in urban locations such as Oswestry and Newport, and the villages in the south that have expanded rapidly in recent years.
- **Middle Severn Corridor**– The Middle Severn Corridor sub-area extends from Worcester in the south up to Shrewsbury. This corridor is predominantly rural, with the exception of the urban centres of Shrewsbury, Ironbridge, Bridgnorth, Bewdley, Stourport and Worcester. There is a long and well documented history of fluvial flooding within the catchment, especially along the River Severn. Flooding in the catchment is characterised by rapid river level rises in response to rainfall, particularly on smaller watercourses. This makes providing accurate and timely warnings difficult. Urbanised areas of the catchment are also at increased risk of surface water flooding, and there are significant interactions between

multiple sources of flooding (watercourses, surface water, sewers and groundwater) which make accurate forecasting and warning challenging.

- **Telford, Black Country, Bromsgrove, Kidderminster and Coventry Cluster –** This sub-area is split into two parts, covering the major urban centres of Telford, Coventry, Leamington Spa, Dudley, Halesowen, Stourbridge, Wolverhampton, Bromsgrove, Kidderminster and Droitwich. There is significant risk of flooding from fluvial and surface water in these areas. Furthermore, trends in land management and land-use change have increased risk over time in these areas and will continue to do so in the future, exacerbated by climate change.

2.5.6 Telford & Wrekin Council Local Flood Risk Management Strategy

The **Telford & Wrekin Council Lead Local Flood Authority Local Flood Risk Management Strategy** (LFRMS) was published in 2015. The Strategy sets out how Telford & Wrekin Council will manage flood risk from surface water runoff, groundwater and ordinary watercourses for which they have a responsibility as LLFA and the work that other Risk Management Authorities are doing to manage flood risk in the borough. Following the publication of the National Strategy in September 2020, LLFAs will need to update their Local Strategies so that they reflect how national objectives for flood risk management will be delivered locally.

The Strategy notes that the Council will seek to encourage sustainable drainage systems (SuDS) as part of new development and retrofitting of SuDS in its roles as statutory consultee for major planning applications and non-statutory consultee for non-major planning applications.

The Strategy does not identify objectives for flood risk management in the Borough, however it identifies 24 policies setting out how the Council will seek to manage flood risk in the borough, which aim to:

- Raise awareness of flooding and increase preparedness
- Improve the understanding of flooding in the area, including improving flood mapping, investigating areas where high numbers of properties are at risk, and investigating ground and minewater flooding
- Encourage the uptake of SuDS in the area including the adoption of qualifying SuDS features and publishing SuDS guidance.
- Improve routine flood management activities including the clearance of highway gullies and keeping a register of drainage assets and features serving to reduce flood risk
- Ensure that climate change is taken into account in future flood alleviation projects and when checking the suitability of future development proposals within the Borough

2.5.7 Water Cycle Studies

Water Cycle Studies (WCS) assist councils to select and develop sustainable development allocations in locations where there is minimal impact on the environment, water quality, water resources, infrastructure, and flood risk. WCS provide the required evidence, and an agreed strategy, to ensure that planned growth occurs within environmental constraints (and, where possible, contributes to environmental improvements), with the appropriate infrastructure in place in a timely manner so that planned allocations are deliverable. This is undertaken by identifying areas where there may be conflict between any proposed development, the requirements of the environment and by recommending potential solutions to these conflicts.

The latest WCS covering Telford & Wrekin Borough was **Telford & Wrekin Council Detailed Water Cycle Study**, published in 2014 and updated in 2015. This supports the Council in selecting and developing sustainable development allocations where there is

minimal impact on the environment, water quality, water resources, infrastructure, and flood risk.

Water Resources West is a strategic body comprised of the Environment Agency, United Utilities, Severn Trent, South Staffs Water and Dŵr Cymru Welsh Water providing strategic oversight and coordination of water resources across the river catchments in the West of England, including the cross-border river systems shared with Wales.

2.5.8 LLFAs, surface water and SuDS

The 2019 NPPF states that: 'Major developments should incorporate sustainable drainage systems unless there is clear evidence that this would be inappropriate' (Para 165). When considering planning applications, local planning authorities should consult the LLFA on the management of surface water to satisfy that:

- The proposed minimum standards of operation are appropriate
- Through the use of planning conditions or planning obligations there are clear arrangements for on-going maintenance over the development's lifetime

Telford & Wrekin Council's requirements for new developers on SuDS are set out on their website, alongside supporting documents. At the time of writing this SFRA, documents and policies relevant to SuDS and surface water in Telford & Wrekin Borough are:

- **Telford & Wrekin Council Local Flood Risk Management Strategy**
- **Telford & Wrekin Council Sustainable Drainage Systems Handbook**
- **Highways Design Guide**
- **Shropshire County Council – Guidance Notes: Surface Water**
- **The SuDS Manual (C753)**, published in 2007, updated in 2015
- **DEFRA Non-statutory technical standards for sustainable drainage systems**, 2015
- **DEFRA National Standards for sustainable drainage systems Designing, constructing (including LASOO best practice guidance), operating and maintaining drainage for surface runoff**, 2011
- **Building Regulations Part H (MHCLG)** 2010

The 2019 NPPF states that flood risk should be managed "using opportunities provided by new development to reduce causes and impacts of flooding". As such, Telford & Wrekin Council expects SuDS to be incorporated on minor development as well as major development.

2.5.9 Surface Water Management Plans

A Surface Water Management Plan (SWMP) is a study to understand the flood risks that arise from local flooding, which is defined by the Flood and Water Management Act 2010 as flooding from risk from surface runoff, groundwater, and ordinary watercourses. SWMPs are led by a partnership of flood risk management authorities who have responsibilities for aspects of local flooding, including the LLFA, Local Authority, Sewerage Undertaker, and other relevant authorities. The purpose of a SWMP is to identify what the local flood risk issues are, what options there may be to prevent them or the damage they cause and who should take these options forward. This is then presented in an Action Plan that the stakeholders and partners agree. There are currently no surface water management plans for the Telford & Wrekin Borough, with the previous Plan superseded by the LLFA FRMS.

3 Planning policy for flood risk management

This section summarises national planning policy for development and flood risk.

3.1 National Planning Policy Framework and Guidance

The revised **National Planning Policy Framework (NPPF)** was published in July 2019, replacing the 2012 version. The NPPF sets out Government's planning policies for England. It must be considered in the preparation of local plans and is a material consideration in planning decisions. The NPPF defines Flood Zones, how these should be used to allocate land and flood risk assessment requirements. The NPPF states that:

"Strategic policies should be informed by a strategic flood risk assessment and should manage flood risk from all sources. They should consider cumulative impacts in, or affecting, local areas susceptible to flooding, and take account of advice from the Environment Agency and other relevant flood risk management authorities, such as lead local flood authorities and internal drainage boards"

National Planning Practice Guidance on flood risk was published in March 2014 and sets out how the policy should be implemented. **Diagram 1 in the NPPG** sets out how flood risk should be considered in the preparation of Local Plans.

3.2 The risk-based approach

The NPPF takes a risk-based approach to development in flood risk areas. This approach is further explained below.

3.2.1 The Flood Zones

The definition of the Flood Zones is provided below. The Flood Zones do not consider defences. This is important for planning long-term developments as long-term policy and funding for maintaining flood defences over the lifetime of a development may change over time.

The Flood Zones do not consider surface water, sewer or groundwater flooding or the impacts of canal or reservoir failure. They do not consider climate change. Hence there could still be a risk of flooding from other sources and that the level of flood risk will change over time during the lifetime of a development.

The Flood Zones are:

- **Flood Zone 1 – Low probability:** less than a 0.1% chance of river and sea flooding in any given year.
- **Flood Zone 2 – Medium probability:** between a 1% and 0.1% chance of river flooding in any given year or 0.5% and 0.1% chance of sea flooding in any given year.
- **Flood Zone 3a – High probability:** greater or equal to a 1% chance of river flooding in any given year or greater than a 0.5% chance of sea flooding in any given year. Excludes Flood Zone 3b.
- **Flood Zone 3b – Functional Floodplain:** land where water must flow or be stored in times of flood. SFRAs identify this Flood Zone in discussion with the LPA and the Environment Agency. The identification of functional floodplain takes account of local circumstances. Only water compatible and essential infrastructure are permitted in this zone and should be designed to remain operational in times of flood, resulting in no loss of floodplain or blocking of water flow routes. It may be required to consider climate change on the functional floodplain; this would need hydraulic modelling to confirm extents and therefore it is recommended that this is considered in a Flood Risk Assessment and a suitable approach is agreed with the EA.

Important note on Flood Zone information in this SFRA

The Flood Zones (Flood Zone 2 and 3a) in the Appendix A PDFs are the same as those shown on the Environment Agency's **'Flood Map for Planning'** which incorporates latest modelled data, where available.

The Environment Agency Flood Zones do not cover all catchments or ordinary watercourses with areas <3km^2. As a result, whilst the Environment Agency Flood Zones may show an area is in Flood Zone 1, there may be a flood risk from smaller watercourse not shown in the Flood Zones.

Functional floodplain (Flood Zone 3b) is identified as land which would flood with an annual probability of 1 in 20 years, where detailed hydraulic modelling exists. The 1 in 20-year defended modelled flood extents have been used to represent Flood Zone 3b, where available from the Environment Agency. For areas outside of the detailed model coverage, or where no outputs were available, Flood Zone 3a can be used as a conservative indication. Further work should be undertaken as part of a detailed site-specific Flood Risk Assessment to define the extent of Flood Zone 3b where no detailed modelling exists.

3.2.2 The Sequential Test

Firstly, land at the lowest risk of flooding and from all sources should be considered for development. A test is applied called the 'Sequential Test' to do this. Figure 3-1 summarises the Sequential Test. The LPA will apply the Sequential Test to strategic allocations. For all other developments, developers must supply evidence to the LPA, with a Planning Application, that the development has passed the test.

The LPA should work with the Environment Agency to define a suitable area of search for the consideration of alternative sites in the Sequential Test. The Sequential Test can be undertaken as part of a Local Plan Sustainability Appraisal. Alternatively, it can be demonstrated through a free-standing document, or as part of Strategic Housing Land or Employment Land Availability Assessments.

Whether any further work is needed to decide if the land is suitable for development will depend on both the vulnerability of the development and the Flood Zone it is proposed for. **Table 2 of the NPPG** defines the vulnerability of different development types to flooding. **Table 3 of the NPPG** shows whether, having applied the Sequential Test first, that vulnerability of development is suitable for that Flood Zone and where further work is needed.

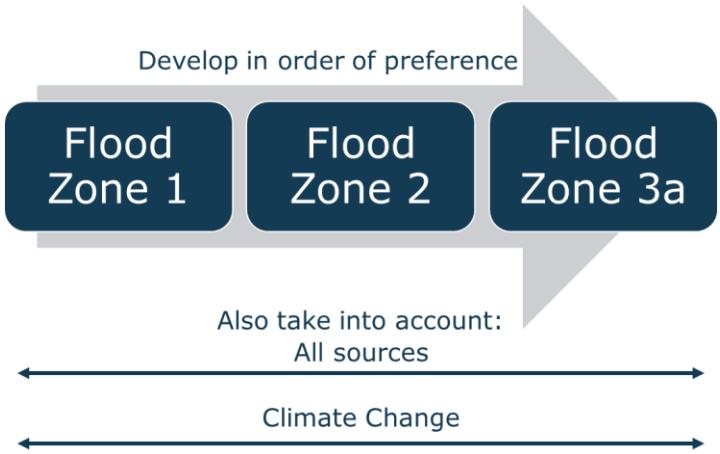

Figure 3-1: The Sequential Test

Figure 3-2 illustrates the Sequential and Exception Tests as a process flow diagram using the information contained in this SFRA to assess potential development sites against the EA's Flood Map for Planning flood zones and development vulnerability compatibilities.

This is a stepwise process, but a challenging one, as several of the criteria used are qualitative and based on experienced judgement. The process must be documented, and evidence used to support decisions recorded. In addition, the risk of flooding from other sources and the impact of climate change must be considered when considering which sites are suitable to allocate. The SFRA User Guide in Appendix C shows where the Sequential and Exception Test may be required for the datasets assessed in the SFRA, and how to interpret different levels of concern with the datasets, recommending what development might be appropriate in what situations.

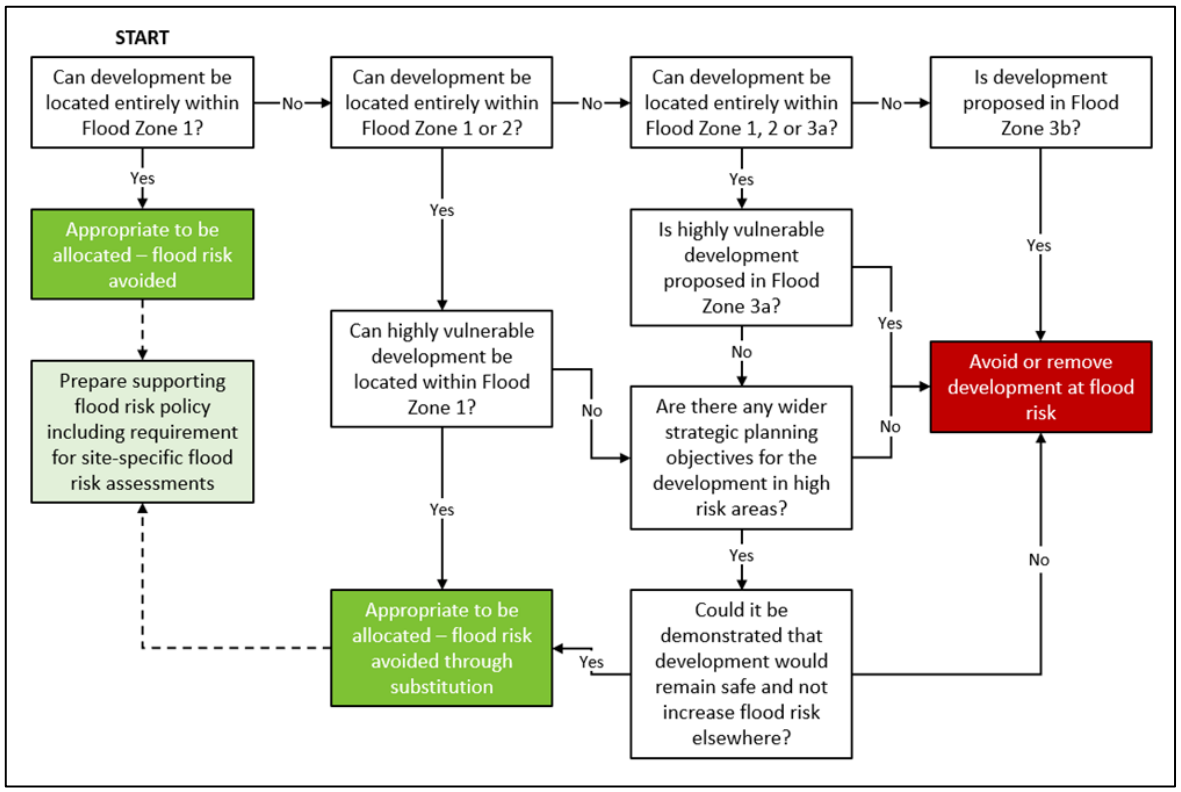

Figure 3-2: Local Plan sequential approach to site allocation

3.2.3 The Exception Test

It will not always be possible for new development to be allocated on land that is not at risk from flooding. To further inform whether land should be allocated, or Planning Permission granted, a greater understanding of the scale and nature of the flood risks is required. In these instances, the Exception Test will be required.

The Exception Test should only be applied following the application of the Sequential Test. It applies in the following instances:

- More vulnerable in Flood Zone 3a
- Essential infrastructure in Flood Zone 3a or 3b
- Highly vulnerable in Flood Zone 2 (this is NOT permitted in Flood Zone 3a or 3b)

Figure 3-3 summarises the Exception Test.

For sites allocated within the Local Plan, the Local Planning Authority should use the information in this SFRA to inform the Exception Test. At planning application stage, the

Developer must design the site such that is appropriate flood resistant and resilient in line with the recommendations in National and Local Planning Policy and supporting guidance and those set out in this SFRA. This should demonstrate that the site will still pass the flood risk element of the Exception Test based on the detailed site level analysis.

For developments that have not been allocated in the Local Plan, developers must undertake the Exception Test and present this information to the Local Planning Authority for approval. The Level 1 SFRA can be used to scope the flooding issues that a site-specific FRA should investigate in more detail to inform the Exception Test for windfall sites.

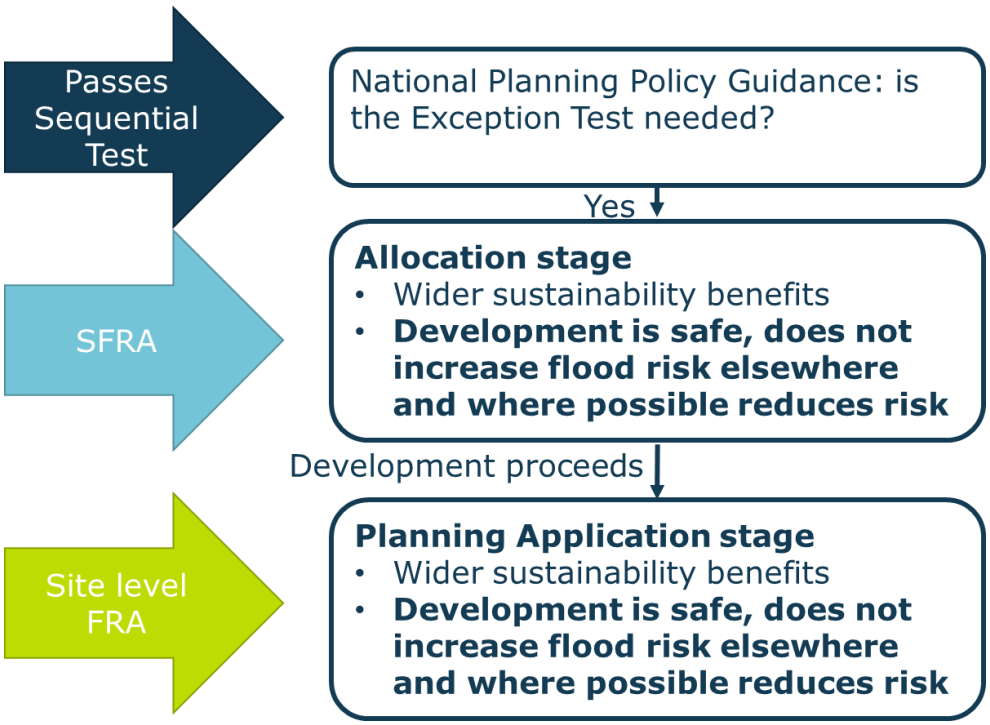

Figure 3-3: The Exception Test

There are two parts to demonstrating a development passes the Exception Test:

1. *Demonstrating that the development would provide wider sustainability benefits to the community that outweigh the flood risk*

Local planning authorities will need to consider what criteria they will use to assess whether this part of the Exception Test has been satisfied and give advice to enable applicants to provide evidence to demonstrate that it has been passed. If the application fails to prove this, the Local Planning Authority should consider whether the use of planning conditions and / or planning obligations could allow it to pass. If this is not possible, this part of the Exception Test has not been passed and planning permission should be refused.

At the stage of allocating development sites, Local Planning Authorities should consider wider sustainability objectives, such as those set out in Local Plan Sustainability Appraisals. These generally consider matters such as biodiversity, green infrastructure, historic environment, climate change adaptation, flood risk, green energy, pollution, health, transport etc.

The Local Planning Authority should consider the sustainability issues the development will address and how doing so will outweigh the flood risk concerns for the site, e.g. by facilitating wider regeneration of an area, providing community facilities, infrastructure that benefits the wider area etc.

2. *Demonstrating that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.*

A Level 2 SFRA is likely to be needed to inform the Exception Test in these circumstances for strategic allocations. At Planning Application stage, a site-specific Flood Risk Assessment will be needed. Both would need to consider the actual and residual risk and how this will be managed over the lifetime of the development.

3.2.4 Making a site safe from flood risk over its lifetime

Local Planning Authorities will need to consider the actual and residual risk of flooding and how this will be managed over the lifetime of the development, considering the source and nature of the risk:

- The actual risk is the risk to the site considering existing flood mitigation measures. The fluvial 1% chance flood in any year event is a key event to consider because the National Planning Policy Guidance refers to this as the 'design flood' against which the suitability of a proposed development should be assessed and mitigation measures, if any, are designed.
- Safe access and egress should be available during the design flood event. Firstly, this should seek to avoid areas of a site at flood risk. If that is not possible then access routes should be located above the design flood event levels. Where that is not possible, access through shallow and slow flowing water that poses a low flood hazard may be acceptable.
- Residual risk is the risk that remains after the effects of flood defences have been considered and/ or from a more severe flood event than the design event. The residual risk can be:
    - The effects of an extreme 0.1% chance flood in any year event. Where there are defences this could cause them to overtop, which may lead to failure if this causes them to erode; and/or
    - Structural failure of any flood defences, such as breaches in embankments or walls.

Flood resistance and resilience measures should be considered to manage any residual flood risk by keeping water out of properties and seeking to reduce the damage it does, should water enter a property. Emergency plans should also account for residual risk, e.g. through the provision of flood warnings and a flood evacuation plan where appropriate.

In line with the NPPF, the impacts of climate change over the lifetime of the development should be considered when considering actual and residual flood risk.

3.3 Applying the Sequential Test and Exception Test to individual planning applications

3.3.1 Sequential Test

Telford & Wrekin Council, with advice from the Environment Agency, are responsible for considering the extent to which Sequential Test considerations have been satisfied.

Developers are required to apply the Sequential Test to all development sites, unless the site is either:

- A strategic allocation and the test has already been carried out by the LPA.
- A change of use (except to a more vulnerable use).
- A minor development (householder development, small non-residential extensions with a footprint of less than 250m^2); or
- A development in Flood Zone 1, unless there are other flooding issues in the area of the development (i.e. surface water, ground water, sewer flooding).

The SFRA contains information on all sources of flooding and considering the impact of climate change. This should be considered when a developer undertakes the Sequential Test, including the consideration of reasonably available sites at lower flood risk.

Local circumstances must be used to define the area of application of the Sequential Test (within which it is appropriate to identify reasonably available alternatives). The criteria used to determine the appropriate search area relate to the catchment area for the type of development being proposed. For some sites this may be clear e.g. school catchments, in other cases it may be identified by other Local Plan policies. For some sites e.g. regional distribution sites, it may be suitable to widen the search area beyond LPA administrative boundaries.

The sources of information on reasonably available sites may include:

- Site allocations in Local Plans
- Sites with Planning Permission but not yet built out
- Strategic Housing and Economic Land Availability Assessments (SHELAAs)/ five-year land supply/ annual monitoring reports
- Locally listed sites for sale

It may be that a number of smaller sites or part of a larger site at lower flood risk form a suitable alternative to a development site at high flood.

Ownership or landowner agreement is not acceptable as a reason not to consider alternatives.

The SFRA User Guide in Appendix C shows where the Sequential and Exception Test may be required for the datasets assessed in the SFRA, and how to interpret different levels of concern with the datasets, recommending what development might be appropriate in what situations.

3.3.2 The Exception Test

If, following application of the Sequential Test it is not possible for the development to be located in areas with a lower probability of flooding the Exception Test must then be applied if required (as set out in Table 3 of the NPPG). Developers are required to apply the Exception Test to all applicable sites (including strategic allocations).

The applicant will need to provide information that the application can pass both parts of the Exception Test:

- Demonstrating that the development would provide wider sustainability benefits to the community that outweigh the flood risk.
- Applicants should refer to wider sustainability objectives in Local Plan Sustainability Appraisals. These generally consider matters such as biodiversity, green infrastructure, historic environment, climate change adaptation, flood risk, green energy, pollution, health, transport etc.
- Applicants should detail the suitability issues the development will address and how doing it will outweigh the flood risk concerns for the site e.g. by facilitating wider regeneration of an area, providing community facilities, infrastructure that benefits the wider area etc.
- Demonstrating that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.
- The site-specific Flood Risk Assessment should demonstrate that the site will be safe, and the people will not be exposed to hazardous flooding from any source. The FRA should consider actual and residual risk and how this will be managed over the lifetime of the development, including:
    - The design of any flood defence infrastructure
    - Access and egress
    - Operation and maintenance

- Design of the development to manage and reduce flood risk wherever possible
- Resident awareness
- Flood warning and evacuation procedures, including whether the developer would increase the pressure on emergency services to rescue people during a flood event; and
- Any funding arrangements required for implementing measures.

4 Impact of climate change

Climate change projections show an increased chance of warmer, wetter winters and hotter, drier summers with a higher likelihood of more frequent and intense rainfall. This is likely to make severe flooding happen more often.

> The NPPF sets out that flood risk should be managed over the lifetime of a development, taking climate change into account. This section sets out how the impact of climate change should be considered.

4.1 Revised Climate Change Guidance

The Climate Change Act 2008 creates a legal requirement for the UK to put in place measures to adapt to climate change and to reduce carbon emissions by at least 80% below 1990 levels by 2050.

The Environment Agency published **updated climate change guidance** in 2019 on how allowances for climate change should be included in both strategic and site specific FRAs. The guidance adopts a risk-based approach considering the vulnerability of the development. Whilst the guidance was updated in 2019, fluvial allowances are still to be updated from those in the original 2016 guidance.

In 2018, the government published new UK Climate Projections (UKCP18). The Environment Agency are currently using these to update their climate change guidance for new developments with regards to updated fluvial and rainfall allowances. Developers should check on the government website for the latest guidance before undertaking a detailed Flood Risk Assessment. Updated guidance is due in 2021 but has not yet been released.

4.2 Applying the climate change guidance

To apply the climate change guidance, the following information needs to be known:

- The vulnerability of the development – see the **NPPG**
- The likely lifetime of the development – in general 60 years is used for commercial development and 100 for residential, but this needs to be confirmed in an FRA
- The River Basin that the site is in –Telford & Wrekin Borough is situated in the Severn River Basin District
- Likely depth, speed and extent of flooding for each allowance of climate change over time considering the allowances for the relevant epoch (2020s, 2050s and 2080s)
- The 'built in' resilience measures used, for example, raised floor levels
- The capacity or space in the development to include additional resilience measures in the future, using a 'managed adaptive' approach

4.3 Relevant allowances for the Telford & Wrekin Borough

Table 4-1 shows the peak river flow allowances that apply in the Telford & Wrekin Borough for fluvial flood risk. These categories show the change predicted under a range of potential climate change scenarios, with H++ being the most extreme scenario and central being a more moderate scenario. Table 4-2 shows the peak rainfall intensity allowances that apply in the Telford & Wrekin Borough for small catchments (less than 5km^2) and urban catchments for surface water flood risk. Catchments which are larger than 5km^2 or are rural should use Table 4-1 for peak rainfall intensity. Both the central and upper end allowances should be considered to understand the range of impact. These allowances are correct at the time of writing this report. Where more recent guidance has been released then the most up-to-date figures should be used.

Table 4-1: Peak river flow allowances for the Severn river basin district

Allowance Category	Total potential change anticipated for the '2020s' (2015 to 2039)	Total potential change anticipated for the '2050s' (2040 to 2069)	Total potential change anticipated for the '2080s' (2070 to 2115)
H++	20%	45%	90%
Upper end	20%	40%	70%
Higher central	15%	25%	35%
Central	10%	20%	25%

Table 4-2: Peak rainfall intensity allowances for small and urban catchments

Allowance Category	Total potential change anticipated for the '2020s' (2015 to 2039)	Total potential change anticipated for the '2050s' (2040 to 2069)	Total potential change anticipated for the '2080s' (2070 to 2115)
Upper end	10%	20%	40%
Central	5%	10%	20%

4.4 Representing climate change in the Level 1 SFRA

Climate change modelling for the watercourses in the study area was undertaken based on the EA's climate change guidance.

Existing EA hydraulic models were obtained, and where these had not already been run with the latest climate change allowances, these were run for the 2080s period for all three 2080s allowance categories (relevant to the Severn river basin district, so 100-year +25%, +35% and +70%). This includes the River Severn, River Tern, Wesley Brook, River Roden, Coalbrook and their tributaries. Appendix B shows the models used in this assessment.

For any sites not covered by the EA's detailed modelling, Flood Zone 2 was used as an indicative climate change extent. This is appropriate given the 100-year +70% flows are often similar to the Flood Zone 2 extents; therefore, the difference in impacts of climate change would be minimal.

The 1,000-year surface water extent can also be used as an indication of future surface water risk, and risk to smaller watercourses, which are too small to be covered by the EA's Flood Zones.

Developers will need to undertake a more detailed assessment of climate change as part of the planning application process when preparing Flood Risk Assessments, using the percentage increases which relate to the proposed lifetime and the vulnerability classification of the development. In areas where no modelling is present, this may require development of a 'detailed' hydraulic model, using channel topographic surveys. The EA should be consulted to provide further advice for developers on how best to apply the new climate change guidance.

Climate change mapping has been provided in Appendix A.

In summary, the climate change outputs on the PDF maps for the SFRA may be from:

- 'Indicative Climate Change (FZ2)': Flood Zone 2, which is used outside of the areas covered by specific flood models and should be indicative.
- 'Climate Change Central, Higher Central and Upper End': Existing hydraulic model 100-year events upscaled by the 2080s climate change allowances.

It is important to note that although the flood extent may not increase noticeably on some watercourses, the flood depth, velocity and hazard may increase compared to the 100-year current-day event.

When undertaking a site-specific Flood Risk Assessment, developers should:

- Confirm which national guidance on climate change and new development applies by visiting **GOV.uk**
- Apply this guidance when deciding the allowances to be made for climate change, having considered the potential sources of flood risk to the site (using this SFRA), the vulnerability of the development to flooding and the proposed lifetime of the development. If the site is just outside the indicative climate change extents in this SFRA, the impact of climate change should still be considered because these may get affected should the more extreme climate change scenarios materialise.
- Refer to Chapter 8 which provides further details on climate change for developers, as part of the FRA guidance, and the SFRA User Guide in Appendix C.

4.5 Adapting to climate change

The **NPPG Climate Change guidance** contains information and guidance for how to identify suitable mitigation and adaptation measure in the planning process to address the impacts of climate change. Examples of adapting to climate change include:

- Considering future climate risks when allocating development sites to ensure risks are understood over the development's lifetime.
- Considering the impact of and promoting design responses to flood risk and coastal change for the lifetime of the development.
- Considering availability of water and water infrastructure for the lifetime of the development and design responses to promote water efficiency and protect water quality.
- Designing for exceedance to account for increasing event intensities in the future as a result of climate change. The Construction Industry Research & Information Association has provided **guidance** for this.
- Promoting adaptation approaches in design policies for developments and the public realm for example by building in flexibility to allow future adaptation if needed, such as setting new development back from watercourses; and
- Identifying no or low-cost responses to climate risks that also deliver other benefits, such as green infrastructure that improves adaptation, biodiversity and amenity, for example by leaving areas shown to be at risk of flooding as public open space.
- Considering the standard of protection of defences and sites for future development, in relation to sensitivity to climate change. The Council and developers will need to work with RMAs and use the SFRA datasets to understand whether development is affordable or deliverable. Locating development in such areas of risk may not be a sustainable long-term option, such as at the defence locations mentioned in Chapter 6.

It is recommended that the differences in flood extents from climate change are compared by the Council when allocating sites, to understand how much additional risk there could be, where this risk is in the site, whether the increase is marginal or activates new flow paths, whether it affects access/ egress and how much land could still be developable overall. Recommendations for development are made for the levels of risk in the SFRA User Guide in Appendix C.

5 Understanding flood risk in Telford & Wrekin Borough

This chapter explores the key sources of flooding in the borough and the factors that affect flooding including topography, soils and geology. The main sources of flooding are from watercourses and surface water.

This is a strategic summary of the risk in Telford & Wrekin Borough. Developers should use this chapter to scope out the flood risk issues they need to consider in greater detail in a site-specific Flood Risk Assessment to support a Planning Application.

Appendix B contains a list of the sources of data used in the SFRA and the approach to using hydraulic model data to inform the mapping.

5.1 Historical flooding

Telford & Wrekin Council (LLFA) holds records of historic flooding within Telford & Wrekin Borough. There is a history of documented flood events, with the sources being fluvial and surface water. Table 5-1: Historic flooding incidents held by Telford & Wrekin Council highlights the most significant historic flood events.

Source of Flooding	Dates	Locations
Fluvial Flooding from the River Severn/tributaries (inc. Coalbrook)	January 1948	Buildwas, Coalbrookdale, Ironbridge, Coalport, Jackfield
	December 1960	
	October 1998	
	October 2000	
	February 2004	
	February 2014	
	February 2020	
	January 2021	
Fluvial Flooding from the River Tern	February 2004	Admaston, Longdon On Tern, Marsh Green
	September-December 2000	
Surface Water	1st June 2018	Newport
	14th June 2020	Buildwas, Coalbrookdale, Coalport, Dawley, Ironbridge, Jackfield, Ketley
	12th August 2020	Arelston, Apley Castle, Dawley,Donnington, Edgmond, Hadley Castle, Haygate, Ketley, Ketley Bank, Newport, Overdale, Sambrook, Wellington

Table 5-1: Historic flooding incidents held by Telford & Wrekin Council

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Fluvial Flooding from the River Severn/tributaries (inc. Coalbrook)	January 1948	Buildwas, Coalbrookdale, Ironbridge, Coalport, Jackfield
	December 1960	
	October 1998	
	October 2000	
	February 2004	
	February 2014	
	February 2020	
	January 2021	
Fluvial Flooding from the River Tern	February 2004	Admaston, Longdon On Tern, Marsh Green
	September-December 2000	
Surface Water	1st June 2018	Newport
	14th June 2020	Buildwas, Coalbrookdale, Coalport, Dawley, Ironbridge, Jackfield, Ketley
	12th August 2020	Arelston, Apley Castle, Dawley,Donnington, Edgmond, Hadley Castle, Haygate, Ketley, Ketley Bank, Newport, Overdale, Sambrook, Wellington

5.2 Topography, geology, soils and hydrology

The topography, geology and soil are all important in influencing the way the catchment responds to a rainfall event. The degree to which a material allows water to percolate through it, the permeability, affects the extent of overland flow and therefore the amount of run-off reaching the watercourse. Steep slopes or clay rich (low permeability) soils will promote rapid surface runoff, whereas more permeable rock such as limestone and sandstone may result in a more subdued response.

5.2.1 Topography

The topography of Telford & Wrekin is shown in Figure 5-1 (and in Appendix A).

The highest area is the Wrekin, in the south of the Borough, west of Telford centre, with a peak elevation 407m AOD. Elevations in the south of the Borough are generally higher, with elevations of around 200m AOD around Dawley. The topography south of Telford slopes steeply south towards the River Severn. Through the central and northern regions of the borough, the elevations are significantly lower (around 50m AOD) and the topography flatter. This includes the Strine IDB area with several watercourses and drainage ditches.

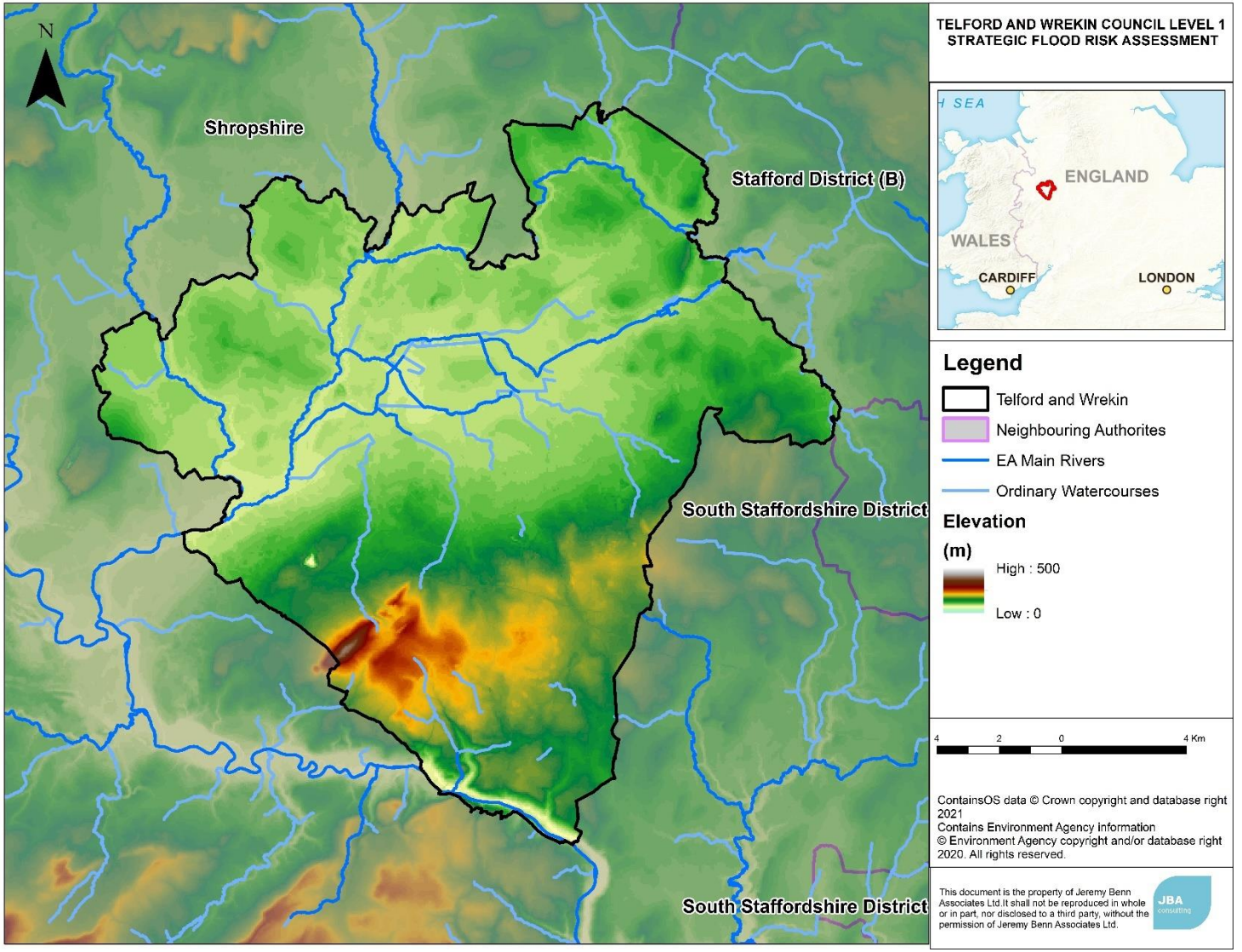

Figure 5-1 Topography of Telford & Wrekin

5.2.2 Geology

The bedrock geology of the area is very varied (see Appendix A). The British Geological Survey (BGS) memoir of the area lists over 35 bedrock members/units, from youngest Triassic Sandstones in the low lying areas of the north of the Authority, through the Carboniferous coal bearing strata that underlie the high ground around Telford, to various older deposits from the Silurian, Ordovician and Cambrian and Precambrian which outcrop in the south of the area. The units generally dip from north to south allowing the older rocks to outcrop on the higher ground.

Of particular note is the Ironbridge Gorge, through which flows the River Severn. The gorge is cut from layers of coal, limestone, haematite and clay. Landslides are known to occur in the area, with over 20 recorded in the National landslide Database. The steepness of slopes, layers of clay and mining in the area are all contributing factors to the risk of landslides in the area.

The distribution of superficial deposits across the area (Appendix A) have the following features:

- Relatively patchy till deposits on the high ground under Telford,
- Thick glacio-fluvial deposits underlying the Wellington and Newport area,
- Peat and lacustrine (lake) deposits underlying the lowest parts of the authority around Sleapford,
- Bands of alluvium and river terrace deposits along the River Tern and Roden.

It should be noted that large parts of the urban area of Telford have been modified by human processes including made ground from industrial activity, spoil mounds and infill of open cast mining to a considerable depth in some places.

5.3 Hydrogeology

Appendix A show the groundwater properties of the bedrock units of the area based on the BGS 1:625k Hydrogeology layer. The table below provides a description of the classes. The Triassic and Permian deposits in the north of the area, form the main highly productive bedrock aquifers in the area:

- Triassic Chester Formation - Sandstone and Conglomerate
- Permian - Bridgnorth Sandstone Formation

Both are identified as principal aquifers by the Environment Agency. The EA also identify the smaller Sylvan Limestone (mapped as Dinantian Rocks in Appendix A) as a principal aquifer. The other older bedrock units are less productive and thus are classed as Secondary aquifers by the Environment Agency.

Table 5-2: Aquifer Classification

Class	Description
1A	Highly productive aquifer - significant intergranular flow
2B	Moderately productive aquifer, flow is virtually all through fractures and other discontinuities
2C	Low productivity aquifer, flow is virtually all through fractures and other discontinuities.

5.3.1 Soils

The soils across Telford & Wrekin are also spatially variable. In the south of the Borough there are slightly acid loamy and clayey soils with impeded drainage, which correlate with the area of clay geology. In the south, there is also an area of restored soils mostly from quarry and opencast spoil. This is associated with the history of mining in the area.

Through the central and northern areas, the soils become more variable. There are large areas of seasonally wet loamy and clayey soils mixed with bands of freely draining slightly acid sandy soils. In the centre, the area associated with the Strine IDB, is an area of fen peat soils.

5.4 Hydrology

There are several watercourses that flow through the study area. These include main rivers and ordinary watercourses. Appendix A shows the location of Main Rivers and ordinary watercourses in the Telford & Wrekin Council area.

5.4.1 Main rivers

These tend to be larger streams and rivers, though some of them are smaller watercourses of local significance. The EA has permissive powers to carry out maintenance, improvement or construction work on Main Rivers to manage flood risk. Consultation with the EA will be required for any development projects within 20m of a Main River or flood defence. A summary of the principal watercourses in the SFRA study area is provided in Table 5-3.

Table 5-3: Main Rivers in the study area

Watercourse	Classification	Description
River Severn	Main River	The River Severn flows along the southern boundary of the study area in a south easterly direction.
River Meese	Main River	The River Meese flows in a westerly direction in the north of the borough, forming a tributary to the River Tern.
River Roden	Main River	The River Roden flows in a southerly direction through the north west of the borough where it forms a tributary to the River Tern.
River Strine (IDB)	Main River	The River Strine flows in a westerly direction in the north of the borough forming a tributary to the River Tern.
Strine Brooks (A & B)	Main River	There are two watercourses called the Strine Brook within the study area. Both flow in a westerly direction in the north of the borough, forming tributaries to the River Strine. The Strine Brook (A) (as labelled in Figure 1-2) rises near Kynnersley, whilst the Strine Brook (B) rises further west near Newport.
River Tern	Main River	The River Tern flows in a southerly direction through the area before changing to a westerly direction near Admaston to join the River Severn outside the Telford and Wrekin boundary.
Commission Drain	Main River	In the centre of the study area, the Commission Drain flows in a westerly direction and forms a tributary to the River Tern.
Hurley Brook	Main River	The Hurley Brook flows in a north-westerly direction in the centre of the study area and forms a tributary to the Commission Drain.
Coalbrook (Loamhole Brook)	Main River	The Loamhole Brook flows in a southerly direction in the south where it forms a tributary to the River Severn.

5.4.2 Ordinary watercourses

These are all watercourses not designated as Main Rivers or IDB watercourses. An ordinary watercourse is any river, stream, ditch, drain, dyke etc. which is not classified as a Main River. As LLFA, Telford & Wrekin Council are required to develop a strategy to tackle local

flood risks involving flooding from ordinary watercourses. The local authority or IDB has permissive powers to maintain them, but the responsibility lies with the riparian owner.

5.5 Fluvial flood risk

Fluvial flood risk occurs when water levels rise higher than the bank levels within a river channel, causing floodwater to spill onto adjacent land (floodplain). The main reasons for this to occur are:

- Intense and/or long duration rainfall causing runoff and flow to increase in rivers resulting in flows exceeding the capacity of the river channel. This can be further exacerbated by wet antecedent conditions or where there are significant contributions of groundwater
- Constrictions within the river channel resulting in flood water backing upstream.
- Blockage of structures or within the river channel itself causing flood water to back up upstream.
- High water levels and/or flood gates prevention discharge out the outlet of the watercourse.

The risk of flooding is a function of the probability that a flood will occur and the consequence to the community or receptor as a direct result of flooding. Section 14 of the **NPPF** seeks to assess the probability of flooding from rivers by categorising areas within the fluvial floodplain into zones of low, medium and high probability and presented on the Flood Map for Planning (Rivers and Sea) available on the Environment Agency website. These Flood Zones have been presented in Appendix A. It should be noted that the Flood Zones shown on the Environment Agency Flood Map for Planning do not take account of the possible impacts of climate change.

It should be noted that a separate map is available on the Government website which is referred to as **'Risk of Flooding from Rivers and Sea'**. This map considers the presence of flood defences and so describes the actual chance of flooding, rather than the chance if there were no defences present. While flood defences reduce the level of risk, they do not completely remove it as they can be overtopped or fail (breach) in extreme weather conditions, or if they are in poor condition.

The residual risk of flooding, or the risk should existing defences fail, is discussed further in Section 6.6.2 of this SFRA. However, for planning purposes the 'Flood Map for Planning (Rivers and the Sea)' and associated Flood Zones remains the primary source of information.

The widest flood extents within Telford & Wrekin Borough are associated with the River Strine, Strine Brook, Commission drain and their tributaries, and the areas flooded are almost entirely agricultural fields and moorland. There are many smaller tributaries and brooks throughout the Borough with smaller associated flood extents, the majority of which are unnamed watercourses. The areas that these smaller watercourses affect is predominantly rural, largely covered by the Strine IDB area.

The most significant areas of flood risk are parts of Telford associated with the Humber Brook, Hurley Brook, Coalbrook/Loamhole Brook and the Mad(e) Brook, where significant numbers of properties are within Flood Zone 3. There are also a large number of commercial premises at risk. A significant number of properties are also at risk from flooding from the River Severn in the south of the Borough, and several communities including Marsh Green and Longdon on Tern are at risk of flooding from the River Tern in the north of the Borough.

In addition to flood risk shown by the flood risk mapping, there are several small watercourses and field drains which may pose a risk to development. Flood Zone mapping (where more detailed modelling investigations are not available) has only been prepared for watercourses with a catchment greater than 3km^2. Therefore, whilst these smaller watercourses may not be shown as having flood risk on the flood risk mapping, it does not necessarily mean that there is no flood risk. Many of these ordinary watercourses have their headwaters within Telford urban area. As part of a site-specific Flood Risk Assessment, the potential flood risk and extent of Flood Zones should be refined for these smaller

watercourses and this information used as appropriate to perform the Sequential and Exception Tests. The Risk of Flooding from Surface Water (RoFSW) mapping can be used to indicate where this is likely to be an issue.

5.6 Surface water flooding

Surface water runoff (or 'pluvial' flooding) is most likely to be caused by intense downpours e.g. thunderstorms. At times the amount of water falling can completely overwhelm the drainage network, which is not designed to cope with extreme storms. The flooding can also be complicated by blockages to drainage networks, sewers being at capacity and/ or high-water levels in watercourses that cause local drainage networks to back up.

The Environment Agency has undertaken modelling of surface water flood risk at a national scale and produced mapping identifying and classifying those areas at risk of surface water flooding:

- 3.33% annual probability (1 in 30 year), 'high'
- 1% annual probability (1 in 100 year), 'medium'
- 0.1% annual probability (1 in 1,000 year) 'low'

The latest version of the mapping is referred to as the 'Risk of Flooding from Surface Water Map (RoFfSW). Appendix Apresents the RoFfSW mapping for Telford & Wrekin Borough. This dataset is also available nationally on the Environment Agency website.

The Environment Agency Risk of Flooding from Surface Water mapping (RoFSW) shows that several communities are at risk of surface water flooding. The mapping shows that surface water predominantly follows topographical flow paths of existing watercourses or dry valleys and can pond in low-lying areas. Whilst in most cases the risk is confined to roads, there are notable prominent run-off flow routes around properties, e.g. properties situated in topographic low points.

5.7 Sewer flooding

Sewer flooding occurs when intense rainfall/river flooding overloads sewer capacity (surface water, foul or combined), and/or when sewers cannot discharge to watercourses due to high water levels.

Sewer flooding can also be caused by blockages, collapses, equipment failure or groundwater leaking into sewer pipes.

Since 1980, the Sewers for Adoption guidelines mean that new surface water sewers have been designed to have capacity for a rainfall event with a 1 in 30 chance of occurring in any given year, although until recently this did not apply to smaller private systems. This means that sewers will be overwhelmed in larger rainfall and flood events. Existing sewers can also become overloaded as new development adds to the surface water discharge to their catchment, or due to incremental increases in roofed and paved surfaces at the individual property scale (urban creep). Sewer flooding is therefore a problem that could occur in many locations across the study area.

Position Statement- At the time of drafting this Level 1 SFRA, records of sewer flooding have not been provided by Severn Trent Water for inclusion within the SFRA.

5.8 Groundwater flooding

This section presents an overview of groundwater related issues. A definition of groundwater flooding is provided by BGS below.

"The characteristic feature of groundwater flooding events is the relatively long duration compared with fluvial flooding."

Groundwater flooding is defined here as the emergence of groundwater at the ground surface away from perennial river channels or the rising of groundwater into man-made ground, under conditions where the 'normal' ranges of groundwater level and groundwater flow are exceeded.

The impact of groundwater flooding can occur before water levels reach the ground surface where there is inundation of building basements and buried services or other assets below ground level.

Groundwater levels that rise above ground have the potential to reach low-lying areas protected from fluvial flooding.

Exceptionally large flows from perennial springs or large flows from intermittent or dormant springs, which also come under the above definition of groundwater flooding, can cause both localised flooding in the vicinity of the springs and down gradient where surface water drainage channels may not be adequate.

5.8.1 Where does groundwater flooding occur?

Three main settings have been identified in the UK where significant groundwater flooding can occur:

- Unconfined major aquifers
- Shallow unconsolidated sedimentary aquifers
- Groundwater rebound in urban centres

The first two of these settings encompass the majority of sites affected by groundwater flooding in the UK.

The ESI groundwater flood map is shown in Appendix A. For an area to be identified as having a potential groundwater flood risk, it needs two elements:

- Underlain by permeable deposits, to allow sufficient groundwater to be conveyed through it.
- Predicted to sometimes have a high-water table.

This means that relatively low permeability deposits that are frequently waterlogged such as peat do not get flagged as a groundwater risk area. The distribution of the risk areas closely matches the distribution of permeable deposits in low lying areas. Most of the low and moderate risk areas have the following features:

- underlain by the principal aquifer in the north,
- underlain by higher permeability alluvium, river terrace deposits and glacio-fluvial deposits,
- low lying.

Two small areas of high groundwater flood risk area identified by the ESI mapping. These are associated with outcrops of the Sylvan Limestone Formation, a formation with karst flow. These are mapped as Dinantian Rocks in Appendix A.

Additionally, Borehole Logs for Baddesley Wells and local knowledge of past conditions suggests that there is an area of high groundwater flood risk in the south of Newport, near Audley Avenue.

5.9 Mine water flooding

The area of Telford & Wrekin has a long history of coal mining. Parts of Telford are subject to flooding from mine water emerging and some waterbodies' water quality are affected by the discharge of polluting mine water. This section has two aims:

- Identify where mine water emergence may be an issue.
- Identify where developments and their drainage schemes have the potential to exacerbate issues.

British Mining (1989) detail the nature of the mine drainage in the Telford area in the late 1980s. The Synopsis (see box below) makes clear that the drainage system of the mine workings is complex.

Box 1 Synopsis from British Mining (1989)

The combination of topography and mining tradition has brought about an unusual range of problems in the Coalfield, now the site of Telford New Town in Shropshire. The availability of men skilled in mining techniques and of engineers capable of putting ideas into practice through their furnaces, foundries and engines made possible the development of many ingenious drainage and transporation schemes. Some of these schemes were single purpose, such as the drainage of mines or as means of getting from A to B avoiding some obstacle or *other. Others however were dual purpose like the Wrockwardine Wood 'Navigation Levels' which were used both for drainage and for transportation.*

The related subjects of drainage and water supply are complex and only those aspects directly affected by geology, mineral working and land reclamation are referred to in this paper. The presence of hitherto unrecorded tunnels, whose original purpose is no longer remembered, makes it necessary to include all tunnels since many of these are now acting as drainage channels, and all of them could result in some degree of instability at the surface.

The mine water drainage beneath Telford is shown in diagrammatical form in Figure 5-2. This is from British Mining 1989, and additional sewers to drain the system have been constructed since then. The drainage has the following features:

- Drainage approximately follows topography, with a watershed on the high ground which divides flow between water that discharges to low ground to the north and the River Severn,
- Historic tunnels and soughs drained the working via gravity,
- Additional modern sewers have been installed to manage the drainage of the system,
- Where historic tunnels and workings collapse or become blocked, the shallow mines do not effectively drain, and groundwater emergence can occur.
- No active pumping occurs in the system to suppress mine water levels.

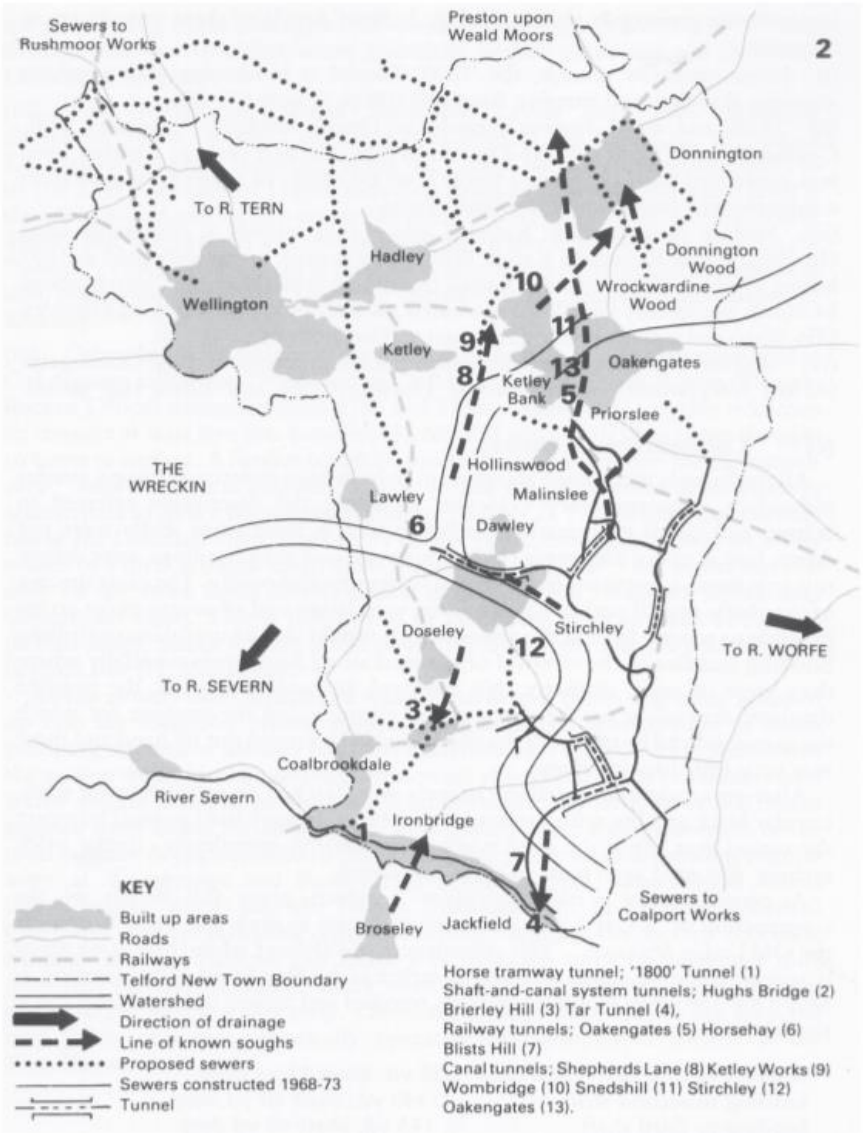

Figure 5-2: Diagrammatical Map of Mine Water Drainage[1]

Appendix A presents maps showing the location of mining features in the area. It shows the following:

- The location of the Lower and Middle Coal Measures outcrops,
- The mapped extent of shallow working the Coal Authority has identified in the area,
- Mine entries,
- Locations where the authority have recorded mine water issues.
- The height of the ground above the river network (based on an underlying layer of the JBA groundwater flood map).

Appendix A also presents the approximate height of ground above the local river network and the location of mine water issues, entrances, and shallow workings. It shows that the most likely location of mine water issues are in low lying areas with mine entries. These entries do not necessarily need to be in shallow working areas, but can be associated with drainage features such as Day Level Sough in the Donnington Area. However, not all mine

[1] Brown, I.J, 1989, *Drainage, Water Supply, Soughs and other Drainage Tunnels in the Coalbrookdale Coalfield, Past, Present and Future,* British Mining no. 39, The Northern Mine Research Society p97-116

water issues are in low lying areas. The figure shows mine water issues being recorded on higher ground in Dawley and in Ironbridge.

The height of mine water within the shallow working is controlled by the drainage network. The effectiveness of this network changes with times as old drainage tunnels collapse and new sewer infrastructure is installed.

Estimating the height of mine water across the area currently is difficult, and it is likely to be subject to change. It should be assumed that all areas with shallow mine workings have the potential to have shallow mine water within them; however, the risk of high mine water and mine water emergence appears more likely in lower lying areas with shallow working, mine entries, and/or drainage features.

5.9.1 Mine Water Constraints Advice

In the North East of England, the Coal Authority have produced **guidance** on the appropriateness of infiltration SuDS different parts of coal fields. The guidance was produced in response incidences where proposed developments did not consider mining and groundwater sufficiently, leading to experiences with groundwater/minewater flooding and poor functioning of SuDS systems. The guidance developed was dependent on the nature of the local mining systems and height of mine water (see Table 5-4).

Table 5-4: North East Coal Authority Groundwater Constraints Advice

Category	Criteria description	Action summary
A	Off the coalfield	SuDS guidance and best practice for assessing pollution and flood risk should be followed. Groundwater should always be considered when designing drainage schemes
B	On the coalfield area	Specific requirements for major development and deep ground works or deep drainage boreholes Note - See Box 3 for specific requirements
C 1	On the coalfield area with one, or both of: shallow mine workings, and nearby controlling outflow	Major development and deep ground works or deep drainage boreholes require pre-application consultation with the Coal Authority
C 2	On the coalfield area with shallow mine water	Infiltration SuDS may not work, developer must suggest alternative methodologies or undertake detailed hydrogeological risk assessment or investigation, that require pre-application consultation with the Lead Local Flood Authority
D	On the coalfield area with shallow mine water, and one, or both of: shallow mine workings, and nearby controlling outflow	Infiltration SuDS may not work, developer must suggest alternative methodologies or undertake detailed hydrogeological risk assessment or investigation, that will require pre-application consultation with the Coal Authority and the Lead Local Flood Authority

Box 2 - Specific Requirements of Category B

Your project is not a major development

If your project is not a major development follow CIRIA's SuDS manual (C753) for assessing pollution and flood risk on controlled waters, including groundwater, to provide a fully justified risk assessment to support sustainable development.

Your project is a major development, but you are not proposing drainage boreholes (deep-bore soakaway) deeper than 30 metres

If your site is a major development but you are not proposing drainage boreholes over 30 metres deep there is no specific consultation required. However, the impacts of the proposal and suitability of the subsurface coalfield environment should be considered. Follow CIRIA's SuDS manual (C753) for assessing pollution and flood risk on controlled waters, including groundwater, to provide a fully justified risk assessment to support sustainable development.

Your project is a major development and you are proposing drainage boreholes deeper than 30 metres

Anthropogenic infiltration drainage schemes may result in flooding and pollution away from the proposed development and may impact mine waters and assets operated by the Coal Authority.

Therefore, infiltration rates of the development should be assessed and compared to greenfield or pre-development rates. Consider impacts of the development and suitability of the subsurface coalfield environment in terms of quantity, routing of water and the pollution risk.

Follow CIRIA's SuDS manual (C753) for assessing pollution and flood risk on controlled waters, including groundwater.

Developers must undertake site specific flood and drainage assessment and the assessments need to consider current and future mine water and groundwater data.

Statutory consultation with the Lead Local Flood Authority regarding flood risk must also be undertaken.

Pre-application discussions with the Environment Agency are required regarding Environmental Permitting Regulations, where infiltration is directed to unsaturated coal measures strata.

If the proposals impact Coal Authority property or assets you are required to seek pre-application consultation with the Coal Authority.

From - https://www.gov.uk/guidance/mining-and-groundwater-constraints-for-development

Table 5-5 outlines how the constraints used in the Coal Authority guidance can be translated into the Telford & Wrekin area.

Table 5-5: Discussion of Constraint Factors in the Telford & Wrekin Area

Areas	Telford and Wrekin Situation
On the Coal Field	This can be identified by the Coal Mining Reporting Area
Shallow Mine Workings (<30m from Surface)	This can be identified by the Coal Authority Shallow Mine Working Layer
Shallow Mine Water (<10m)	It should be assumed that all Shallow Mine Working have shallow mine water within the area. The workings are drained via gravity through a series of tunnels some of which can be subject to collapse, leading to the emergent of groundwater. Only through detailed site-specific assessment would it be possible to identify that mine water is greater than 10m below ground level.
Controlling Outfalls	The Coal Authority in the development of the NE guidance identifies controlling outfalls and requires consultation with themselves if a development lies within 1 km. Controlling outfalls have not been formally identified in Telford & Wrekin, however the LLFA is aware of 3 main outfalls: • Day Level- the outfall daylights on a Ministry of

	Defence site near Donnington. • Trench/Blockleys Mineshaft- the outfall daylights at Middle pool and flows northwards through a treatment system. • Lawley Furnaces- the outfall daylights near Lawley Furnaces and enters Ketley Brook. Groundwater emergent issues are more likely to occur close to mine entries in low lying areas (less than 5m above riverbank level). The areas surrounding these entries appear to have a higher risk of mine water emergence.

Table 5-6 presences modified constraints advice baseline on the guidance outline in Table 5-4 and the nature of local constraints. There are two main differences to guidance in Table 5-4:

- It is assumed that all shallow working have the possibility of shallow groundwater
- It is assumed that all mine entries in low lying areas could form mine water emergence points.

As a result, is possible that infiltration SuDS will not work in these areas. The guidance in Box 3 for the Category B area suggests consultation with the CA would be required. This may only be necessary to translated into local guidance if the CA requires.

Table 5-6: Modified Constraints Advice

Category	Criteria description	Action summary
A	Off the coalfield	SuDS guidance and best practice for assessing pollution and flood risk should be followed. Groundwater should always be considered when designing drainage schemes
B	On the coalfield area	Specific requirements for major development and deep ground works or deep drainage boreholes
C	On the coalfield area with shallow mine water, and shallow mine workings, and close to mine entries in low lying areas	Infiltration SuDS may not work, developer must suggest alternative methodologies or undertake detailed hydrogeological risk assessment or investigation, that will require pre-application consultation with the Lead Local Flood Authority

5.9.2 Soluble Rock Risk

The Environment Agency's groundwater vulnerability mapping (available on Magic.go.uk) shows area of soluble rock risk. As well as increasing the vulnerability to pollution, solution features can cause geotechnical issues such as crown holes (often referred to as sink holes). Infiltration has the potential to enhance the creation of solution features and therefore are unlikely to be appropriate in these areas unless provide by detailed assessment. The groundwater vulnerability mapping only identifies risk on a 1kmx1km basis and can be viewed on DEFRA's Magic Map (https://magic.defra.gov.uk/MagicMap.aspx).The geological units identified as having a risk associated with them appear to be limited to:

- Sylvan Limestone Formation (mapped as part of the Dinantian Rocks),
- Wenlock Limestone (mapped as part of the Wenlock Rocks).

The Sylvan Limestone around the Lilleshall area has existing known issues within instability, with the main developed area if Lilleshall having been grouted/remediated.

Unless supported by site specific assessments, infiltrations cannot be assumed to be appropriate for these areas as they could exacerbate issues surrounding solution features.

5.9.3 Other Instability Issues

The Local Authority has identified a No-Soakaway Zone around the Ironbridge area (as shown in Figure 5-3). There are a range of instability issues associated with the legacy of mine working in the area. Soakaways are not allowed in the area in case they exacerbate land stability issues in the area.

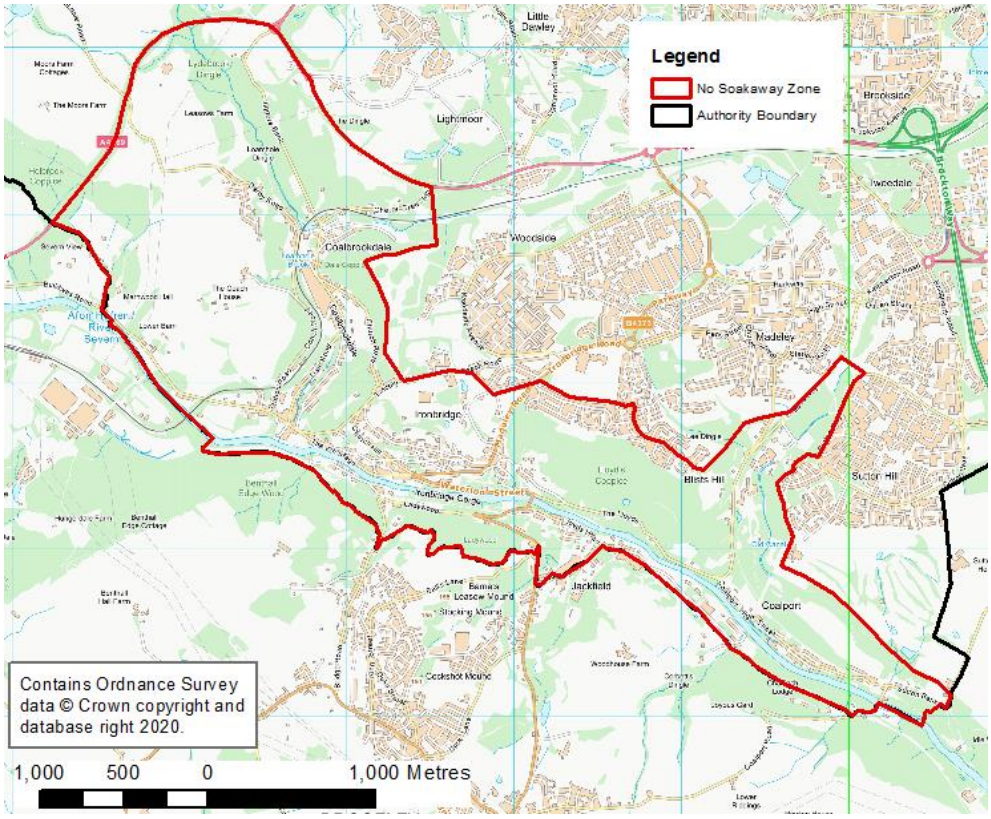

Figure 5-3: Ironbridge No Soakaway Zone

5.10 Flooding from canals

Canals are regulated waterbodies and are unlikely to flood unless there is a sudden failure of an embankment or a sudden ingress of water from a river in areas where they interact closely. Embankment failure can be caused by:

- Culvert collapse
- Overtopping
- Animal burrowing
- Subsidence/ sudden failure e.g. collapse of former mine workings
- Utility or development works close or encroaching onto the footings of a canal embankment.

Flooding from a breach of a canal embankment is largely dictated by canal and ground levels, canal embankment construction, breach characteristics and the volume of water within the canal that can discharge into the lower lying areas behind the embankment. The volume of water released during a breach is dependent on the pound length (i.e. the distance between locks) and how quickly the operating authorities can react to prevent further water loss, for example by the fitting of stop boards to restrict the length of the canal that can empty through the breach, or repair of the breach. The Canal and River Trust monitor embankments at the highest risk of failure.

There are no navigable canals located in the Telford & Wrekin Borough, however there remains one and a half miles of old canal through Newport which remains in water, though not navigable.

5.11 Flooding from reservoirs

Reservoirs with an impounded volume greater than 25,000 cubic metres are governed by the **Reservoir Act 1975** and are on a register held by the Environment Agency. The level and standard of inspection and maintenance required by a Supervising Panel of Engineers under the Act means that the risk of flooding from reservoirs is very low.

Flooding from reservoirs occurs following partial or complete failure of the control structure designed to retain water in the artificial storage area. Reservoir flooding is very different from other forms of flooding; it may happen with little or no warning and evacuation will need to happen immediately. The likelihood of such flooding is difficult to estimate but is extremely low compared to flooding from other sources. It may not be possible to seek refuge upstairs from floodwater as buildings could be unsafe or unstable due to the force of water from the reservoir breach or failure.

The Environment Agency hold mapping showing what might happen if reservoirs fail. Developers and planners should check the **Long-Term Risk of Flooding website** before using the reservoir data shown in this SFRA to make sure they are using the most up to date mapping. Existing or new hydraulic models in locations where there are reservoirs should represent the effect of reservoirs, for example the attenuation effect on flood response, which will either be represented in the hydrology or as part of the model itself.

12 reservoirs pose a potential risk of flooding to areas in the borough. These are listed below in Table 5-7.

Table 5-7: Reservoirs in Telford & Wrekin Borough

Reservoir	Is the reservoir within the study area?
Alscott Lagoons	Yes
Apley Pool	Yes
Ercall Reservoir	Yes
Holmer Lake	Yes
Horsehay Pool	Yes
Ketlwy Sands	Yes
Middle Pool	Yes
Proirslee Balancing Lake	Yes
Proirslee Flash	Yes
Roden pond	Yes
Trench Reservoir	Yes
Withy Pool	No

5.12 Impact of climate change on flood risk

This section explores which areas of the Borough are most sensitive to increases in flood risk due to climate change. It should be noted that areas that are already at high risk will also become at increasing risk in future and the frequency of flooding will increase in such areas.

It is recommended that the Council works with other Risk Management Authorities to review the long-term sustainability of existing and new development in these areas when developing climate change plans and strategies for the borough.

5.12.1 Impact of climate change on fluvial flood risk

Climate change modelled flood extents (or Flood Zone 2 where no modelling exists) can be compared to the 100-year flood extent (Flood Zone 3a) for an indication of areas most sensitive to climate change. .

5.12.2 Impact of climate change on surface water flood risk

In the absence of modelling surface water risk with climate change uplifts, the 1,000-year surface water flood extent can be used as an indication of climate change (as well as for smaller watercourses; some of which are not included in the Flood Zones).

Areas in the borough most sensitive to changes between the 100-year and 1,000-year surface water extents are:

- Areas of low-lying flat topography in Telford.
- Newport
- Coalbrookdale
- Ironbridge

5.12.3 Impact of climate change on groundwater flood risk

There is no technical modelling data available to assess climate change impacts on groundwater. It would depend on the flooding mechanism, historic evidence of known flooding and geological characteristics, for example prolonged rainfall in a chalk catchment. Flood risk could increase when groundwater is already high or emerged, causing additional overland flow paths or areas of still ponding.

A high likelihood of groundwater flooding may mean infiltration SuDS are not appropriate and groundwater monitoring may be recommended.

5.13 Flood Alert and Flood Warnings

The Environment Agency is the lead organisation for providing warnings of river flooding. Flood Warnings are supplied via the Flood Warning System (FWS) service, to homes and business within Flood Zones 2 and 3.

There are currently two Environment Agency Flood Alert Areas (FAA) and one Flood Warning Areas (FWAs) covering Telford & Wrekin Borough. Flood Alerts are issued when there is water out of bank for the first time anywhere in the catchment, signalling that 'flooding is possible', and therefore Flood Alert Areas usually cover the majority of Main River reaches. Flood Warnings are issued to designated Flood Warning Areas (i.e. properties within the extreme flood extent which are at risk of flooding), when the river level hits a certain threshold; this is correlated between the FWA and the gauge, with a lead time to warn that 'flooding is expected'.

A separate flood warning system exists for the Coalbrook at the time of writing this report. This warning relates to the rapid response flood risk from this catchment and, although the Coalbrook is a Main River, the warning system is currently operated and managed by Telford & Wrekin Council.

A list of the Flood Alert and Flood Warning Areas is available in Appendix D. A map of the Flood Alert Areas and Flood Warning Areas is included in Appendix A Figure 15.

5.14 Summary of flood risk in Telford & Wrekin Borough

A table summarising all sources of flood risk to key settlements in Telford & Wrekin Borough can be found in Appendix E.

6 Flood alleviation schemes and assets

This section provides a summary of existing flood alleviation schemes and assets in the Telford and Wrekin Borough. Planners should note the areas that are protected by defences where further work to understand the actual and residual flood risk through a Level 2 SFRA may be beneficial. Developers should consider the benefit they provide over the lifetime of a development in a site-specific Flood Risk Assessment.

6.1 Asset management

Risk Management Authorities hold databases of flood risk management and drainage assets:

- The Environment Agency holds a national database that is updated by local teams
- The LLFA holds a database of significant local flood risk assets, required under Section 21 of the Flood and Water Management Act (2010)
- Highways Authorities hold databases of highways drainage assets, such as gullies and connecting pipes
- Water Companies hold records of public surface water, foul and combined sewers, the records may also include information on culverted watercourses.

The databases include assets RMAs directly maintain and third-party assets. The drainage network is extensive and will have been modified over time. It is unlikely that any RMA contains full information on the location, condition and ownership of all the assets in their area. They take a prioritised approach to collecting asset information, which will continue to refine the understanding of flood risk over time.

Developers should collect the available asset information and undertake further survey as necessary to present an understanding of current flood risk and the existing drainage network in a site-specific Flood Risk Assessment.

6.2 Standards of Protection

Flood defences are designed to give a specific Standard of Protection (SoP), reducing the risk of flooding to people and property in flood prone areas. For example, a flood defence with a 100-year SoP means that the flood risk in the defended area is reduced to at least a 1% chance of flooding in any given year.

Over time the actual SoP provided by the defence may decrease, for example due to deterioration in condition or increases in flood risk due to climate change. The understanding of SoP may also change over time as RMAs undertake more detailed surveys and flood modelling studies.

It should be noted that the Environment Agency's on-going hydraulic modelling programme may revise flood risk datasets and, therefore, the standard of protection offered by flood defences in the area may differ from those discussed in this report.

Developers should consider the standard of protection provided by defences and residual risk as part of a detailed FRA.

6.3 Maintenance

The Environment Agency and local authorities have permissive powers to maintain and improve Main Rivers and Ordinary Watercourses, respectively. There is no legal duty to maintain watercourses, defences or assets and maintenance and improvements are prioritised based on flood risk. The ultimate responsibility for maintaining watercourses rests with the landowner.

Highways authorities have a duty to maintain public roads, making sure they are safe, passable and the impacts of severe weather have been considered. Water companies have a duty to effectually drain their area. What this means in practise is that assets are maintained to common standards and improvements are prioritised for the parts of the network that do not meet this standard e.g. where there is frequent highway or sewer flooding. Telford & Wrekin Council as LLFA have permissive powers and limited resources are prioritised and targeted to where they can have the greatest effect.

There is potential for the risk of flooding to increase in areas where flood alleviation measures are not maintained regularly. Breaches in raised flood defences are most likely to occur where the condition of a flood defences has degraded over time. Drainage networks in urban areas can also frequently become blocked with debris and this can lead to blockages at culverts or bridges.

Developers should not assume that any defence, asset or watercourse is being or will continue to be maintained throughout the lifetime of a development. They should contact the relevant RMA about current and likely future maintenance arrangements and ensure future users of the development are aware of their obligations to maintain watercourses.

Formal structural defences are given a rating based on a grading system for their condition. A summary of the grading system used by the Environment Agency for condition is provided in Table 6-1.

Table 6-1: Grading system used by the Environment Agency to assess flood defence condition

Grade	Rating	Description
1	Very good	Cosmetic defects that will have no effect on performance
2	Good	Minor defects that will not reduce the overall performance of the asset.
3	Fair	Defects that could reduce the performance of the asset.
4	Poor	Defects that would significantly reduce the performance of the asset. Further investigation required.
5	Very Poor	Severe defects resulting in complete performance failure.

Source: Condition Assessment Manual – Environment Agency 2006

6.4 Major flood risk management assets in the borough

The Environment Agency AIMS dataset shows the location of any flood defence assets in the Borough and is shown in Appendix A. High ground is shown along most of the main rivers in the Borough. An embankment and flood wall are in the north of Walcot along the River Roden. Temporary defences are present along The Wharfage in Ironbridge.

6.5 Existing and future flood alleviation schemes

There are two significant regional SuDS feature located at Limekiln Lane and Brick Kiln Bank. There are also Flood Alleviation Schemes in Jackfield and Ketley. Historically, a system of balancing lakes and oversized sewers was constructed by the Telford Development Corporation which are considered to have flood risk management benefits.

In Ironbridge gorge, currently temporary flood defences are used along the banks of the Severn during periods of high flow. Owing to the temporary nature of the defences, they offer a relatively low standard of protection and whilst these have been effective in several

previous events, during the Winter of 2020-21, barriers were shifted by the force of the water (although not breached). Consequently, the Environment Agency and Council are currently undertaking work to improve the conditions for deployment of the barriers. The Council is also in the early stages of exploring options for permanent defences in the future, including seeking funding from the Government.

6.6 Actual and residual flood risk

A Level 2 SFRA (for strategic allocations) or developer site-specific Flood Risk Assessment will need to consider the actual and residual flood risk due to the presence of flood and drainage assets in greater detail.

6.6.1 Actual flood risk

This is the risk to the site considering existing flood mitigation measures and any planned to be provided through new development. Note that it is not likely to be acceptable to allocate developments in existing undefended areas on the basis that they will be protected by developer works, unless there is a wider community benefit that can be demonstrated.

The assessment of the actual risk should consider that:

- The level of protection afforded by existing defences might be less than the appropriate standards and hence may need to be improved if further growth is contemplated.
- The flood risk management policy for the defences will provide information on the level of future commitment to maintain existing standards of protection. If there is a conflict between the proposed level of commitment and the future needs to support growth, then it will be a priority for this to be reviewed.
- The standard of safety must be maintained for the intended lifetime of the development. Over time the effects of climate change will erode the present-day standard of protection afforded by defences and so commitment is needed to invest in the maintenance and upgrade of defences if the present-day levels of protection are to be maintained and where necessary, land secured and safe-guarded that is required for affordable future flood risk management measures.
- By understanding the depth, velocity, speed of onset and rate of rise of floodwater it is possible to assess the level of hazard posed by flood events from the respective sources.

6.6.2 Residual risk

Residual risk is the risk that remains after the effects of flood risk infrastructure have been considered. It is important that these risks are quantified to confirm that the consequences can be safely managed. The residual risk can be:

- The effects of a larger flood than defences were designed to alleviate (the 'design flood'). This can cause overtopping of flood banks, failure of flood gates to cope with the level of flow or failure of pumping systems to cope with the incoming amount of water.
- Failure of the defences or flood risk management measures, such as breaches in embankments or walls, failure of flood gates to open or close or failure of pumping stations.

It is the responsibility of the developer to fully assess flood risk, propose measures to mitigate it and demonstrate that any residual risks can be safely managed.

This SFRA does not assess the probability of failure other than noting that such events are very rare. However, in accordance with NPPF, all sources of flooding need to be considered. If a breach or overtopping event were to occur, then the consequences to people and property could be high. Developers should be aware

that any site that is at or below defence level, may be subject to flooding if an event occurs that exceeds the design capacity of the defences, or the defences fail, and this should be considered in a detailed Flood Risk Assessment.

The assessment of residual risk should consider:

- The flood hazard, depth and velocity that would result from overtopping or breach of defences. Flood gate or pumping station failure and/ or culvert blockage (as appropriate). The Environment Agency can provide advice at site-specific development level for advice on breach/ overtopping parameters for flood models.
- The design of the development to take account of the highest risk parts of the site e.g. allowing for flood storage on parts of the site and considering the design of the development to keep people safe e.g. sleeping accommodation above the flood level.
- A system of warning and a safe means of access and egress from the site in the event of a flood for users of the site and emergency services.

Developers should also seek to safely design for exceedance, considering how developments can safely accommodate flows in periods when defences are overtopped or drainage capacities exceeded. The Construction Industry Research & Information Association has provided **guidance** for this.

6.6.3 Overtopping

The risk from overtopping of defences is based on the relative heights of property or defence, the distance from the defence level and the height of water above the crest level of the defence. The Defra and Environment Agency **Flood Risks to People** guidance document provides standard flood hazard ratings based on the distance from the defence and the level of overtopping.

Any sites located next to defences or perched ponds/ reservoirs, may need overtopping modelling or assessments at the site-specific FRA stage.

6.6.4 Defence breach

A breach of a defence occurs when there is a failure in the structure and a subsequent ingress of flood water.

Where defences are present, risk of breach events should be considered as part of the site-specific flood risk assessment. Flood flows from breach events can be associated with significant depths and flow velocities in the immediate vicinity of the breach location and so FRAs must include assessment of the hazards that might be present so that the safety of people and structural stability of properties and infrastructure can be appropriately taken into account. Whilst the area in the immediate vicinity of a breach can be subject to high flows, the whole flood risk area associated with a breach must also be considered as there may be areas remote from the breach that might, due to topography, involve increased depth hazards.

Considerations include the location of a breach, when it would occur and for how long, the depth of the breach (toe level), the loadings on the defence and the potential for multiple breaches. There are currently no national standards for breach assessments and there are various ways of assessing breaches using hydraulic modelling. Work is currently being undertaken by the Environment Agency to collate and standardise these methodologies. It is recommended that the Environment Agency are consulted if a development site is located near to a flood defence, to understand the level of assessment required and to agree the approach for the breach assessment.

7 Cumulative impact of development and strategic solutions

This section provides a summary of the catchments with the highest flood risk and development pressures and then makes recommendations for local planning policy based on these.

7.1 Introduction

Under the NPPF, strategic policies and their supporting Strategic Flood Risk Assessments (SFRAs), are required to 'consider cumulative impacts in, or affecting, local areas susceptible to flooding' (para.156), rather than just to or from individual development sites.

When allocating land for development, consideration should be given to the potential cumulative impact of the loss of floodplain storage volume, as well as the impact of increased flows on flood risk downstream. Whilst the loss of storage for individual developments may only have a minimal impact on flood risk, the cumulative effect of multiple developments may be more severe.

All developments are required to comply with the NPPF and demonstrate they will not increase flood risk elsewhere. Therefore, providing developments comply with the latest guidance and legislation relating to flood risk and sustainable drainage, in theory they should not increase flood risk downstream.

Catchments within the study area that have the potential to influence existing flood risk issues in neighbouring Local Authorities were identified, as well as catchments in the study area that may be influenced by development in catchments in neighbouring Local Authorities. Historic flood incidents, the current and predicted increase in surface water flood risk to properties and cross boundary issues in each catchment were assessed to identify the catchments at greatest risk.

Local planning policies can also be used to identify areas where the potential for development to increase flood risk is highest and identify opportunities for such new development to positively contribute to decreases in flood risk downstream.

7.2 Strategic flood risk solutions

The Telford & Wrekin Local Flood Risk Management Strategy sets out a vision for the future management of flood risk and drainage within the Borough. Alongside flood risk management, this concerns environmental and water quality enhancements. Strategic solutions may include upstream flood storage, integrated major infrastructure/ FRM schemes, new defences and watercourse improvements as part of regeneration and enhancing green infrastructure, with opportunities for natural flood management and retrofitting sustainable drainage systems. The Local Flood Risk Management Strategy sets out specific actions for the district.

Chapter 10 sets out the strategic plans that exist for environmental resources in the Borough, with Chapter 10.4.3 specifically addressing flood risk management.

The Shropshire Middle Severn Catchment covers the northern part of Telford & Wrekin Borough. The catchment covers a wide area, consisting of the Rivers Perry and Tern and their tributaries to their confluences with the River Severn at Mytton and Atcham respectively. The strategic policy vision from the Catchment Flood Management Plan (CFMP) and River Basin Management Plan (RBMP) focuses on reducing flood risk in the urban areas. This seeks to limit runoff increase as a result of development and providing wider environmental and other benefits to improve the natural, rural and built environment consistent with the principles of sustainable development.

The Worcestershire Middle Severn Catchment covers the south of Telford & Wrekin Borough. The catchment consists of the main River Severn from Shrewsbury to Worcester, including the Rivers Stour and Worfe and their tributaries. The strategic policy vision from the CFMP and RBMP focuses on reducing or preventing an increase in risk to communities within rapidly responding catchments along various tributaries, as well as steering development to less vulnerable areas. Again, the aim is to provide wider environmental and other benefits to improve the natural, rural and built environment consistent with the principles of sustainable development.

Within Telford & Wrekin Borough, strategic solutions encourage development to:

- Retain water on-site through sustainable drainage, integrate flood storage compensation measures, improve the capacity of receiving watercourses and provide appropriate buffering between watercourses and development.
- Make allowances for future development for example the paving of gardens, in the design and capacity of drainage systems (urban creep). Local evidence shows that there is a trend over time for green spaces to be tarmacked to reduce maintenance and provide additional parking by residents and businesses.
- Plan for the lifetime of the development and the effects of climate change by setting appropriate floor levels, providing safe pedestrian and vehicle access and where appropriate provide a flood evacuation management plan.
- Design SuDS to adoptable standards, with management and maintenance plans for drainage systems set out at application stage detailing how maintenance will be carried out, funded and who the responsible end party will be. The costs of maintaining these systems should be considered within the design.
- Reduce the length of culverted watercourses, where possible.
- Promote partnership working with all relevant stakeholders.
- Where possible, land management change should be used to reduce run-off rates from the development whilst maintaining or enhancing the capacity of the natural floodplain to retain water. Greenfield sites should restrict runoff to as close to greenfield rates as possible whilst brownfield sites should achieve a minimum 50% reduction in runoff. In susceptible catchments, Telford & Wrekin Council may require additional betterment.
- Use SFRAs to inform future development and minimise flood risk from all sources.

7.3 Assessment of cross-boundary issues

Figure 7-1 shows the catchments in Telford & Wrekin Borough mapped against the topography and the direction that they drain into or out of neighbouring Authorities. Growth in neighbouring authorities was not considered in the cumulative impact assessment, however the potential remains for growth in neighbouring authorities to affect flood risk within the Borough and for high risk catchments, developments in other Authorities should be considered as part of more detailed work. Growth in neighbouring authorities is unlikely to impact risk within the main urban centre of Telford, as the headwaters are within the Borough, however this may impact risk in the rural areas in the far north of the Borough.

As part of the Shropshire Level 1 & 2 Strategic Flood Risk Assessments, the Wesley Brook - source to River Worfe catchment was previously identified as at a high risk from the cumulative impacts of development. Telford & Wrekin Council should work closely with Shropshire Council on any sites proposed within this catchment. Policy recommendations for the catchment may be found in Section 10.1.1

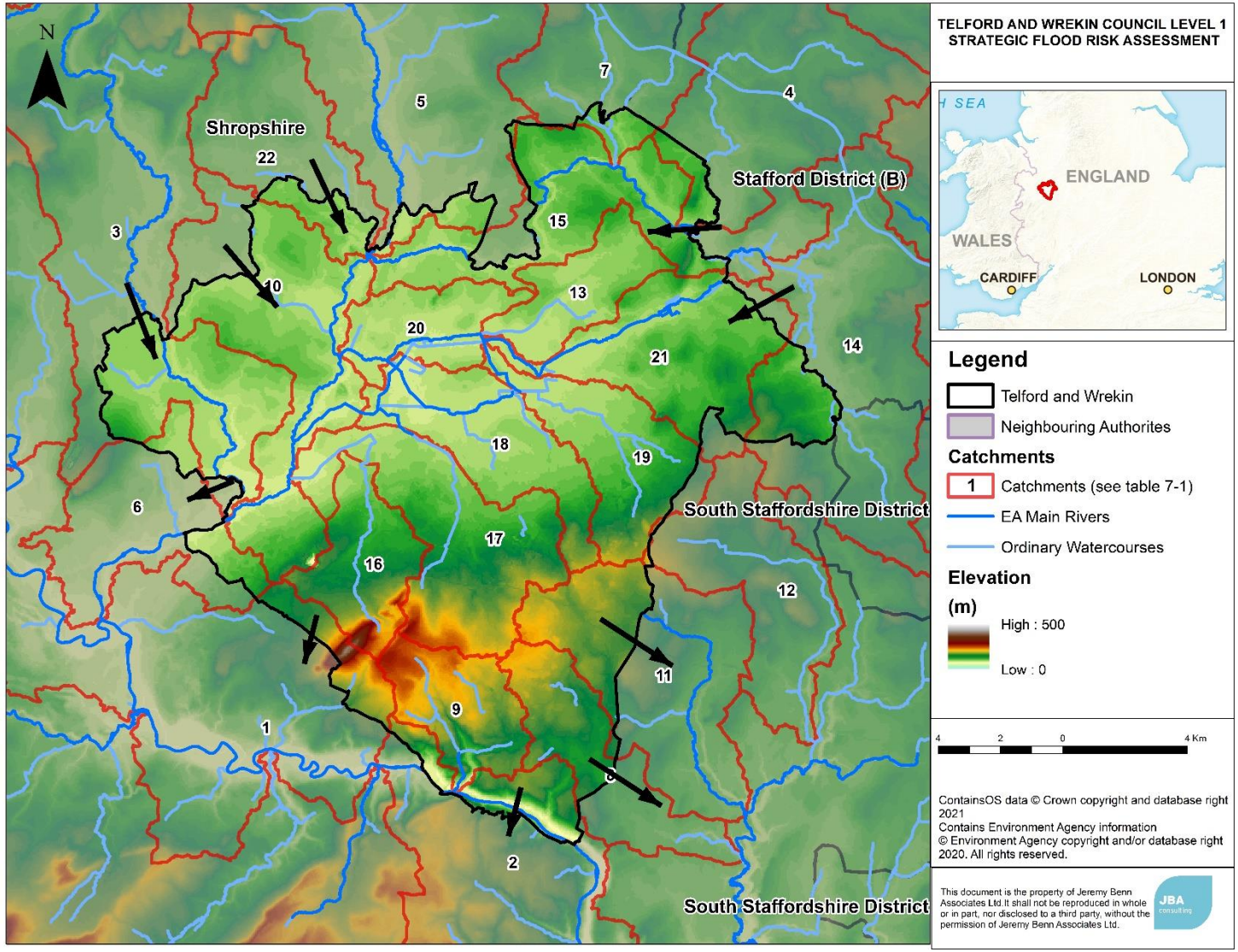

Figure 7-1 Catchments within Telford & Wrekin Borough and the directions of flow into and out of the Borough (numbered as in Table 7-1)

Table 7-1 Catchments within Telford & Wrekin Borough as numbered in Figure 7-1

Catchment Number	Catchment Name
1	Severn - Sundorne Brook to Much Wenlock-Farley Brook
2	Severn - Much Wenlock-Farley Brook to River Worfe
3	Roden - Sleap Brook to River Tern
4	Lonco Brook - source to River Meese
5	Tern - Bailey Brook to River Meese
6	Tern - River Roden to River Severn
7	Ellerton Brook - source to River Meese
8	Mad(e) Brook - source to River Worfe
9	Lyde Brook (inc. Coalbrook) - source to River Severn
10	Tern - River Meese to River Roden
11	Wesley Brook (inc. Nedge Brook) - source to River Worfe
12	Burlington Brook - source to Neachley Brook
13	Pipe Strine - source to River Strine
14	Meese - Aqualate Mere tributaries
15	Meese - Aqualate Mere to River Tern
16	Beanhill Brook - source to Shawbirch
17	Ketley Brook (inc. Hurley Brook) - source to Ketley Sands Flood Meadow
18	Red Strine - source to River Strine
19	Wall Brook - source to Pipe Strine
20	Strine - Pipe Strine to River Tern
21	Strine Brook - source to Wall Brook
22	Platt Brook - source to River Tern

Consequently, there are several catchments within the Borough where future development may impact flood risk in the neighbouring Local Authorities outlined above, particularly where there are existing flood risk issues. Figure 7-2 summarises the catchments which have watercourses flowing out of Telford & Wrekin, where the impact of flood risk downstream should be assessed when considering development. The sources of data used to inform the existing flood risk issues to properties in neighbouring local authorities can be found in Appendix B.

The following Local Plans have been adopted by neighbouring Local Authorities and include policies relevant to flood risk and drainage:

- **Shropshire Local Development Framework**- 2016-2038 (Currently under partial review)
- **South Staffordshire Local Plan**- 2012-2028 (to be reviewed Summer 2021)
- **Stafford Borough Local Plan**- 2011-2031 (New Local Plan 202-2040 currently under consultation)

Table 7-2: Summary of catchments that drain into the neighbouring Local Authorities from Telford & Wrekin Borough

Catchment	Neighbouring downstream Local Authority
Severn- Sundorne Brook to Much Wenlock-Farley Brook	Shropshire
Severn Much Wenlock-Farley Brook to River Worfe	Shropshire
Roden - Sleap Brook to River Tern	Shropshire
Tern - River Roden to River Severn	Shropshire
Mad(e) Brook - Source to River Worfe	Shropshire
Wesley Brook - source to River Worfe	Shropshire

7.4 Cumulative Impact Assessment

To assess the cumulative impact of development across the study area, the surface water flood risk in each catchment was assessed along with evidence of historic flooding incidents. Potential change in developed areas within each catchment within Telford & Wrekin Borough was considered, - development sites within neighbouring Authorities were not available for the assessment, however these are unlikely to have impacted the final rankings. These should be considered as part of the future Level 2 SFRA. Analysis of this data facilitated the identification of catchments at the greatest risk of cumulative impacts of an increase in impermeable area within the catchment.

Figure 7-2 shows the methodology used and Table 7-3 summarises the datasets used within Telford & Wrekin Borough cumulative development scenario. More detailed information on the methodology, assumptions and considerations of the cumulative impact assessment can be found in 7.4.4.

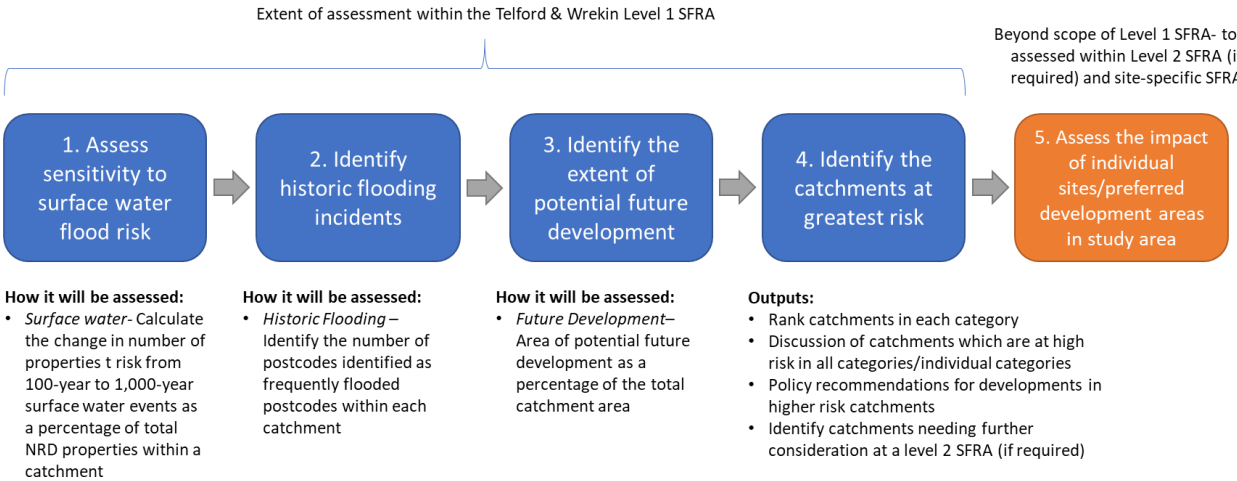

Figure 7-2: Overview of the method used within the Cumulative Impact Assessment

Table 7-3: Summary of datasets used within the Cumulative Impact Assessment

Dataset	Coverage	Source of data	Use of data
Catchment Boundaries	Telford & Wrekin Study Area	Water Framework Directive Catchments	Surface Water and Development Flood Risk
National Receptor Database (2014)	Telford & Wrekin Study Area	Environment Agency	Assessing the number of properties at risk of surface water flooding within each catchment
Risk of Surface Water Flooding Mapping	Telford & Wrekin Study Area	Environment Agency	Assessing the number of properties at risk of surface water flooding within each catchment
Future development areas: - Existing allocations -Housing Completions -Housing under construction/not yet started	Telford & Wrekin Study Area	Telford & Wrekin Council	Assessing the impact of proposed future development on risk of flooding.
Historic Recorded Internal Flooding Events	Telford & Wrekin Study Area	Telford & Wrekin Council	Assessing incidences of historic flooding within the study area.

7.4.1 Assessing sensitivity to surface water flood risk

To understand the sensitivity of a catchment to an increased risk in surface water flooding, a potential result of increased development, the number of additional properties at risk in the 1,000-year event compared to the 100-year event was calculated. This approach utilised National Receptor Database (NRD) data to indicate the location of properties alongside the Environment Agency's Risk of Flooding from Surface Water mapping datasets. Water Framework Directive (WFD) catchment data was used to determine the number of properties at risk in each river catchment.

7.4.2 Assessing historic flooding incidents

Historic internal flood events were supplied by Telford & Wrekin Council (earliest records from 2007). The total number of historically flooded properties within each catchment was recorded.

7.4.3 Assessing future development

Currently allocated site for future development, housing under construction and recent completions were provided by Telford & Wrekin Council. The area of recent/future development within each catchment was calculated as a percentage of the total catchment area. It is assumed that all development will feature a similar proportion of impermeable surfaces and are therefore directly comparable for the purposes of the study.

7.4.4 Assessment assumptions and limitations

The study has been undertaken using the best available data. The assumptions made in assessing and ranking the impacts of cumulative development on catchments within Telford & Wrekin Borough are summarised in Table 7-4.

Table 7-4 Assumptions and limitations of the cumulative impact assessment

Assessment aspect	Assumption made	Details of limitation in method	Justification of method used
Surface water flood risk	Total number of properties flooded	Assumption that all properties have been included in the 2014 NRD dataset. It may not include all new build properties.	This was the most up to date and accurate data available.
Surface Water Flood Risk	Difference in numbers of properties effected between the 100- and 1,000-year events.	As the assessment uses the difference between the 100- and 1,000-year event, the assessment will not necessarily highlight areas where there is a large number of properties at risk in the 100-year event.	This assessment identifies those catchments at greatest risk of increasing flood risk as a result of the cumulative impacts of development. Where significant numbers of properties are already at risk, this is already a known issue and the comparative increase in risk in the future is likely to be lower.
Historic Flooding incidents	Total number of historic events and severity of flooding	Only flooding incidents since 2007 were recorded, therefore events before the record will not be accounted for and results may be skewed towards those areas which have experienced flooding more recently. There is also is no consideration of the severity of flooding.	This was the only information available and there is a benefit in identifying the areas known to be most at risk even where other areas may be identified were the data available.
Future Planned Development	All sites identified at this stage (see Table 7-3) will be built out. Brownfield and greenfield sites have not been distinguished.	Assuming all sites are built out is likely to overestimate the risk presented by future development. Brownfield site development may reduce surface water runoff should appropriate SuDS be installed.	This is a conservative approach, giving a reasonable worst-case view.
Future Planned Development	Development in neighbouring authorities was not considered.	Development upstream may impact flood risk within Telford & Wrekin, which is not accounted for.	Data was not available. Given the large number of catchments, development outside the Borough is unlikely to have significantly impacted final rankings.
Topography	Differences in cumulative impact of development between areas of different topographic character are not accounted for.	Flood extents will increase more in flatter areas, whilst steep catchments may see an increase in flood velocities and hazards with only a small increase in flood extent.	Accurately characterising the topography of catchments in a consistent, comparable way would be technically challenging. Furthermore, topography varies even within catchments and should be considered further as part of a Level 2 SFRA.
Sewer Flooding	Sewer network age and capacity differences are	The age and capacity of the existing drainage/sewer network will have an impact	Accurately characterising the age and capacity of sewer networks relative to the strain placed upon them

	not accounted for.	on the cumulative impact of development upon flood risk.	by development in a consistent and comparable way would be technically challenging, beyond the scope of this assessment. This should be considered further as part of a Level 2 SFRA.

7.5 Cumulative Impact Assessment Outcomes

The assessment was conducted on the Water Framework Directive (WFD) River Catchments. Each catchment was given a ranking for each metric, as outlined in Table 7-5 Criteria for ranking catchments based on metrics described in Section 7.4. These metrics are comparative between the catchments considered in the study and should not be used to determine whether a catchment is at higher or lower risk compared to areas outside of the immediate study area.

The results of the cumulative impact assessment can be summarised to give a rating of low, medium or high risk for each catchment, as described in Table. The rating of each catchment in each of these assessments was combined to give an overall ranking.

Table 7-5 Criteria for ranking catchments based on metrics described in Section 7.4

Flood risk ranking	% of properties at increased risk of SW flooding	Total number of historic internal flooding incidents	% Area of Catchment Covered by new development
Low risk	<2.3%	0	<1%
Medium risk	2.3 to 3%	1 to 15	1 to 5%
High risk	>3%	>15	>5%

Table 7-6 Final rankings for catchments based on rankings for each individual metric

Individual Rank	Score	Total Score (out of 9)	Final Rank
High Risk	3	7-9	High Risk
Medium risk	2	5-6	Medium Risk
Low Risk	1	3-4	Low Risk

Table 7-7 shows the catchments identified as high risk due to the increased risk of surface water flooding, Table 7-8 shows the percentage of the catchments covered by future planned development (see Table 7-3 for datasets considered) and Table 7-9 shows the highest risk catchments based on the number of historic flooding incidents recorded.

Table 7-7: Percentage of properties in a catchment sensitive to increased surface water flood risk

Catchment	Properties sensitive to increased surface water flood risk (%)
Lonco Brook- Source to River Meese	4.0
River Meese- Aqualate Mere to River Tern	3.2

Ketley Brook- Source to Ketley Sands Flood Meadow	3.1

Table 7-8: Percentage of catchment covered by future planned development

Catchment	Area of catchment for development (%)
Ketley Brook - Source to Ketley Sands Flood Meadow	13.5
Lyde Brook (inc. Coalbrook)- Source to River Severn	11.7
Wesley Brook (inc. Nedge Brook) - Source to River Worfe	7.2
Beanhill Brook - source to Shawbirch	5.9

Table 7-9: Number of recorded historic internal flooding events within a catchment

Catchment	No. of recorded properties flooded internally
Severn- Much Wenlock-Farley Brook to River Worfe	121
Ketley Brook- Source to Ketley Sands Flood Meadow	83
Lyde Brook (inc. Coalbrook)- Source to River Severn	47
Strine Brook - Source to Wall Brook	39
Red Strine- Source to River Strine	28

As can be seen from the above tables, one catchment, Ketley Brook Source to Ketley Flood Meadow, is at high risk in all categories.

Figure 7-3 shows a map of catchments within Telford & Wrekin Borough and identifies the highest risk catchments which are the most sensitive to the impacts of cumulative impacts of development.

These rankings give an indication of the relative susceptibility of catchments to the cumulative impacts of development only- they do not infer the present-day risk of flooding within the catchment, or whether development is appropriate at particular sites within the catchment. Rather, this means that development in high-risk catchments must take particular care to mitigate the potential impacts of development (see section 7.6). It should also be noted that development offers the opportunity to reduce the risk within the catchment, for example through implementation of SuDS.

Five catchments (see Table 7-1) are identified as highest risk (red), these are:

- Ketley Brook Source to Ketley Sands Flood Meadow (ref. 17)
- Lyde Brook (inc. Coalbrook)- Source to River Severn (ref. 9)
- Wall Brook- Source to Pipe Strine (ref. 19)
- Red Strine- Source to River Strine (ref. 18)

These are predominantly urban catchments that drain the Telford urban area.

In addition, the Wesley Brook - source to River Worfe catchment was previously identified as at a high risk from the cumulative impacts of development as part of the Shropshire Level 1 & 2 SFRAs.

A further six catchments that fall within or partially within Telford & Wrekin Borough have been identified as at medium risk (amber) which include:

- Beanhill Brook- Source to Shawbirch (ref. 16)
- River Meese- Aqualate Mere to River Tern (ref. 15)
- Mad(e) Brook - Source to River Worfe (ref. 8)
- Lonco Brook- Source to River Meese (ref. 4)
- River Tern- River Meese to River Roden (ref. 10)
- Severn- Much Wenlock-Farley Brook to River Worfe (ref. 2)

The remaining catchments (green) are identified as at a low risk of the impacts of cumulative development.

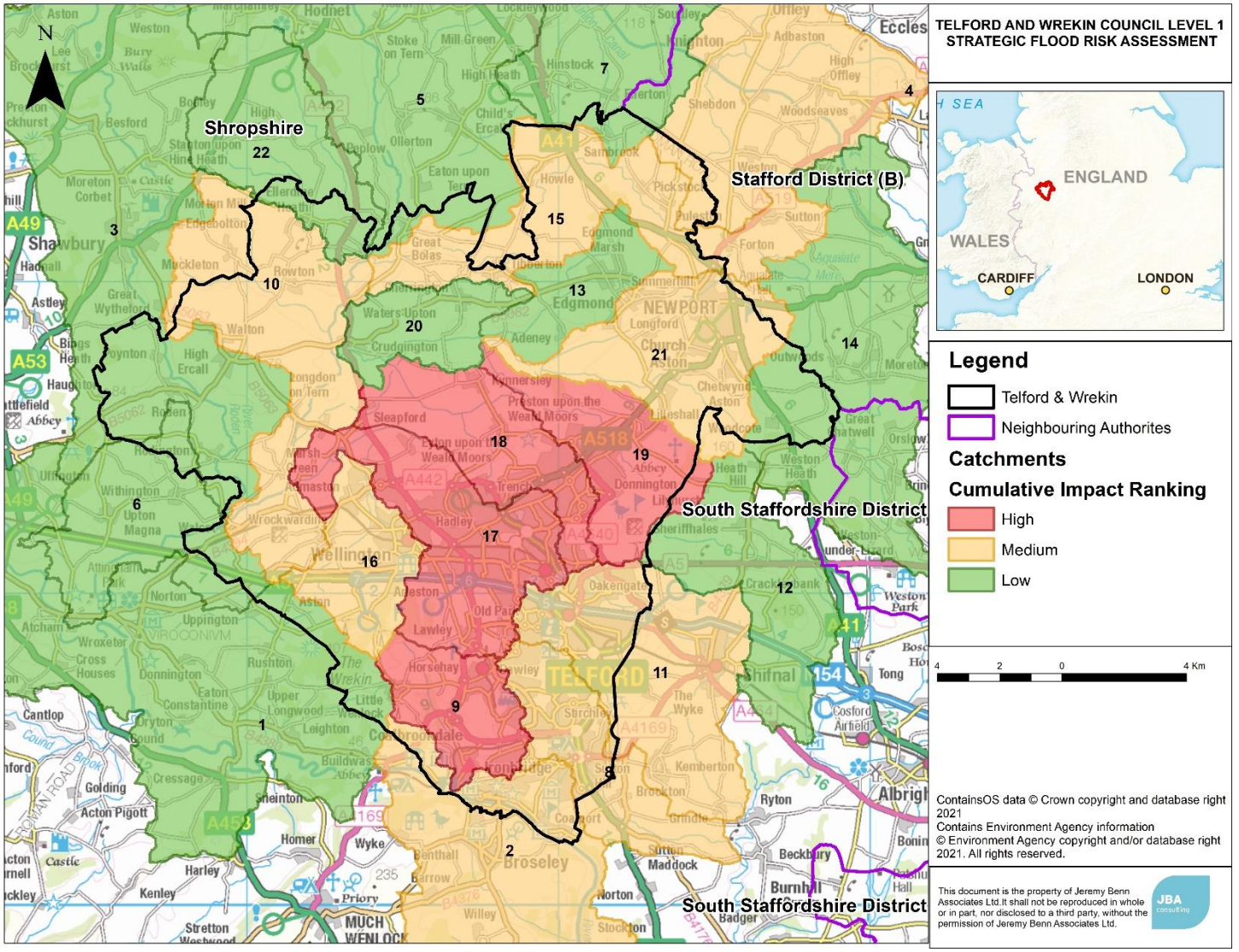

Figure 7-3 Map showing the results of the cumulative impact assessment for each catchment within Telford & Wrekin (numbered as in Table 7-1)

7.6 Planning Policy Recommendations

Planning Policy recommendations are made for each catchment based on their ranking in the Cumulative Impact Assessment. Policies are split between those that apply to the Local Authority and those that apply to developers. Furthermore, recommendations are made for areas where specific local issues have been identified:

- Newport and Edgmond have recently experienced significant surface water flooding issues.
- The Lyde Brook (inc. Coalbrook) is designated as a Rapid Response Catchment.
- The Wesley Brook catchment was previously identified as high risk in the Shropshire Level 2 SFRA.

Table 7-10 Matrix of Policy recommendations for catchments within Telford & Wrekin.

Policy Recommendation	Catchment Cumulative Impact Assessment Ranking			Newport & Edgmond	Lyde Brook (inc. Coalbrook)	Wesley Brook
	High	Med	Low			
For the Local Authority						
That a Level 2 SFRA or detailed local area Strategic Drainage Study considers further how the cumulative effects of potential peak rates and volumes of water from development sites would impact on peak flows, duration of flooding and timing of flood peaks on receiving watercourses. Such studies could be used to justify greater restrictions/ enforce through Local Planning Policy development site runoff rates and volumes specific to each catchment that are over and above those required by National and Local SuDS Standards. They could also identify where there are opportunities with allocated sites to provide off-site betterment e.g. online/ offline flood storage and where land should be safeguarded within proposed site allocations to fulfil this purpose.	X			X	X	X
That Telford & Wrekin Council consider requiring developers to contribute to flood defences both within and outside of their red line boundary in these catchments to provide wider benefits and help offset the cumulative impact of development.	X				X	X

That Telford & Wrekin Council consider requiring additional betterment for runoff rates from brownfield sites, beyond those currently set. Currently, the Telford & Wrekin Council Local Flood Risk Management Strategy states that greenfield sites should limit runoff to greenfield rates whilst brownfield sites should reduce runoff to greenfield rates or achieve a minimum 50% reduction in runoff where it can be proved lower is not possible.	X	X		X	X	X
That, where appropriate, SuDS retrofit in urban areas and river restoration should be maximised in these catchments. In support of the objectives outlined in the Telford and Wrekin Local Flood Risk Management Strategy, SuDS should be designed to Local Authority or Water Company adoptable standards and include plans for maintenance and end responsibility. It should be noted that part of the Lyde Brook (inc. Coalbrook)– Source to River Severn catchment is within the Ironbridge no soakaway zone.	X	X		X	X	X
Telford & Wrekin Council should liaise with Shropshire Council to ensure that provision and strategic drainage is implemented on any development site upstream within the Wesley Brook catchment to protect communities within Shropshire.						X
Telford & Wrekin Council as LLFA will review Surface Water Drainage Strategies in accordance with their local requirements for major and non-major developments. These should consider all sources of flooding to ensure that future development is resilient to flood risk and does not increase flood risk elsewhere.	X	X	X	X	X	X
Telford & Wrekin Council and Shropshire Council should work collaboratively to ensure development within Telford and Wrekin does not increase the risk in downstream areas with known flooding issues, including exploring opportunities to alleviate risk downstream where appropriate.						X

For Developers						
That a Surface Water Drainage Strategy be required for all developments, regardless of development size. It should be noted that part of the Lyde Brook (inc. Coalbrook) – Source to River Severn catchment is within the Ironbridge no soakaway area, and any SuDS proposed in the wider area should be carefully considered.	X			X	X	
That a detailed Flood Risk Assessment is required for all developments, regardless of their size. This should include a Flood Warning and Evacuation Plan for use during extreme events in Rapid Response catchments.	X				X	
That developers explore, through site-specific FRAs, opportunities to provide wider flood risk & water resource benefits as part of new development and justify where such measures are not included. Measures that can be put in place to contribute to a reduction in flood risk downstream should be considered, with a focus on slowing the flow of water downstream, particularly in the upper catchment. This could include the provision of additional storage e.g. oversized SuDS and/or Partnership Funding contributions towards wider schemes. Consultation on the site-specific requirements should be undertaken with Telford & Wrekin Council as LLFA and the Environment Agency at the earliest opportunity in the planning application process.	X	X			X	X
Take account of the Rapid Response nature of the catchment when designing safe access and escape routes and consider the availability of flood alerts/warnings and time residents will have to respond to ensure that no additional burden is placed					X	

upon Telford & Wrekin Council and emergency services as part of any agreed emergency flood plan.						
Developers should identify whether proposed developments will drain directly or indirectly into culverted watercourses and non-adopted surface water sewers* as part of a site-specific flood risk assessment. Developers should demonstrate that development will not increase flows through culverted watercourses. Should this be the case, Telford & Wrekin Council should consider requiring developers to contribute to the tracing, monitoring, maintenance and upkeep of these features. **non-adopted surface water sewers are typically those that do not flow into the combined sewer network at any point*				X		
Opportunities for tracing of unknown culvert routes and non-adopted surface water sewers and opening up of existing culverts as part of development should identified.				X		
Developers should identify the impact of development upon drain/sewer flows. Should new proposed development be shown to increase the pressure on existing drainage/sewerage networks, Telford & Wrekin Council should consider requiring developers to contribute to the maintenance and improvement of impacted sewer systems.				X		

Developers should incorporate SuDS and provide details of adoption, ongoing maintenance and management on all development sites. Proposals will be required to provide reasoned justification for not using SuDS techniques, where ground conditions and other key factors show them to be technically feasible. Schemes should consider all four pillars of SuDS (water quality, quantity, amenity, and biodiversity). Preference will be given to systems that contribute to the conservation and enhancement of biodiversity and green infrastructure in the borough where practicable. As per Telford & Wrekin Council's Becoming Carbon Neutral Action Plan, developments should also identify opportunities to increase carbon sequestration through use of SuDS techniques.	X	X	X	X	X	X

7.7 Water quality considerations

In addition to cross-boundary issues regarding flood risk, there are also cross-boundary issues relating to water quality. Development or changes to land management practises in the upper catchments of watercourses that flow across boundaries into Telford & Wrekin can potentially impact on the quality of watercourses within the study area. Development should consider the quality of the water that is released from sites and the impact it may have on the water quality on any receiving waterbodies. Future development should ensure there is no adverse impact on the quality of watercourses within the Council administrative area. Any impacts identified should then be considered in relation to the WFD Ecological, Hydromorphological and Chemical Status of the waterbody and the status objectives. Opportunities to improve the status of watercourses should also be considered, particularly in relation to their status under the WFD.

8 Flood risk management requirements for developers

This section provides guidance on site-specific Flood Risk Assessments (FRAs). These are carried out by (or on behalf of) developers to assess flood risk to and from a site. They are submitted with Planning Applications and should demonstrate how flood risk will be managed over the development's lifetime, considering climate change and vulnerability of users.

The report provides a strategic assessment of flood risk within Telford & Wrekin Borough. Prior to any construction or development, site-specific assessments will need to be undertaken so all forms of flood risk and any defences at a site are considered in more detail. Developers should, where required, undertake more detailed hydrological and hydraulic assessments of watercourses to verify flood extents (including latest climate change allowances), to inform the sequential approach within the site and prove, if required following the Sequential Test, whether the Exception Test can be satisfied.

A detailed Flood Risk Assessment (FRA) may show that a site, windfall[2] or other, is not appropriate for development of a particular vulnerability or even at all. The Sequential and Exception Tests in the NPPF apply to all developments and an FRA should not be an alternative to proving these tests have been met.

8.1 Principles for new developments

8.1.1 Apply the Sequential and Exception Tests

Developers should refer to Section 3 for more information on how to consider the Sequential and Exception Tests. For allocated sites, Telford & Wrekin Council should use the information in this SFRA to apply the Sequential Test. For windfall sites a developer must undertake the Sequential Test, which includes considering reasonable alternative sites at lower flood risk. Only if it passes the Sequential Test should the Exception Test then be applied if required. The Sequential and Exception Tests in the NPPF apply to all developments and an FRA should not be an alternative to proving these tests have been met.

Developers should also apply the sequential approach to locating development within the site. The following questions should be considered:

- can risk be avoided through substituting less vulnerable uses or by amending the site layout?
- can it be demonstrated that less vulnerable uses for the site have been considered and reasonably discounted? and
- can the site layout be varied to reduce the number of people, the flood risk vulnerability or the building units located in higher risk parts of the site?

8.1.2 Consult with statutory consultees at an early stage to understand their requirements

Developers should consult with the Environment Agency, Telford & Wrekin Council as LLFA and Severn Trent Water at an early stage to discuss flood risk including requirements for site-specific FRAs, detailed hydraulic modelling and drainage assessment and design.

[2] 'Windfall sites' is used to refer to those sites which become available for development unexpectedly and are therefore not included as allocated land in a planning authority's development plan.

8.1.3 Consider the risk from all sources of flooding and that the most up to date flood risk data and guidance is used

The SFRA can be used by developers to scope out what further detailed work is likely to be needed to inform a site-specific Flood Risk Assessment. At a site level, developers will need to check before commencing on a more detailed Flood Risk Assessment that they are using the latest available datasets. TWC as LLFA may hold records of local or site-specific flood risk. Developers should apply the most up to date Environment Agency climate change guidance and ensure the development has considered climate change adaptation measures.

8.1.4 Ensure that the development does not increase flood risk elsewhere

Chapter 9 sets out these requirements for taking a sustainable approach to surface water management. Developers should also ensure mitigation measures do not increase flood risk elsewhere and that floodplain compensation is provided where necessary.

8.1.5 Ensure the development is safe for future users

Consideration should first be given to minimising risk by planning sequentially across a site. Once risk has been minimised as far as possible, only then should mitigation measures be considered. Developers should consider both the actual and residual risk of flooding to the site, as discussed in section 3.

Further flood mitigation measures may be needed for any developments in an area protected by flood defences, where the condition of those defences is 'fair' or 'poor', and where the standard of protection is not of the required standard.

8.1.6 Enhance the natural river corridor and floodplain environment through new development

Developments should demonstrate opportunities to create, enhance and link green assets, commonly known as blue/green infrastructure. This can provide multiple benefits across several disciplines including flood risk and biodiversity/ ecology and may provide opportunities to use the land for an amenity and recreational purposes, or to further the priorities laid out in Telford & Wrekin Council's Becoming Carbon Neutral Action Plan. Development that may adversely affect blue/green infrastructure assets should not be permitted. Where possible, developers should identify and work with partners to explore all avenues for improving the wider river corridor environment. Developers should open existing culverts and should not construct new culverts on site except for short lengths to allow essential infrastructure crossings.

8.1.7 Consider and contribute to wider flood mitigation strategy and measures in the Borough and apply the relevant local planning policies

Wherever possible, developments should seek to help reduce flood risk in the wider area e.g. by contributing to a wider community scheme or strategy for strategic measures, such as defences or natural flood management or by contributing in kind by mitigating wider flood risk on a development site. More information on the contribution developers are expected to make towards achieving the wider vision for FRM and sustainable drainage in the district can be found in section 7.2. Developers must demonstrate in an FRA how they are contributing towards this vision.

8.2 Requirements for site-specific Flood Risk Assessments

8.2.1 When is an FRA required?

Site-specific FRAs are required in the following circumstances:

- Proposals of 1 hectare or greater in Flood Zone 1.
- Proposals for new development (including minor development such as non-residential extensions, alterations which do not increase the size of the building or householder developments and change of use) in Flood Zones 2 and 3.
- Proposals for new development (including minor development and change of use) in an area within Flood Zone 1 which has critical drainage problems (as notified to the LPA by the Environment Agency).
- Where proposed development or a change of use to a more vulnerable class may be subject to other sources of flooding.

An FRA may also be required for some specific situations:

- If the site may be at risk from the breach of a local defence (even if the site is in Flood Zone 1)
- Where evidence of historical or recent flood events have been passed to the LPA
- In an area of significant surface water flood risk.

8.2.2 Objectives of a site-specific FRA

Site-specific FRAs should be proportionate to the degree of flood risk and the scale, nature and location of the development. Site-specific FRAs should establish:

- Whether a proposed development is likely to be affected by current or future flooding from any source.
- Whether a proposed development will increase flood risk elsewhere.
- Whether the measures proposed to deal with the effects and risks are appropriate.
- The evidence, if necessary, for the local planning authority to apply the Sequential Test; and
- Whether, if applicable, the development will be safe and pass the Exception Test.

FRAs should follow the approach recommended by the NPPF (and associated guidance) and guidance provided by the Environment Agency and Telford & Wrekin Council. Guidance and advice for developers on the preparation of site-specific FRAs include:

- **Standing Advice on Flood Risk** (Environment Agency)
- **Flood Risk Assessment for Planning Applications** (Environment Agency)
- **Site-specific Flood Risk Assessment: CHECKLIST** (NPPF NPPG, Defra)

Guidance for local planning authorities for reviewing Flood Risk Assessments submitted as part of planning applications has been published by Defra in 2015 – **Flood Risk Assessment: Local Planning Authorities**.

8.3 Local requirements for mitigation measures

8.3.1 Site layout and design

Flood risk 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.

Space for SuDS should be considered at the earliest stage of development planning and the site layout should be developed to accommodate existing flow routes. Site should be designed with SuDS systems that mimic pre-development drainage regimes as closely as possible.

The NPPF states that a sequential, risk-based approach should be applied to try to locate more vulnerable land use away from flood zones to higher ground, while

more flood-compatible development (e.g. vehicular parking, recreational space) can be located in higher risk areas. Whether parking in floodplains is appropriate will be based on the likely flood depths and hazard, evacuation procedures and availability of flood warning.

Waterside areas, or areas along known flow routes, can act as 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.

Exceedance flow routes should also be considered and directed towards highway and areas of POS. Thresholds should, wherever possible be higher than adjacent highway levels.

8.3.2 Modification of ground levels

Any proposal for modification of ground levels will need to be assessed as part of a detailed flood risk assessment.

Modifying ground levels to raise the land above the required 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 as raising land above the floodplain could reduce conveyance or flood storage in the floodplain and could adversely impact flood risk downstream or on neighbouring land. Raising ground levels can also deflect flood flows, so analysis should be performed to demonstrate that there are no adverse effects on third party land or property. Where land is raised to protect from surface water, new surface water modelling should be undertaken and submitted to the EA to update the RoFfSW maps

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 (for it to fill and drain). It should be in the vicinity of the site and within the red line of the planning application boundary (unless the site is strategically allocated). Guidance on how to address floodplain compensation is provided in Appendix A3 of the CIRIA Publication C624.

Where proposed development results in a change in building footprint, the developer should ensure that it does not impact upon the ability of the floodplain to store or convey water and seek opportunities to provide floodplain betterment.

Raising levels can also create areas where surface water might pond during significant rainfall events. Any proposals to raise ground levels should be tested to ensure that it would not cause increased ponding or build-up of surface runoff on third party land.

8.3.3 Raised floor levels

If raised floor levels are proposed, these should be agreed with Telford & Wrekin Council and the Environment Agency. The minimum Finished Floor Level (FFL) may change dependent upon the vulnerability and flood risk to the development.

The Environment Agency advises that minimum finished floor levels should be set 600mm above the 100-year plus climate change peak flood level, where the latest climate change allowances have been used (see Chapter 4 for the climate change allowances). An additional allowance may be required because of risks relating to blockages to the channel, culvert or bridge and should be considered as part of an FRA.

Allocating the ground floor of a building for less vulnerable, non-residential, use is an effective way of raising living space above flood levels. 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). This risk can be reduced by use of multiple storey construction and raised areas that provide a safe escape route.

Similarly, the use of basements should be avoided. Habitable uses of basements within Flood Zone 3 should not be permitted, whilst basement dwellings in Flood Zone 2 should consider ground conditions and soil type, and will be required to pass the Exception Test. Access should be situated 300mm above the design flood level and waterproof construction techniques used.

8.3.4 Development and raised defences

Construction of localised raised floodwalls or embankments to protect new development is not a preferred option, as a residual risk of flooding will remain. Compensatory storage must be provided where raised defences remove storage from the floodplain.

Where development is located behind, or in an area benefitting from defences, the residual risk of flooding must be considered.

8.3.5 Developer contributions

In some cases, and following the application of the Sequential Test, it may be appropriate for the developer to contribute to the improvement of flood defence provision that would benefit both proposed new development and the existing local community. Developer contributions can also be made to maintenance and provision of flood risk management assets, flood warning and the reduction of surface water flooding (i.e. SuDS).

8.3.6 Buffer strips

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. It also enables the avoidance of disturbing riverbanks, adversely impacting ecology and having to construct engineered riverbank protection.

Building adjacent to riverbanks can cause problems to the structural integrity of the riverbanks and the building itself, making future maintenance of the river much more difficult.

8.3.7 Making space for water

The **NPPG** sets out a clear aim in Flood Zone 3 to create space for flooding by restoring functional floodplain. Generally, development should be directed away from these areas.

All new development close to rivers should consider the opportunity to improve and enhance the river environment. Developments should look at opportunities for river restoration and enhancement as part of the development. Options include backwater creation, de-silting, in-channel habitat enhancement and removal of structures. When designed properly, such measures can have benefits such as reducing the costs of maintaining hard engineering structures, reducing flood risk, improving water quality and increasing biodiversity. Social benefits are also gained by increasing green space and access to the river, as well as contributing towards climate change aims and wider resilience.

The Environment Agency is likely to seek an 8-metre-wide undeveloped buffer strip alongside main fluvial rivers for maintenance purposes. Any works on a main river or within 8 meters of a main river, flood defence structure or culvert on a main river will require an activity permit.

8.4 Property Flood Resistance and Resilience measures

The consideration of resistance and resilience measures should not be used to justify development in inappropriate locations.

Having applied planning policy, there will be instances where developments, such as those that are water compatible and essential infrastructure are permitted in high flood risk areas. The above measures should be considered before Property Flood Resistance and Resilience measures are replied on. The effectiveness of these forms of measures are often dependant on the nature of flooding, the availability of a reliable forecasting and warning system and the use of back up pumping to evacuate water from a property as quickly as possible. These measures are most effective when tailored to consider the specific needs of the end users occupying protected properties. The proposals must include details of how the temporary measures will be erected and decommissioned, responsibility for maintenance and the cost of replacement when they deteriorate. Resistance measures also have a limited operational height and a low standard of protection. Available resistance and resilience measures are shown in Table 8-1.

Table 8-1: Available temporary measures

Measures	Description
Permanent barriers	Permanent barriers can include built up doorsteps, rendered brick walls and toughened glass barriers
Temporary barriers	Temporary barriers consist of moveable flood defences which can be fitted into doorways and/or windows. The permanent fixings required to install these temporary defences should be discrete and keep architectural impact to a minimum. On a smaller scale, temporary snap on covers for airbricks and air vents can also be fitted to prevent the entrance of flood water.
Community resistance measures	These include demountable defences that can be deployed by local communities to reduce the risk of water ingress to a number of properties. The methods require the deployment of inflatable (usually with water) or temporary quick assembly barriers in conjunction with pumps to collect water that seeps through the systems during a flood.
Flood resilience & recoverability measures	These measures aim to ensure no permanent damage is caused, the structural integrity of the building is not compromised and the clean up after the flood is easier. Interior design measures to reduce damage caused by flooding can include electrical circuitry installed at a higher level and water-resistant materials for floors, walls and fixtures.

It is fundamental to consider the resilience of electricity/power supplies where resistance measures rely upon power i.e. pumps. Where conventional power supplies cannot be relied upon during a flood, backup generators should be considered.

8.5 Reducing flood risk from other sources

8.5.1 Groundwater

Groundwater flooding has a very different flood mechanism to any other and so many conventional flood mitigation methods are not suitable. The only way to fully reduce flood risk would be through building design (development form), ensuring floor levels are raised above the water levels caused by a 1 in 100-year plus climate change event. Site design would also need to preserve any flow routes followed by the groundwater overland to ensure flood risk is not increased downstream.

Infiltration SuDS can cause increased groundwater levels and subsequently may increase flood risk on or off a site. Developers should provide evidence and ensure that this will not be a significant risk. Groundwater flood risk will also affect the

type and function of any SuDS systems and these will need to be designed to prevent groundwater ingress or floatation.

8.5.2 Minewater

Minewater may pose a risk to development within the Telford & Wrekin area. Developers should refer to Appendix A, to identify any whether there are any shallow mine workings within the vicinity that have the potential to pose a risk of minewater emergence.

Mines also have the potential to affect whether infiltration SuDS may be suitable in a given location and developers should refer to Table 5-6 in conjunction with Appendix A to determine whether there are any constraints upon the site as a result.

8.5.3 Surface water and sewer flooding

Developers should discuss public sewerage capacity with the water utility company at the earliest possible stage. It is important that a Surface Water Drainage Strategy (often done as part of a Flood Risk Assessment) shows that this will not increase flood risk elsewhere, and that the drainage requirements regarding runoff rates and SuDS for new development are met.

If residual surface water flood risk remains, the likely flow routes and depths across the site should be modelled. The site should be designed so that these flow routes are preserved and building design should provide resilience against this residual risk (see section 8.3.1).

When redeveloping existing buildings, the installation of some permanent or temporary floodproofing and resilience measures could protect against both surface water and sewer flooding. Non-return valves prevent water entering the property from drains and sewers. Non-return valves can be installed within gravity sewers or drains within a property's private sewer upstream of the public sewerage system. These need to be carefully installed and must be regularly maintained.

Consideration must also be given to attenuation and flow ensuring that flows during the 100-year plus climate change storm event are retained within the site if any flap valves shut. This should be demonstrated with suitable modelling techniques.

8.5.4 Reservoirs

As discussed in Section 5.9, the likelihood of reservoir flooding is extremely low. However, there remains a residual risk to development from reservoirs which developers should consider during the planning stage:

- Developers should contact the reservoir owner for information on:
    - the Reservoir Risk Designation
    - reservoir characteristics: type, dam height at outlet, area/volume, overflow location
    - operation: discharge rates / maximum discharge
    - discharge during emergency drawdown; and
    - inspection / maintenance regime.
    - high risk/vulnerable development downstream of a reservoir may also affect a reservoirs designation

- The EA online Reservoir Flood Maps contain information on the extents, depths and velocities following a reservoir breach (note: only for those reservoirs with an impounded volume greater than 25,000 cubic metres are governed by the Reservoir Act 1975, although the Flood & Water Management Act 2010 gives Ministers the ability to extend regulation to cover reservoirs impounding over 10,000 cubic metres). Consideration should be given to the extent, depths and velocities shown in these online maps.
- The GOV.UK website on **Reservoirs: owner and operator requirements** provides information on how to register reservoirs, appoint a panel engineer, produce a flood plan and report an incident.
- In addition, developers should consult the **Telford & Wrekin website** for information about emergency planning in the Borough.

Developers should use the above information to:

- Apply the sequential approach to locating development within the site.
- Consider the impact of a breach and overtopping, particularly for sites proposed to be located immediately downstream of a reservoir. This should consider whether there is sufficient time to respond, and whether in fact it is appropriate to place development immediately on the downstream side of a reservoir.
- Assess the potential hydraulic forces imposed by sudden reservoir failure event and check that that the proposed infrastructure fabric could withstand the structural loads.
- Develop site-specific Emergency Plans and/ or Off-site Plans if necessary and ensure the future users of the development are aware of these plans. This may need to consider emergency drawdown and the movement of people beforehand, similar to the response to the Toddbrook Reservoir incident in Whaley Bridge, Derbyshire, 2019.

8.6 Emergency planning

Emergency planning covers three phases: before, during and after a flood. 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. National Planning Policy takes this into account by seeking to avoid inappropriate development in areas of flood risk and considering the vulnerability of new developments to flooding.

The 2019 NPPF requires site level Flood Risk Assessments to demonstrate that

> *"d) any residual risk can be safely managed; and*
>
> *e) safe access and escape routes are included where appropriate, as part of an agreed emergency plan."*

Certain sites will need emergency plans:

- Sites with vulnerable users, such as hospitals and care homes
- Camping and caravan sites (where provision of suitable plans will affect the vulnerability classification of the development)
- Sites with transient occupants e.g. hostels and hotels
- Developments at a residual risk of sudden/severe flooding from any source e.g. immediately downstream of a reservoir or behind raised flood defences, Rapid Response Catchments (such as the Coalbrook)
- Developments within Rapid Response Catchments

- Situations where occupants cannot be evacuated (e.g. prisons) or where it is safer to remain "in-situ" and / or move to a higher floor or safe refuge area (e.g. at risk of a breach).

Emergency Plans will need to consider:

- The characteristics of the flooding e.g. onset, depth, velocity, hazard, flood borne debris
- The vulnerability of site occupants.
- Structural safety
- The impact of the flooding on essential services e.g. electricity, drinking water
- Flood warning systems and how users will be encouraged to sign up for them
- Safe access and egress for users and emergency services
- How to manage the consequences of events that are un-foreseen or for which no warnings can be provided e.g. managing the residual risk of a breach.
- A safe place of refuge where safe access and egress and advance warning may not be possible, having discussed and agreed this first with emergency planners. Proposed new development that places an additional burden on the existing response capacity of the Council/emergency services will not normally be appropriate.

The **West Mercia Local Resilience Forum** provides Emergency Planning relevant information that is both general and flood specific. This includes practical advice before, during and after flooding has occurred including, preparation, understanding warnings, actions to limit exposure to risk and recovery.

Further information is available from:

- **The National Planning Policy Guidance** (https://www.gov.uk/government/publications/national-planning-policy-framework--2)
- **2004 Civil Contingencies Act** (http://www.legislation.gov.uk/ukpga/2004/36/contents)
- **DEFRA (2014) National Flood Emergency Framework for England** (https://www.gov.uk/government/publications/the-national-flood-emergency-framework-for-england)
- **FloodRe** (http://www.floodre.co.uk/)
- The Environment Agency and DEFRA's **Standing Advice for FRAs** (https://www.gov.uk/guidance/flood-risk-assessment-standing-advice)
- Telford and Wrekin Council's **"Emergencies"** page on their website (https://www.telford.gov.uk/info/20254/emergencies) for more information on emergency planning in the borough.
- Environment Agency's **"How to plan ahead for flooding"** (https://flood-warning-information.service.gov.uk/plan-ahead-for-flooding)
- Sign up for **Flood Warnings** with the Environment Agency (https://www.gov.uk/sign-up-for-flood-warnings)
- The **National Flood Forum** (https://nationalfloodforum.org.uk/)
- **GOV.UK** - Make a Flood Plan guidance and templates (https://www.gov.uk/prepare-for-flooding/future-flooding)

9 Surface water management and SuDS

This chapter provides guidance and advice on managing surface water runoff and flooding.

9.1 Role of the LLFA and Local Planning Authority in surface water management

Telford & Wrekin Council is both the LLFA and LPA. As LLFA they are a statutory planning consultee on the management of surface water. They provide technical advice on surface water drainage strategies and designs put forward for major development proposals, to ensure that onsite drainage systems are designed in accordance with the current legislation and guidance.

As LPA, Telford & Wrekin Council should satisfy themselves that a development's proposed minimum standards of operation are appropriate and ensure through the use of planning conditions or planning obligations that there are clear arrangements for on-going maintenance over the lifetime of the development.

It is essential that developers consider sustainable drainage at an early stage of the development process – ideally at the master-planning stage. To further inform development proposals at the master-planning stage, pre-application advice is offered by Telford & Wrekin Council. This will assist with the delivery of well designed, appropriate and effective SuDS.

9.2 Sustainable Drainage Systems (SuDS)

Sustainable Drainage Systems (SuDS) are designed to maximise the opportunities and benefits that can be secured from surface water management practices.

SuDS provide a means of dealing with the quantity and quality of surface water and can also provide amenity and biodiversity benefits. Given the flexible nature of SuDS they can be used in most situations within new developments as well as being retrofitted into existing developments. SuDS can also be designed to fit into most spaces. For example, permeable paving could be used in parking spaces or rainwater gardens as part of traffic calming measures.

Telford & Wrekin Council require developments of 10 or more houses to provide above ground/multi-functional SuDS in accordance with their SuDS handbook. Developers are required to justify why these cannot be provided where buried attenuation systems are proposed.

Landscaping and planning should be considered at the SuDS design stage.

It is a requirement for all new major development proposals to ensure that sustainable drainage systems for management of runoff are put in place. Likewise, minor developments should also ensure sustainable systems for runoff management are provided. The developer is responsible for ensuring the design, construction and future/ongoing maintenance of such a scheme is carefully and clearly defined, and a clear and comprehensive understanding of the existing catchment hydrological processes and current drainage arrangements is essential.

9.3 Sources of SuDS guidance

9.3.1 C753 CIRIA SuDS Manual (2015)

The C753 CIRIA SuDS Manual (2015)

(https://ciria.sharefile.com/share/getinfo/s7227335a22e40b6a) provides guidance on planning, design, construction and maintenance of SuDS. The manual is divided

into five sections ranging from a high-level overview of SuDS, progressing to more detailed guidance with progression through the document.

9.3.2 Non-Statutory Technical Guidance, Defra (March 2015)

Non-Statutory Technical guidance provides non-statutory standards on the design and performance of SuDS. It outlines peak flow control, volume control, structural integrity, flood risk management and maintenance and construction considerations. At the time of writing, this is under review and due to be updated.

9.3.3 Non-statutory Technical Guidance for Sustainable Drainage Practice Guidance, LASOO (2016)

The Local Authority SuDS Officer Organisation produced their **practice guidance** in 2016 to give further detail to the Non-statutory technical guidance.

9.3.4 Telford & Wrekin Council SuDS Guidance

Telford & Wrekin Council have published a **comprehensive SuDS Handbook** which includes borough-specific guidance for the design and implementation of SuDS in new developments. Additional information can be found on the **planning section** of Telford & Wrekin Council's website.

9.4 Other surface water drainage design considerations

The Environment Agency published new groundwater vulnerability maps in 2015. These maps provide a separate assessment of the vulnerability of groundwater in overlying superficial rocks and those that comprise of the underlying bedrock. The map shows the vulnerability of groundwater at a location based on the hydrological, hydro-ecological and soil propertied within a one-kilometre grid square.

The groundwater vulnerability maps should be considered when designing SuDS. Depending on the height of the water table at the location of the proposed development site, restrictions may be placed on the types of SuDS appropriate to certain areas. Groundwater vulnerability maps can be found on **Defra's interactive mapping**. These should be considered alongside the documented risk to Newport and shallow minewater emergence risk.

9.4.1 Groundwater Source Protection Zones (GSPZ)

The Environment Agency also defines Groundwater Source Protection Zones (GSPZs) near groundwater abstraction points. These protect areas of groundwater used for drinking water. The GSPZ requires attenuated storage of runoff to prevent infiltration and contamination. GSPZs can be viewed on **DEFRA's Magic Map** and in Appendix A.

There are various GSPZs in and around Telford & Wrekin Borough and developers should check to identify if the site is within a GSPZ.

9.4.2 Nitrate Vulnerable Zones

Nitrate Vulnerable Zones (NVZs) are areas designated as being at risk from agricultural nitrate pollution. Nitrate levels in waterbodies are affected by surface water runoff from surrounding agricultural land entering receiving waterbodies. The level of nitrate contamination will potentially influence the choice of SuDS and should be assessed as part of the design process.

Much of Telford & Wrekin Borough is within an NVZ and developers should consult the **Environment Agency's website** to determine if their site is within an NVZ.

10 Summary and Recommendations

- Historic flooding incident records from Telford & Wrekin Council show the most affected areas are the southern areas of the Borough, particularly around the corridor along Ironbridge gorge. There has also been historic flooding recorded along the River Tern in the northwest of the catchment. Recently, Newport and some high risk hotspots in Ketley have experienced severe flood events.
- The main rivers associated with fluvial flooding are the River Severn, which flows along the southern edge of the borough through the Ironbridge Gorge, the Coalbrook, which is a Rapid Response Catchment, and the River Tern, which flows through the north-west through Longdon-on-Tern and Marsh Green. There is also a history flooding of agricultural land associated with the River Strine and its tributaries.
- Owing to the low-lying nature of the land, large parts of the north of the Borough are susceptible to surface water flooding, although this predominantly affects fields and moorland. Within the Telford urban area, there are many areas susceptible to surface water flooding during an extreme event, including significant flows from Middle Pool down through the Wormbridge area, from Ketley through to Overdale and from Lawley Common through Lawley. Owing to the hilly terrain, there are however numerous significant surface water flows across the urban area and the Environment Agency's Risk of Flooding from Surface Water map should be consulted for full details.
- Telford & Wrekin has a long history of coal mining. Parts of Telford are subject to flooding from mine water emerging and some waterbodies' water quality are affected by the discharge of polluting mine water. All areas with shallow mine workings have the potential to have mine water within them; however, the risk of high mine water and mine water emergence is more likely in lower lying areas with shallow workings, mine entries, and/or drainage features. The presence of shallow mine workings is also likely to impact the suitability of infiltration SuDS measures for particular sites
- At the time of drafting this Level 1 SFRA, records of sewer flooding have not been provided by Severn Trent Water for inclusion within the SFRA.
- Areas at risk of flooding are likely to become at increasing risk in the future and the frequency of flooding will increase in such areas as a result of climate change. Flood extents will increase; in some locations, this may not be by very much, but flood depth, velocity and hazard may have more of an impact due to climate change. It is recommended that the Council works with other Risk Management Authorities to review the long-term sustainability of existing and new development in these areas when developing climate change plans and strategies for the Borough.
- Opportunities should be sought to provide flood risk benefit (e.g. through the implementation of SuDS) and improve infrastructure alongside additional development.
- In general, most of the southern part of the Borough is at negligible risk of groundwater flooding. The majority of the lower lying land north of Telford is at moderate risk of groundwater flooding with two small areas (around Arelston and Church Aston) identified as high risk.
- There are no navigable canals within Telford & Wrekin Borough.
- 12 reservoirs pose a very low potential risk of flooding to areas in the Borough. The level and standard of inspection and maintenance required by a Supervising Panel of Engineers under the Act means that the risk of flooding from reservoirs is very low.

10.1 Recommendations

Reduction of flood risk through site allocations and appropriate site design

- Telford & Wrekin Council should seek to locate new development in areas of lowest risk, in line with the Sequential Test, by steering sites to Flood Zone and away from areas at risk of flooding from other sources. If a Sequential Test is undertaken and a site at flood risk is identified as the only appropriate site for the development, the Exception Test shall be undertaken.
- After application of the Exception Test, a sequential approach to site design will be used to reduce risk. Any re-development within areas of flood risk which provide other wider sustainability benefits will provide flood risk betterment and made resilient to flooding.
- Telford & Wrekin Council should seek to identify long-term opportunities to remove development from the floodplain and to make space for water.
- Ordinary watercourses not currently afforded flood maps should be modelled to an appropriate level of detail to enable a sequential approach to the layout of the development, either as part of a Level 2 SFRA or by developers as part of site-specific FRAs.
- To ensure development is 'safe', pedestrian egress from the floodplain and emergency vehicular access should be possible for all residential development. Wherever possible, safe access routes should be provided that are located above design flood levels and avoiding flow paths. Where this is not possible, limited depths of flooding may be acceptable depending upon the hazard, provided that the proposed access is designed with appropriate signage etc to make it safe. If at risk, then an assessment should be made to detail the flood duration, depth, velocity, and flood hazard rating in the 1 in 100-year plus climate change flood event, in line with FD2320.
- Residential and commercial finished floor levels should be 600mm above the 1 in 100-year plus climate change flood level.
- Telford & Wrekin Council should seek to identify, protect and promote areas for future flood alleviation schemes.
- Telford & Wrekin Council should safeguard functional floodplain from future development.
- Telford & Wrekin Council should identify opportunities for brownfield sites in functional floodplain to reduce risk and provide flood risk betterment.
- Telford & Wrekin Council should identify opportunities to help fund future flood risk management through developer contributions to reduce risk for surrounding areas, for example through Local Levys.
- Telford & Wrekin Council should seek opportunities to make space for water to accommodate climate change at strategic and site levels.

Promote SuDS to mimic natural drainage routes to improve water quality

- SuDS designs should demonstrate how constraints and opportunities have been considered and how the design provides multiple benefits e.g. landscape enhancement, biodiversity, recreation, amenity, leisure and the enhancement of historical features. SuDS proposals should pay particularly consideration to known areas of groundwater vulnerability in the Borough.

- Planning applications for phased developments should be accompanied by a drainage strategy, which takes a strategic approach to drainage provision across the entire site and incorporates adequate provision for SuDS within each phase.
- Designs should se of the SuDS management train to prevent and control pollutants to prevent the 'first flush' polluting the receiving waterbody.
- SuDS are to be designed to standards as laid out in Telford & Wrekin Council's SuDS Handbook, and developers should set out plans detailing how maintenance will be funded and undertaken, and who will hold end responsibility.

Reduce Surface Water Runoff from New Developments and Agricultural Land

- Space should be provided for the inclusion of SuDS on all allocated sites and outline proposals
- Telford & Wrekin Council should promote biodiversity, habitat improvements and **Countryside Stewardship schemes** and **Environmental Land Management Schemes** to help prevent soil loss and to reduce runoff from agricultural land.
- SuDS should be retrofitted in urban areas and brownfield developments to reduce surface water runoff.

Enhance and Restore River Corridors and Habitat

- Development plans should assess the condition of existing assets and upgrade them, if required, to ensure that infrastructure can accommodate pressures/flows for the lifetime of a development.
- Natural drainage features should be maintained and enhanced.
- Identify opportunities for river restoration/enhancement to make space for water.
- A presumption against culverting of open watercourses except where essential to allow highways and/or other infrastructure to cross, in line with CIRIA's Culvert design and operation guide, (C689) and to restrict development over culverts.
- There should be no built development within 8m from the top of a watercourse or Main River for the preservation of the watercourse corridor, wildlife habitat, flood flow conveyance and future watercourse maintenance or improvement.

Mitigate Against Risk, Improved Emergency Planning and Flood Awareness

- Telford & Wrekin Council should work with emergency planning colleagues and stakeholders to identify areas at highest risk and locate most vulnerable receptors.
- Exceedance flows, both within and outside of a site, should be appropriately designed to minimise risks to both people and property.
- An emergency overflow should be provided for piped and storage features above the predicted water level arising from a 100-year rainfall event, inclusive of climate change and urban creep. Any impounded features should have safe emergency spillways.
- Consideration and incorporation of flood resilience measures up to the 1 in 1,000-year event.
- Ensure robust emergency (evacuation) plans are produced and implemented for major developments where appropriate.
- Increase awareness and promote sign-up to the Environment Agency Flood Warnings Direct (FWD) within Telford & Wrekin, and the Coalbrook warning system, maintained by Telford & Wrekin Council.

10.1.1 Recommendations from the cumulative impact analysis

Planning Policy recommendations are made for each catchment based on their ranking in the Cumulative Impact Assessment. Furthermore, recommendations are made for areas where specific local issues have been identified:

- Newport and Edgmond have recently experienced significant surface water flooding issues.
- The Lyde Brook (inc. Coalbrook) is designated as a Rapid Response Catchment.
- The Wesley Brook catchment was previously identified as high risk in the Shropshire Level 2 SFRA.

Recommendations for each catchment can be found in Table 7-10 Matrix of Policy recommendations for catchments within Telford & Wrekin.

Appendices

A Maps

GeoPDF maps

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Static Maps

Topography
Bedrock Geology
Superficial Deposits
Hydrogeology Classification
Source Protection Zones
Mine Entry Features
Coal Outcrops
Past Shallow Mine Workings
Potable SMW
Mine Water Issues

B Data sources used in the SFRA

C SFRA User Guide

D Flood Alerts and Flood Warnings

E Summary of flood risk across the borough

Offices at

Coleshill
Doncaster
Dublin
Edinburgh
Exeter
Haywards Heath
Isle of Man
Limerick
Newcastle upon Tyne
Newport
Peterborough
Saltaire
Skipton
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