Wolverhampton Level 2 Strategic Flood Risk Assessment

Final

A1-C01

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This report describes work commissioned by the City of Wolverhampton Council, by an instruction dated August 2024. The Client's representative for the contract was Michele Ros of the City of Wolverhampton Council. Georgie Troy of JBA Consulting carried out this work.

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Unless otherwise stated in this Report, the assessments made assume that the sites and facilities will continue to be used for their current purpose without significant changes.

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- City of Wolverhampton Council
- Environment Agency
- Canal and River Trust
- Severn Trent Water

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Abbreviations

1D	One Dimensional (modelling)
2D	Two Dimensional (modelling)
AEP	Annual Exceedance Probability
AIMS	Asset Information Management System
BGS	British Geological Survey
CFMP	Catchment Flood Management Plan
CIRIA	Company providing research and training in the construction industry
DTM	Digital Terrain Model
DWMP	Drainage and Wastewater Management Plan
EA	Environment Agency
FMfP	Flood Map For Planning
FRA	Flood Risk Assessment
FRM	Flood Risk Management
FRMP	Flood Risk Management Plan
GIS	Geographical Information System
GSPZ	Groundwater Source Protection Zone
HM	Hydraulic Modelling
IDB	Internal Drainage Board
ISIS	Hydrology and hydraulic modelling software
LFRMS	Local Flood Risk Management Strategy
LiDAR	Light Detection And Ranging
LLFA	Lead Local Flood Authority
LPA	Local Planning Authority
NaFRA2	National Flood Risk Assessment 2
NFM	Natural Flood Management
NPPF	National Planning Policy Framework
OS	Ordnance Survey
PFRA	Preliminary Flood Risk Assessment
PPG	Planning Policy Guidance
RBMP	River Basin Management Plan
SFRA	Strategic Flood Risk Assessment
TUFLOW	Two-dimensional Unsteady FLOW (a hydraulic model)
UKCP18	United Kingdom Climate Projections 2018

Definitions

1D model: One-dimensional hydraulic model, typically representing a watercourse and structures within the channel (for example bridges and culverts).

2D model: Two-dimensional hydraulic model, typically representing the floodplain flows.

Brownfield: Previously developed parcel of land.

Annual Exceedance Probability (AEP): The probability that a given rainfall total accumulated over a given duration will be exceeded in any one year.

Critical Drainage Areas: A discrete geographic area 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 houses, businesses and/or local infrastructure.

Design flood: This is a flood event of a given annual flood probability, which is generally taken as:

- river flooding likely to occur with a 1% annual probability (a 1 in 100 chance each year); or
- tidal flooding with a 0.5% annual probability (1 in 200 chance each year); or
- surface water flooding likely to occur with a 1% annual probability (a 1 in 100 chance each year),
- plus, an appropriate allowance for climate change.

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. The Exception Test is applied following the Sequential Test.

Flood defence: Infrastructure used to protect an area against floods such 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.

Flood and Water Management Act (2010): 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.

Fluvial Flooding: Flooding resulting from water levels exceeding the bank level of a river.

Functional Floodplain: The land where water has to flow or be stored in times of flood.

Greenfield: Undeveloped parcel of land.

Lead Local Flood Authority (LLFA): County councils and unitary authorities which lead in managing local flood risks (risks of flooding from surface water, groundwater and ordinary (smaller) watercourses). The City of Wolverhampton Council is a Lead Local Flood Authority.

Local Planning Authority (LPA): The local government body which is responsible by law to exercise planning functions for a particular area. The City of Wolverhampton Council is a local planning authority.

Main River: A watercourse shown as such on the Main River Map, and for which the Environment Agency has responsibilities and powers.

Natural Flood Management (NFM): A wide range of techniques can be used that aim to reduce flooding by working with natural features and processes to store or slow down flood waters before they can damage flood risk receptors (e.g., people, property, infrastructure, etc.).

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.

Resilience Measures: Measures designed to reduce the impact of water that enters property and businesses; could include measures such as raising electrical appliances.

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 (RMA): Operating authorities who's remit and responsibilities concern flood and/or coastal risk management.

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.

Standard of Protection (SoP): Defences are provided to reduce the risk of flooding (typically from a river, sea or surface water). A Standard of Protection is usually described in terms of an AEP flood event. For example, a flood embankment could be described as providing a 1% AEP Standard of Protection.

Sustainable Drainage Systems (SuDS): 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 (pluvial) flooding: Flooding 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.

Executive Summary

This Level 2 Strategic Flood Risk Assessment (SFRA) document was created with the purpose of supporting the review and update of the Wolverhampton Local Plan. In this SFRA, 63 proposed development sites were screened, with 12 identified to have significant risk of flooding and/or access and egress issues - these sites have been assessed in 12 site summary tables. This SFRA incorporates recent changes to national and local planning policy and considers the cumulative impacts of development across the City.

The Government's Planning Practice Guidance (PPG) on Flood Risk and Coastal Change advocates a tiered approach to risk assessment involving Level 1 and Level 2 assessments.

The aim of the Level 2 assessment is to build on identified risks from the Level 1 SFRA for proposed development sites, to provide a greater understanding of fluvial, surface water, groundwater, and reservoir related flooding risks to the site. The Level 2 assessment also provides evidence to allow the City of Wolverhampton Council (CWC) to answer part B of the Exception Test to ensure the development is safe for its lifetime. From this, the Local Council and Developers can make more informed decisions and pursue development in an effective and efficient manner. The Level 2 assessment also identifies sites which will require a detailed Flood Risk Assessment to inform a planning application.

The Level 2 assessment includes detailed assessments of the proposed site options. These include:

- Providing an up-to-date Strategic Flood Risk Assessment, taking into account the most recent policy and legislation in the National Planning Policy Framework (2023).
- An assessment of all sources of flooding including fluvial flooding, surface water flooding, groundwater flooding and the potential increase in fluvial and surface water flood risk due to climate change, and how these may be mitigated.
- An assessment of existing flood warning and emergency planning procedures, including an assessment of safe access and egress during an extreme event.
- Advice and recommendations on the likely applicability of sustainable drainage systems for managing surface water runoff.
- 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.
- Advice on whether the sites are likely to pass the second part of the Exception Test with regards to flood risk and on the requirements for a site-specific FRA and outline specific measures or objectives that are required to manage flood risk.

As part of the Level 2 SFRA, detailed site summary tables have been produced for the proposed sites, covering the above. To accompany the site summary tables, there are static maps, which display all the mapped flood risk datasets.

The site summary tables produced detail the flood risk to each site, the Exception Test requirements, and requirements and guidance for site-specific FRAs. A broadscale assessment of suitable SuDS options has been provided, giving an indication where there may be constraints to certain types of SuDS techniques. Each site has static mapping with the respective flood risk outputs. Most sites that are situated in close proximity to watercourses are shown to be at significant fluvial flood risk.

The following points summarise the Level 2 assessment:

- Fluvial Flooding: The following sites which have detailed summary tables are at minor fluvial flood risk from the following watercourses:
  - Bilston Brook (tributary of the River Tame) - E25, E23
  - Unnamed culverted tributary of the River Tame - H21
- Surface Water: surface water flood risk is widespread across Wolverhampton in the 1% AEP plus 40% climate change and 0.1% AEP (low-risk) events. Water predominantly flows into and along topographically low-lying areas, including Pendeford, Compton and the north of Bilston. Surface water is also channelled into watercourses such as the Smestow Brook, Waterhead Brook, Darlaston Brook, Graiseley Brook, Merryhill Brook, and the six canals within Wolverhampton. Most of the sites with a detailed Level 2 summary table are at surface water flood risk. The degree of flood risk varies, with some sites being only marginally affected, and other sites being more significantly affected. The sites at most significant surface water risk are: GT1, E6, E7, E14, E17, E22, H17 and H21.
- Access and Egress: Several sites with detailed Level 2 summary tables have potential access and egress issues as a result of fluvial and surface water flooding on the surrounding roads. These sites are: E17, E22, E23, E6, E7, GT1, H1, H17, H21 and H23. The following sites also have access and egress issues but have not been carried forward to a Level 2 assessment due to a lack of flood risk at the site: 36780, 36810, E13, E16, E24, E3, E4, H11, H20, H24 (Lincoln Green), H6, E1 and E20. These sites have been flagged in this Level 2 report as having access and egress issues. Consideration should be made to these sites as to how safe access and egress can be provided during flood events, both to people and emergency vehicles. Also, consideration should be given to the nature of the risk, for example whether the flooding forms a flow path or bisects the site where access from one side to another may be compromised.
- Effects of Climate Change: fluvial and surface water climate change mapping indicates that flood extents are generally predicted to increase. As a result, the flood depths, velocities, and hazard of flooding may also increase. The significance of the increase tends to be dependent on the topography of the site and the climate change percentage allowance used.
  - Surface water: The 3.3% AEP +35% and the 1% AEP +40% climate change surface water events have been derived from the Risk of Flooding from Surface Water (RoFSW) dataset as an indication of the impact of climate

change on surface water flood risk. The RoFSW 1% AEP plus 40% climate change surface water event is larger than the present day 1% AEP event, but is not as large as the present day 0.1% AEP event, showing Wolverhampton to be relatively sensitive to increases in surface water flooding due to climate change. The sites which are particularly sensitive include E1, H24 (Alamein Road), H21, E17, GT1, E6, E7, H1, H15, H17, H23, H7, H4, E14, E15, 32690, 36780, 36820.

  - Fluvial: Climate change allowances for the 1% AEP event has been derived from hydraulic modelling of the Smestow Brook and Waddens Brook. The models show the 1% AEP plus Central climate change allowances to be predominantly larger than the modelled present day 1% AEP fluvial events but smaller than the modelled present day 0.1% AEP fluvial events.
  - Sites that are the most sensitive to changes in surface water and fluvial flood risk due to climate change include: H1, H17, H21, H23, E6, E7, E17 and E14.
  - Site specific FRAs, site drainage and management plans should confirm the impact of climate change using the latest guidance. It is recommended that CWC work with other Risk Management Authorities (RMAs) to review the long-term sustainability of existing and new developments in these areas when developing climate change plans and strategies for Wolverhampton.

- Historic Flooding: historic data provided by CWC and Staffordshire County Council showed 69 instances of recorded flooding within the study area between 1990 and 2020. Details of whether the flooding was internal to the properties or affected only highways and curtilage was available for some records. The worst affected areas are Compton, Wood End and Fordhouses. However, none of these historic flood incidents have occurred within any of the sites.
- Groundwater: JBA groundwater emergence mapping indicates the majority of the eastern half and parts of the west of Wolverhampton are at negligible risk from groundwater emergence due to the nature of the local geological deposits. There are large sections in the north and west of Wolverhampton that are at moderate to high risk; there is a risk to subsurface assets in these areas, and surface manifestation of groundwater is likely. Emergence is likely on land between Dunstall Hill and the north of the Waterhead Brook, land in close proximity to the Smestow Brook in the west, and land surrounding the culverted sections of the Smestow Brook, Merryhill Brook and Graiseley Brook in the western half of the study area. The following sites are impacted by this risk: 42550000, 36780, E6, E7, E3, E4, GT1, H22, H24 (Lincoln Green), E1 and E2. Part of E21 is also at moderate groundwater emergence risk at Ettingshall in the south of the study area.
- Canals: There are six canals in the Wolverhampton study area which are the Birmingham Canal Navigations, Bradley Arm of the Birmingham Canal Navigations, Shropshire Union Canal, Staffordshire and Worcestershire Canal, Walsall Canal, and the Wyrley and Essington Canal. These have the potential to interact with other watercourses and become flow paths during flood events or in

a breach scenario. The following sites are located in close proximity to canals within Wolverhampton:

  - E2 (Staffordshire and Worcestershire Canal)
  - H2, H3 and H5 (Wyrley and Essington Canal)
  - E6, E7, E8, 36810, 36800, 28840, 36820, 44030, 44640, 36830, E15, H11, E17, E18 and E22 Birmingham Canal Navigations)
  - H14, H15, E23, H16 and H17 (Bradley Arm of the Birmingham Canal Navigations)
  - E25 (Walsall Canal)
  - H4, 32650 and 32660 (Wyrley and Essington Canal and Birmingham Canal Navigations)

- Reservoirs: There is a potential risk of flooding in Wolverhampton that is posed by reservoirs located outside of this study area. The level and standard of inspection and maintenance required under the Reservoirs Act means that the risk of flooding from reservoirs is relatively low. However, there is a residual risk of a reservoir breach and this risk should be considered in any site-specific Flood Risk Assessments (where relevant). The following sites are at risk of reservoir flooding: E18, E20 and E21.
- Culverted watercourses/residual risk: There is an extensive network of culverted tributaries of main rivers and Ordinary Watercourses across Wolverhampton. The LLFA holds some data on culverted watercourses, but given how extensive the network is, detailed records do not exist for every culvert. Culverted watercourses pose a residual risk of flooding should the culvert collapse or become blocked. Where possible, developers should seek to open up culverted sections of watercourse. The following sites contain, or are in close proximity to, culverted watercourses: E23, E25, E6, E7, GT1, H21 and H23.

Requirements for Developers

- Any sites located where there is a Main River (including culverted reaches of Main River) will require an easement of 8m either side of the watercourse from the top of the bank. Developers will be required to apply for appropriate permits so the activity being carried out over easements does not increase flood risk.
- At the planning application stage, developers may need to undertake more detailed hydrological and hydraulic assessments of the watercourses particularly where there are no detailed hydraulic models present. The modelling should verify flood extent with the latest climate change allowances. This may be the case for H21 which is located along the unnamed culverted tributary of the River Tame, and E23 and E25 which are located along the culverted Bilston Brook.
- Developers should wherever possible open up underground culverts, and in a manner which improves biodiversity, amenity and natural drainage in accordance with the current River Basin Management Plans for the area. Culverted

watercourses are located within, or adjacent to, the following sites: E23, E20, E21, H21, H24 (Arnhem Road), E6 and E7.

- Where there is known or suspected culverted watercourse(s) either on or immediately downstream of a site, and where the Level 1 SFRA highlights that there may be a risk of flooding, developers should:
    - Confirm the location and presence of the watercourse (or otherwise) through ground-truthing strategic datasets and undertaking an assessment of the culvert extent and location
    - Confirm by survey, modelling and mapping the flood extents of the watercourse(s), as many of the flood outlines associated with such watercourses have been carried out at a broad scale and may not account specific local features, such as culverts, bridges and detailed topographical survey.
    - Design the development to accommodate the floodplain of the watercourse and mitigate against flooding to properties to the site. This should include a consideration of residual flood risk e.g. if a culvert were to block downstream.
- Developers should adhere to CWC's guidance on SuDS as laid out in Policy ENV 13 – Sustainable Drainage Systems (SuDS) and Surface Water Management:
    - All developments must incorporate Sustainable Drainage Systems (SuDS) and provide for their adequate adoption, ongoing maintenance, and management over the lifetime of the development, in accordance with any surface water drainage strategy required for the development under Policy ENV12.
    - SuDS must be designed in accordance with Local Lead Flood Authority and Severn Trent Water standards, as follows:
        - demonstrate application of the surface water discharge hierarchy: Re-Use (Water Harvesting); Infiltration; Discharge to a watercourse; Discharge to a surface water sewer; Discharge to a combined sewer;
        - manage surface run-off as close to the source as possible to reduce flood risk and improve water quality;
        - include mitigation within storage calculations for future climate change, designed to 100yr + Climate Change (currently 40%);
        - designed to accord with the Environment Agency's Guidance on Flood Risk and Coastal Change, Construction Industry Research and Information Association (CIRIA) guidance, and Department for Environment Food & Rural Affairs (DEFRA) non-statutory technical standards;
        - designed to be daylight (open), natural and contribute to the conservation and enhancement of biodiversity and green infrastructure in the wider area, as far as is practical and viable.
    - For all major developments, surface water flows must be reduced back to equivalent greenfield rates wherever practical. If greenfield runoff rates are not

considered to be feasible for viability or other reasons, then the developer must submit evidence demonstrating what the constraints to achieving this are and how their development will accommodate runoff rates that are as close as reasonably possible to greenfield rates.
    - For all minor developments, a minimum reduction of 30% over pre-development run-off rates will be required. Under no circumstances will post-development runoff rates that are greater than pre-development run-off rates be permitted.
- CWC expects SuDS to be incorporated on minor development as well as major development and, if possible, development in areas at material risk of flooding should be avoided. Masterplans should be designed to ensure that space is made for above ground SuDS features and that the requirements of existing surface water flow paths and storage volumes are appropriately accommodated. Underground tanks should only be used on sites as a last resort.
- Developers should consult with Severn Trent Water to ensure that the development aims to help achieve the targets of the Drainage and Wastewater Management Plan, and Wolverhampton's Wastewater Treatment Works Assessment.
- For sites allocated within the Local Plan, the Local Planning Authority should use the information in this SFRA to inform the Exception Test.
- For developments that have not been allocated in the Local Plan, developers must undertake the Sequential Test followed by the Exception Test (if required) and present this information to the Local Planning Authority for approval. The Exception Test should be applied where there is development which is classed as;
    - More vulnerable in Flood Zone 3a
    - Highly vulnerable in Flood Zone 2 (this is NOT permitted in Flood Zone 3a)
    - Essential infrastructure in Flood Zone 3a or 3b
    - Any development with significant* risk in the surface water 1% AEP event plus 40% climate change allowance flood extent.

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.

It is recommended that as part of the early discussions relating to development proposals, developers discuss requirements relating to site-specific FRA and drainage strategies with both the Local Planning Authority and the Lead Local Flood Authority (LLFA), to identify any potential issues that may arise from the development proposals.

1 Introduction

1.1 Purpose of the Strategic Flood Risk Assessment

Paragraph 160 of the National Planning Policy Framework (NPPF) (2023) states that strategic policies should be informed by a Strategic Flood Risk Assessment (SFRA) 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 (EA), and other relevant flood risk management authorities, such as Lead Local Flood Authorities (LLFAs) and Internal Drainage Boards (IDBs).

The Planning Practice Guidance (PPG) (2024) advocates a staged approach to risk assessment and identifies two levels of SFRA:

- Level 1 SFRA (L1): where flooding is not a major issue and where development pressures are low. The assessment should be sufficiently detailed to allow application of the Sequential Test. Level 1 is completed first to understand whether a Level 2 assessment is required.
- Level 2 SFRA (L2): where land outside the EA's Flood Zones 2 and 3 (and land outside areas affected by other sources of flooding as per the Exception Test requirements) cannot accommodate all the necessary development creating the need to apply the NPPF's 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 SFRA report fulfils the requirements for a Level 2 assessment of strategic sites identified for potential allocation within Wolverhampton and has been prepared in accordance with the NPPF (2023) and PPG (2024).

This report should be read alongside the Wolverhampton Level 1 SFRA (2024) and builds upon the information presented in the Level 1 SFRA.

1.2 SFRA Objectives

The objectives of this Level 2 SFRA are to:

- Provide individual flood risk analysis for site options using the latest available flood risk data, thereby assisting the Council in applying the Exception Test to their proposed site options in preparation of the update to the City of Wolverhampton Council (CWC) Local Plan.
- Using available data to provide information and a comprehensive set of maps presenting flood risk from all sources for each site option.
- Where the Exception Test is required, provide recommendations for making the site safe throughout its lifetime.
- Take into account most recent policy and legislation in the NPPF, PPG and LLFA Sustainable Drainage Systems (SuDS) guidance.

- Update the catchments that are most sensitive to new development in flood risk terms and further review policy and recommendations for these catchments.

1.3 Consultation

SFRAs should be prepared in consultation with other risk management authorities. The following parties (external to the City of Wolverhampton Council as the Local Planning Authority (LPA)) have been consulted during the preparation of this Level 2 SFRA:

- Environment Agency
- Staffordshire County Council
- Canal and River Trust
- Severn Trent Water

1.4 How to Use This Report

Table 1-1 below outlines the contents of this report and how different users can apply this information.

Table 1-1: Outline of the contents of each section of this report and how they should be applied.

Section	Contents	How to use
1. Introduction	Outlines the purpose and objectives of the Level 2 SFRA	For general information and context.
2. The Planning Framework and Flood Risk Policy	Includes information on the implications of recent changes to planning and flood risk policies and legislation, as well as documents relevant to the study. For more detail, please refer to Sections 2 and 3 of the Level 1 SFRA.	Users should refer to this section and the relevant sections of the Level 1 SFRA for any relevant policy which may underpin strategic or site-specific assessments.
3. Sources of Information Used in Preparing the Level 2 SFRA	Summarises the data used in the Level 2 assessments and static mapping. 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.	Users should refer to this section in conjunction with the summary tables and static mapping to understand the data presented. 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. Developers should refer back to this section when understanding

Section	Contents	How to use
		requirements for a site-specific Flood Risk Assessment (FRA).
4. Level 2 Assessment Methodology	Summarises the sites taken forward to a Level 2 assessment and the outputs produced for each of these sites.	This section should be used in conjunction with the site summary tables and static mapping to understand the data presented.
5. Flood Risk Management Requirements for Developers	Identifies the scope of the assessments that must be submitted in FRAs supporting applications for new development. Refers back to relevant sections in the L1 SFRA for mitigation guidance.	Developers should use this section to understand requirements for FRAs and what conditions/ guidance documents should be followed. Developers should also refer to the L1 SFRA for further information on flood mitigation options.
6. Surface Water Management and SuDS	Refers back to relevant sections in the L1 SFRA for information on SuDS and surface water management.	Developers should use this section to understand the suitability of SuDS across the study area and refer to the L1 SFRA for further information on types of SuDS, the hierarchy and management trains information.
7. Summary of Level 2 Assessment and Recommendations	Summarises the results and conclusions of the Level 2 assessment, and signposts to the L1 SFRA for planning policy recommendations.	Developers and planners should use this section to see a summary of the Level 2 assessment and understand the key messages from the site summary tables. Developers should refer to the Level 1 SFRA recommendations when considering requirements for site-specific assessments.

Section	Contents	How to use
Appendix A: Site Summary Tables and Static Mapping	Provides a detailed summary of flood risk for sites requiring a more detailed assessment. The section considers flood risk, emergency planning, climate change, broadscale assessment of possible SuDS, exception test requirements and requirements for site-specific FRAs. Provides static mapping for each Level 2 assessed site displaying flood risk at and around the site.	Planners should use this section to inform the application of the Sequential and Exception Tests, as relevant. Developers should use these tables to understand flood risk, access and egress requirements, climate change, SuDS, and FRA requirements for site-specific assessments. Planners and developers should use these maps in conjunction with the site summary tables to understand the nature and location of flood risk.
Appendix B: Red Amber Green Site Screening Summary	Provides a table which lists all the sites that were screened for the Level 2 assessment. The sites have been categorised as red, amber or green based on whether they have been carried forward to a Level 2 assessment, have been mentioned within the Level 2 report as having minimal flood risk, or do not have any significant flood risk concerns. The table details fluvial and surface water flood risk from EA datasets (FMfP and RoFSW) and hydraulic modelling.	Developers should use this table to understand flood risk for site-specific assessments.

1.5 SFRA Study Area

Wolverhampton is located in the West Midlands, north-west of Birmingham. The city is approximately 69.4 km^2, with a population of approximately 263,700 (2021 Census, Office for National Statistics). The study area is predominantly urban, and beyond the city centre there are several urbanised areas within Wolverhampton, including Bilston, Wednesfield,

Tettenhall and Bushbury, among others. According to the Black Country Local Strategy for Flood Risk Management (2016), these urbanised areas are served by drainage and flood alleviation infrastructure that was predominantly built between 1960 and 1970. The city shares boundaries with the following authorities:

- Dudley Metropolitan Borough Council
- Sandwell Metropolitan Borough Council
- South Staffordshire District Council
- Walsall Council

Wolverhampton and its neighbouring authorities are shown in Figure 1-1.

The Main Rivers that flow through Wolverhampton are the Smestow Brook and Darlaston Brook, which are partially culverted, as well as an unnamed culverted tributary of the River Tame. These can be seen in Figure 1-2. There are several other watercourses, which are either partially or completely culverted, that flow through Wolverhampton which are listed below and can be seen in Figure 1-3:

- River Penk (becomes a Main River further downstream outside of Wolverhampton)
- Waterhead Brook (becomes a Main River further downstream outside of Wolverhampton)
- Pendeford Brook
- Graiseley Brook
- Waddens Brook
- Merryhill Brook
- Bilston Brook
- Oxley Brook
- Ettingshall Brook
- Finchfield Brook/Castlecroft Brook
- Penn Brook

Additionally, there are six canals within Wolverhampton, as seen in Figure 1-4.

The water authority for the study area is covered by Severn Trent Water.

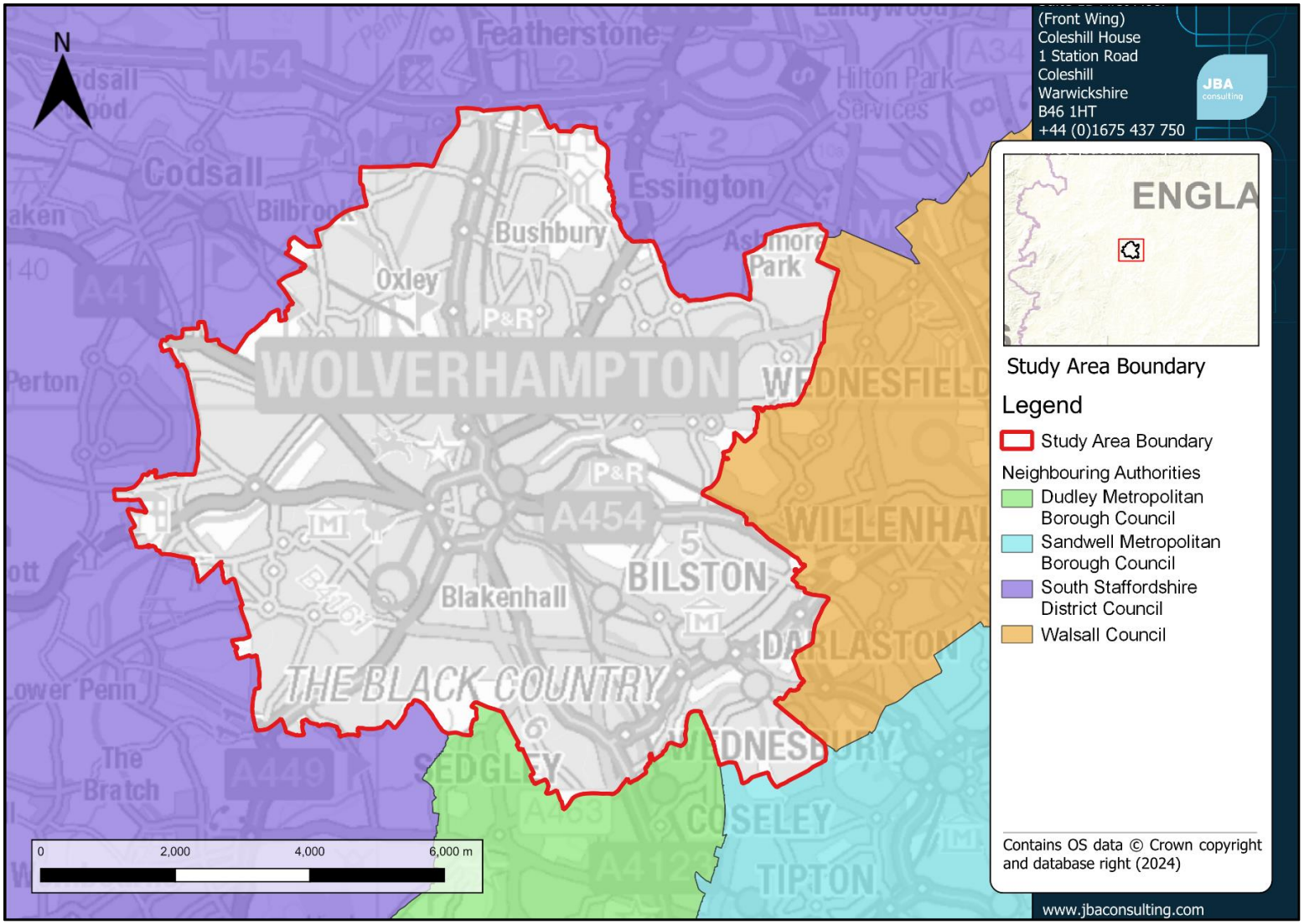


Figure 1-1: Study area with neighbouring authorities

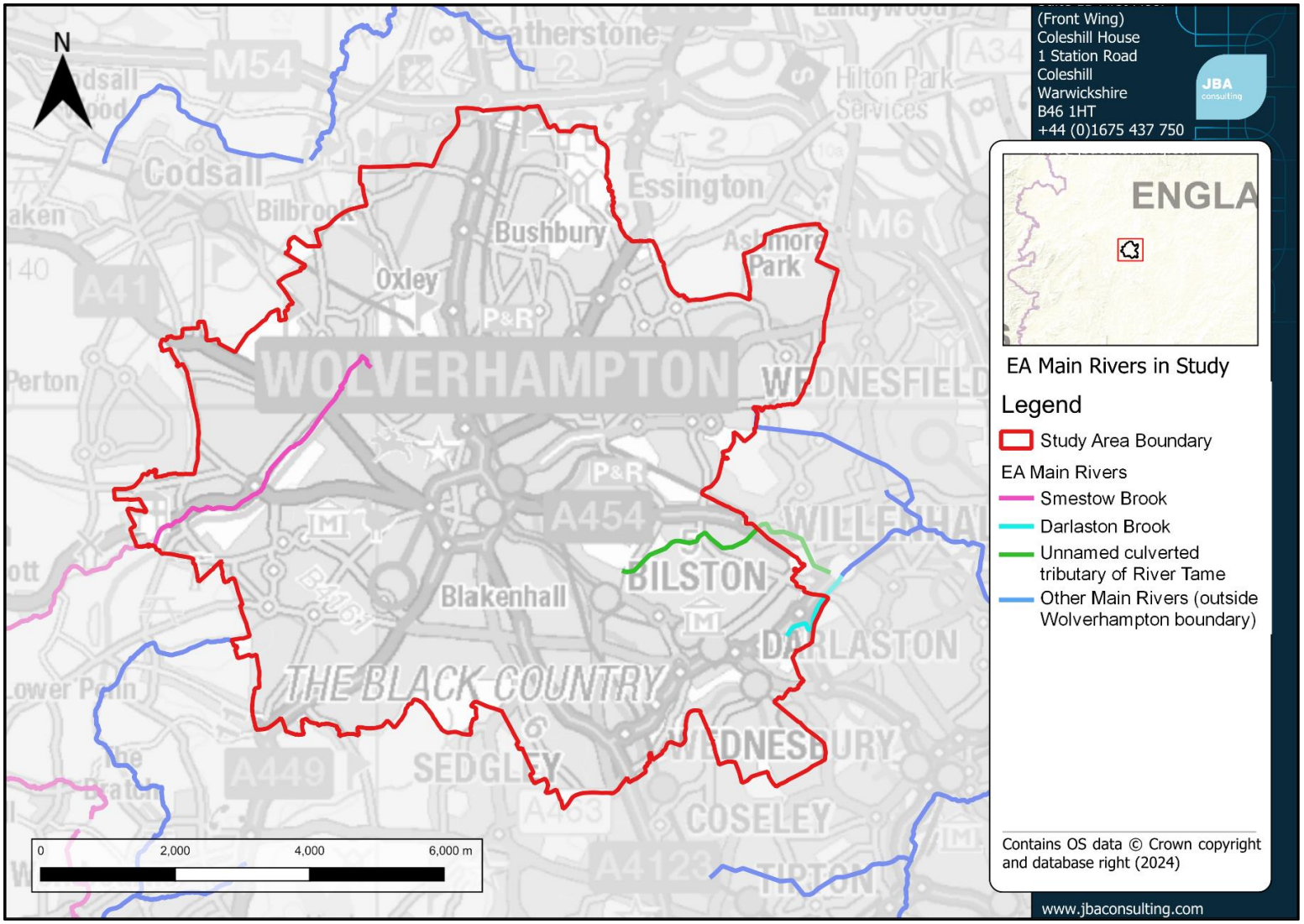


Figure 1-2: Main Rivers within the study area

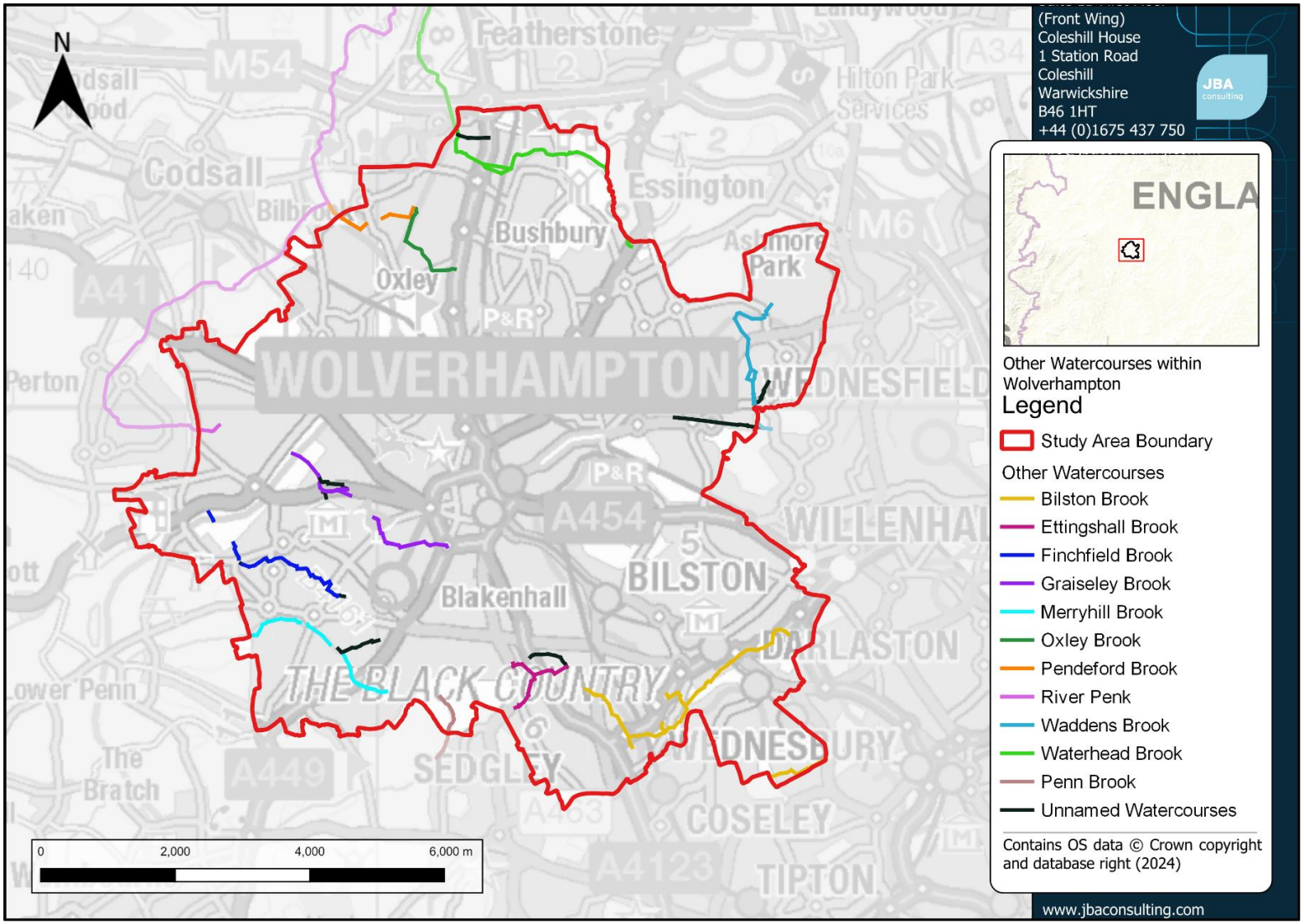


Figure 1-3: Other watercourses within the study area

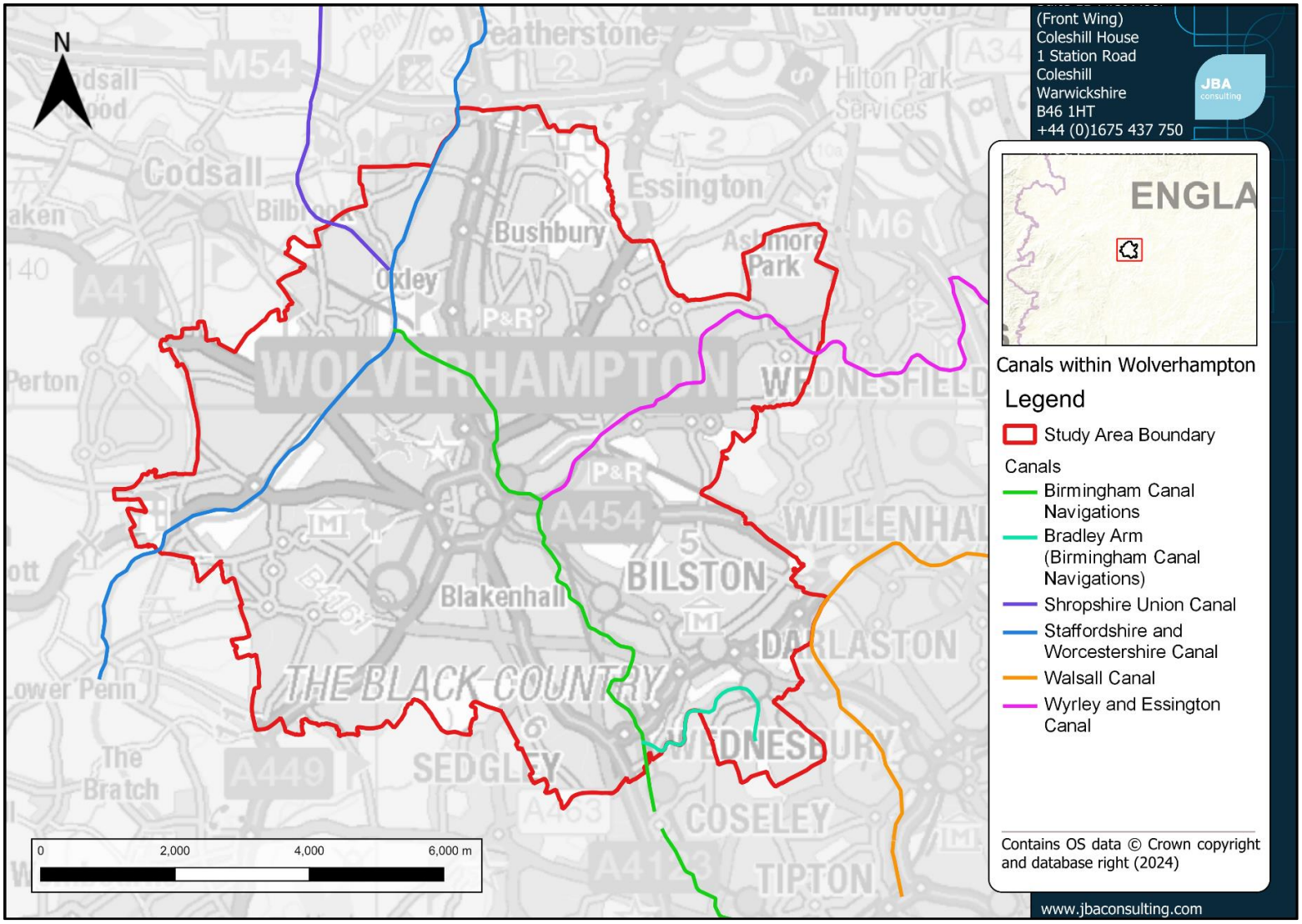


Figure 1-4: Canals within the study area

2 The Planning Framework and Flood Risk Policy

2.1 National Planning Policy Framework and Guidance

The Revised National Planning Policy Framework (NPPF) was updated in December 2023. The NPPF sets out Government's planning policies for England and how these are expected to be applied. The Framework is based on core principles of sustainability and forms the national policy framework in England, also accompanied by a number of Planning Practice Guidance (PPG) notes. It must be accounted for that in the preparation of local plans and is a material consideration in planning decisions.

2.1.1 Planning Practice and Guidance

The most recent updates to the PPG were made in February 2024. The PPG advises on 'how to take account of, and address, the risks associated with flooding and coastal change in the planning process'. The guidance outlines the steps required when preparing strategic policies. Further details regarding the PPG can be found in the Level 1 SFRA.

2.1.2 The Sequential Test

The Sequential Test aims to ensure that areas of little or no flood risk are prioritised for development over areas at a higher risk of flooding. This means areas at a medium or high risk of flooding from any source, now or on the future should be avoided for development where possible.

2.1.3 The Exception Test

It may not always be possible for all 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, where it is not possible for development to be located in areas with a lower risk of flooding:

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

Whilst the Exception Test is only explicitly required for sites within Flood Zones, LPAs should apply a similar approach to other sources of flooding to satisfy themselves that any development proposals in areas at risk from other sources will be safe throughout their lifetime.

It is noted that the EA's Flood Map for Planning Flood Zones represent undefended fluvial outputs. In this SFRA, modelled defended fluvial events for the Smestow Brook and Waddens Brook are used due to the presence of flood defences in Wolverhampton. Developers will need to show that any residual risk to sites can be safely managed and supported by detailed modelling.

Flood Zone 3b, the functional floodplain, is based on the fluvial defended modelled 3.3% AEP event, where available. The Waddens Brook and Smestow Brook hydraulic modelling, which were provided by the EA as part of this Level 2 SFRA, do not contain the 3.3% AEP fluvial flood event. These models were not re-run for this assessment. This decision has been made due to no site allocations being in close proximity to the Smestow Brook modelled flood extents, up to and including the 0.1% AEP modelled flood extent. H21 is the only site to have been carried forward to a Level 2 assessment which is impacted by flood extents from the Waddens Brook hydraulic modelling. However, the extents only encroach a very small area of the site. As a result, the 2% AEP modelled flood extents for the Smestow Brook and Waddens Brook were used as conservative proxies for Flood Zone 3b. For areas not covered by detailed hydraulic modelling within Wolverhampton, Flood Zone 3 of the EA's Flood Map for Planning has been used as a conservative estimate of Flood Zone 3b.

3 Sources of Information Used in Preparing the Level 2 SFRA

3.1 Topography, Geology, Soils, and Watercourses

Topography, geology, soils, and watercourses data were obtained from the following sources:

- Topography data was obtained from the Environment Agency's 1m LiDAR Composite Digital Terrain Model (DTM) 2022.
- Bedrock Geology and Superficial Deposits data was procured from the British Geological Society's (BGS) 50K mapping dataset.
- Soils data was sourced from Cranfield University Soilscapes mapping.
- Watercourses data – main rivers were mapped using the Environment Agency's Statutory Main River Map dataset, and ordinary watercourses from the Environment Agency's (Partner Only) Detailed River Network (DRN) dataset. Caution should be taken when using these layers to identify culverted watercourses which may appear as straight lines but in reality, are not.

3.2 Historic Flooding

The historic flood risk within CWC's administrative area has been assessed using the following:

- The Environment Agency's 'Recorded Flood Outlines' have been used to understand whether historic flooding has been recorded at all sites. The dataset takes into account the presence of defences, structures and other infrastructure, where they existed at the time of flooding.
- Recorded flooding incidents provided by Staffordshire County Council and CWC (July 2024).
- Canal and Rivers Trust recorded overtopping and breach incidents (June 2024).
- Severn Trent Water historic sewer flooding incidents (July 2024).

It is important to note that the absence of historic flood records does not mean than an area has never flooded, only that records are not held. For previously undeveloped sites, it is likely that historic flooding incidents may have gone unreported due to a lack of site use or interest. In addition, it is also possible that flooding mechanisms have changed since the date of a recorded flooding incident, making it more or less likely for flooding to occur on site. More information on historic flooding can be found in Section 5.1 of the Level 1 SFRA.

3.3 Flood Defences

For sites where existing flood defences provide a reduction in the flood risk to the site, it is important to understand the standard of protection these structures and measures provide. It is also necessary to understand how this level of protection changes over time, considering the implications of climate change.

If flood defences are required to protect a development site, evidence will be required to show that the new development does not adversely impact and increase flood risk to other areas, for example that there is no net loss in floodplain storage in circumstances where this is a material consideration. It will need to be established that these defences can be appropriately managed and maintained during the lifetime of the development. In some cases, it will be a requirement to demonstrate that there is an appropriate level of commitment to the maintenance of the standard of protection afforded by existing defences, where reliance is placed on the standard they provide.

Current flood defences have been taken from the Environment Agency's Asset Information Management System (AIMS) Spatial Defences dataset. Their current condition and standard of protection are based on those recorded in the tabulated shapefile data. The Council's asset register was also obtained in the Level 1 SFRA.

According to the EA's AIMS Spatial Flood Defences dataset, the flood defences within Wolverhampton are located along the Smestow Brook and Darlaston Brook. These are predominantly comprised of natural and engineered high ground. There are also walls and a spillway along the Smestow Brook in the vicinity of Dunstall Water Bridge.

3.4 Flood Zones from the EA's Flood Map for Planning

Flood Zones are discrete areas of land identified to be at risk from flooding from rivers and sea. They represent the undefended scenario. Table 3-1 outlines the definition of Flood Zones as per the PPG.

Table 3-1: Definition of the Flood Zones as per the Planning Practice Guidance

Flood Zone	Definition
Zone 1 – Low probability	Land having a less than 0.1% annual probability of river or sea flooding.
Zone 2 – Medium probability	Land having between a 1% and 0.1% annual probability of river flooding; or land having between a 0.5% and 0.1% annual probability of sea flooding.
Zone 3a – High probability	Land having a 1% or greater annual probability of river flooding; or Land having a 0.5% or greater annual probability of sea.

Flood Zones 1, 2 and 3a have been taken from the Environment Agency's 'Flood Map for Planning' and do not take into account flood defences. The Flood Map for Planning is based on generalised modelling where detailed modelling is not available. Whilst the generalised modelling is typically suitable for use on a large scale, they are not provided for specific sites or for land where the catchment of the watercourse is less than 3km^2.

For watercourses with smaller catchments, the Risk of Flooding from Surface Water (RoFSW) map provides an indication of the floodplain of small watercourses and ditches. It is more accurate in upper to mid river valley locations. This is because it does not represent

the floodplain for small watercourses as well in topographically flat areas where the flow routes are not as well defined.

The Flood Map for Planning Flood Zones only detail flood extents. They do not provide data relating to the depth, velocity or hazard rating of flooding which is required to make an informed assessment of flood risk.

In addition, the Flood Map for Planning does not take into account surface water, sewer or groundwater flooding or the impacts of canal or reservoir failure or climate change. Hence there could still be a risk of flooding from other sources and the level of flood risk will change during the lifetime of a development.

For these reasons, the Flood Map for Planning should not be used as application evidence to provide the details of possible flooding for individual properties or sites and for any sites with watercourses on, or adjacent to, the site. Accordingly, for site-specific assessments it will be necessary to perform more detailed studies in circumstances where flood risk is an issue.

The Environment Agency will prepare an updated and improved Flood Map for Planning in the course of updating the National Flood Risk Assessment 2 (NaFRA2). It is anticipated that this data will be available in 2025. Although there will be no new updates to the existing Flood Map for Planning mapping before this update, should any new information become available for localised areas, the EA will notify CWC and an updated PDF map of the Flood Zones will be made available upon request. It is not anticipated that the updated mapping will fundamentally change the locations identified to be at risk from fluvial flooding, but the improved analysis techniques will reduce some of the uncertainties associated with the assessment.

3.5 Climate Change

The static mapping for this SFRA provides an assessment of climate change risk for fluvial and surface water flooding using modelled outputs with the latest climate change uplifts where available.

Developers should undertake detailed modelling of climate change allowances as part of a site-specific FRA, following the climate change guidance set out by the EA, available on the Government website.

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

- The vulnerability of the development.
- The likely lifetime of the development – in general at least 75 years is used for commercial development (depending on the development's characteristics) and 100 years for residential, but this needs to be confirmed in an FRA. It should be noted that in both these cases, the 2080's epoch allowances for rainfall and peak river flow should be applied.
- The River Basin in which the site is located.

3.6 Flooding from Rivers

3.6.1 Fluvial Modelling

Defended Fluvial hydraulic modelling of the Smestow Brook and Waddens Brook has been used to inform this SFRA, as detailed in Table 3-2. This provides a more accurate representation of actual flood risk within Wolverhampton than the Environment Agency's Flood Map for Planning, as it accounts for the presence of flood defence structures along these watercourses.

Table 3-2: Details regarding the fluvial flood risk modelling used to inform this SFRA

Model name	Software
Smestow Brook (2012)	ISIS-TUFLOW
Waddens Brook (2017)	ESTRY-TUFLOW

The following Annual Exceedance Probability events for the fluvial scenarios have been assessed:

- 2% AEP (1 in 50-yr)*
- 1% AEP (1 in 100-yr)
- 0.1% AEP (1 in 1000-yr)

*It should be noted the 3.3% AEP modelled flood event was not provided for the Waddens Brook or Smestow Brook hydraulic models. These models were not re-run for this assessment, due to no site allocations being in close proximity to the Smestow Brook modelled flood extents, up to and including the 0.1% AEP modelled flood extent. H21 is the only site to be carried forward to a Level 2 assessment which is impacted by flood extents from the Waddens Brook hydraulic modelling. However, these modelled flood extents only encroach a small area of the site at the site boundary. As a result, the 2% AEP modelled flood event has been used as a conservative proxy for Flood Zone 3b (the functional floodplain).

3.6.2 Impacts of Climate Change on Fluvial Flood Risk

Climate change is expected to increase peak river flows, meaning that flows which were previously considered extreme will occur more frequently in future. Areas benefiting from flood defences will find the standard of protection decreases over time with failure of defences becoming more likely unless they are upgraded.

Peak river flow climate change allowances developed by the Environment Agency are defined by Management Catchments. Wolverhampton falls under three Management Catchments, as detailed in Table 3-3.

Table 3-3: Climate change allowances for fluvial flood risk for Wolverhampton

Management Catchment	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)
Tame Anker and Mease	Upper end	24%	30%	51%
	Higher central	15%	17%	30%
	Central	10%	11%	22%
Trent Valley Staffordshire	Upper end	30%	38%	61%
	Higher central	19%	23%	39%
	Central	15%	17%	29%
Severn Middle Worcestershire	Upper end	25%	38%	67%
	Higher central	16%	21%	40%
	Central	12%	15%	30%

3.6.3 Climate Change Uplifts for Fluvial Hydraulic Modelling

The following model outputs were used to represent climate change:

- Waddens Brook (2017) - Tame Anker and Mease Management Catchment
  - 1% AEP event (+20%, +30%. +50%)
- Smestow Brook (2012) - Severn Middle Worcestershire Management Catchment
  - 1% AEP event (+20%)

The current Management Catchments' peak river flow allowances have been assessed as part of this SFRA. The original climate change simulations for these models are within +/- 10% of the latest climate change allowances, and are suitable for strategic level assessment of risk. The original climate change simulations for the Waddens Brook model are within this range. However, developers will need to apply the latest climate change allowances as part of a site-specific Flood Risk Assessment to support any planning application.

There are no sites within close proximity to the Smestow Brook, the closest site to the 0.1% AEP flood event is H23, which is approximately 750m east, so it is extremely unlikely that the sites assessed will be at increased flood risk in the future. However, in line with the latest guidance, this Level 2 SFRA has assessed the impacts of climate change on the Smestow Brook. The 1% AEP +20% modelled flood event was the only climate change uplift provided as part of the Smestow Brook hydraulic model. The Central climate change allowance for the Severn Middle Worcestershire 2080's epoch is 30%, therefore the 0.1% AEP event can be used as a conservative proxy for this event. In addition, a further climate change uplift for the Higher Central event was not simulated as part of this assessment. Instead, the 0.1% AEP modelled flood event has also been used as a conservative proxy

for the 1% AEP plus Higher Central climate change fluvial flood event. There are no sites that are impacted by flooding during the 1% AEP +20% climate change and 0.1% AEP modelled flood events of the Smestow Brook.

It should also be noted that with the exception of one site, all the site allocations provided by CWC have been classified as 'More Vulnerable' or 'Less Vulnerable' development. The gypsy and traveller site (GT1) is the only site allocation to be classified as 'Highly Vulnerable'. However, this site is not in close proximity to any watercourses, therefore it is extremely unlikely that the site will be at increased risk of fluvial flooding in the future. Due to the site being in close proximity to an unnamed culverted watercourse, and therefore potentially at residual risk resulting from a culvert blockage, developers will need to carry out detailed hydraulic modelling of culvert blockage scenarios as part of a site-specific FRA. This information is further detailed in the GT1 site summary table in Appendix A of this Level 2 SFRA.

3.7 Surface Water Flooding

3.7.1 Present Day Risk of Flooding from Surface Water

Mapping of surface water flood risk in Wolverhampton has been taken from the Environment Agency's Risk of Flooding from Surface Water (RoFSW) mapping. Surface water flood risk is subdivided into the following four categories:

- **High**: An area has a chance of flooding greater than or within the 3.3% (1 in 30-yr) each year.
- **Medium**: An area has a chance of flooding between 1% (1 in 100-yr) and 3.3% AEP (1 in 30-yr) each year.
- **Low**: An area has a chance of flooding between 0.1% (1 in 1,000-yr) and 1% AEP (1 in 100-yr) each year.
- **Very Low**: An area has a chance of flooding of less than 0.1% (1 in 1,000-yr) each year.

The results should be used for high-level assessments. If a particular site is indicated in the Environment Agency mapping to be at risk from surface water flooding, a more detailed assessment is required to assess the flood risk more accurately at a site-specific scale. Such an assessment should use other sources of local flooding information to confirm the presence of a surface water risk at that particular location.

Detailed modelling based on site survey will be necessary where there is a significant risk of surface water flooding. It is the intention that the Environment Agency will prepare updated and improved surface water mapping in the course of updating NaFRA2. It is anticipated that this data will be available in 2025 and at that time it is recommended that the surface water risk assessment is reviewed. It is not anticipated that the updated mapping will fundamentally change the locations identified to be at risk from surface water flooding, but the improved analysis techniques will reduce some of the uncertainties associated with the assessment.

3.7.2 Impacts of Climate Change on Surface Water Flood Risk

Climate change is predicted to result in wetter winters and increased summer storm intensity in the future. This increased rainfall intensity will affect land and urban drainage systems, resulting in more frequent surface water flooding, due to the increased volume of water entering the systems.

The potential impacts of surface water plus climate change will need to be considered at site-specific assessment stage. In May 2022, the Environment Agency updated the surface water climate change projections, which are now based on Management Catchments. Table 3-4 shows the peak rainfall intensity allowances that apply in Wolverhampton when considering surface water flood risk. The upper end allowance should be considered for both the 3.3% and 1% AEP events to understand the range of impact.

Table 3-4: Climate change allowances for peak rainfall intensity

Management Catchment	% AEP event	Epoch	Central Allowance	Upper End Allowance
Tame Anker and Mease	3.3%	2050	20%	35%
	3.3%	2070	25%	35%
	1%	2050	20%	40%
	1%	2070	25%	40%
Trent Valley Staffordshire	3.3%	2050	20%	35%
	3.3%	2070	25%	35%
	1%	2050	25%	40%
	1%	2070	25%	40%
Severn Middle Worcestershire	3.3%	2050	20%	35%
	3.3%	2070	25%	35%
	1%	2050	20%	40%
	1%	2070	25%	40%

3.7.3 Critical Drainage Areas

A critical drainage area (CDA) is defined as “a discrete geographic area (usually a hydrological catchment) where multiple and interlinked sources of flood risk (surface water, groundwater, sewer and/or river) often cause flooding in a Flood Risk Area during severe weather thereby affecting people, property or local infrastructure.” These can cover wide areas within both rural and urban environments and are typically where manmade drainage infrastructure has been identified as at critical risk of failure, resulting in flooding. An absence of CDAs does not mean there are no areas with potential drainage problems.

According to the Wolverhampton Surface Water Management Plan (SWMP) published in 2012, there are five CDAs within the CWC boundary. None of the sites carried forward to a Level 2 assessment are impacted by these CDAs. CDA5 is the only area to impact some of the sites. This CDA covers part of the west of the city centre and extends west to Blakenhall, Bradmore and Merridale. The sites impacted are listed below:

- 32690
- 27350
- 42550
- 36780
- H8
- H9

None of the above sites have been carried forward to a Level 2 assessment. It should be noted that the SWMP was published in 2012 and is therefore due to be updated. This may result in changes to the CDAs detailed above.

3.8 Sewer Flooding

Historical incidents of flooding are detailed by Severn Trent Water within their Hydraulic Sewer Flooding Risk Register. The sewer flooding register identifies where properties have suffered flooding.

Severn Trent Water is the water company responsible for the management of the drainage networks across Wolverhampton. They have provided details of recorded incidents across 14 different 3/4 digit postcode areas between 11th June 1997 and 24th October 2023.

Records show sewer flooding is widespread across Wolverhampton. The most incidents occurred on 6th July 2006, with 34 separate incidents reported. There are spatial clusters of sewer flooding in Aldersley, Claregate, Tettenhall, Castlecroft, Ettingshall Park and Fordhouses. For further information on sewer flooding within Wolverhampton, please refer to Section 5.9 of the Level 1 SFRA. This includes Table 5-1 which details the breakdown of the number of recorded sewer flooding incidents by postcode.

3.8.1 Impact of Climate Change on Sewers

Surface water and fluvial flooding with climate change have the potential to impact the sewerage system, so careful management of these is needed for development. Due to differing ages of settlements, there will be drainage systems consisting of different types of sewers. Increasing pressures from climate change, urban creep and infill development could impact the performance of the sewerage system.

3.9 Groundwater

In comparison to fluvial flooding, current understanding of the risks posed by groundwater flooding is limited and mapping of flood risk from groundwater sources is in its infancy. Groundwater level monitoring records are available for areas on Major Aquifers; however, for lower lying valley areas, which can be susceptible to groundwater flooding caused by a high-water table in mudstones, clays, and superficial alluvial deposits, very few records are available. Additionally, there is an increased risk of groundwater flooding where long reaches of watercourse are culverted as a result of elevated groundwater levels not being able to naturally pass into watercourses and be conveyed to less susceptible areas.

To assess the risk of groundwater emergence within Wolverhampton, the JBA Groundwater Risk Emergence Mapping (5m resolution) has been provided. This JBA licenced product shows areas of potential groundwater emergence (although not where water may flow to and cause flooding once it has emerged) during a 1% AEP flood event, and highlights areas where there is sufficient evidence to suggest that flooding may occur. This data cannot form part of the Sequential Test as it is not directly comparable to other datasets (e.g. Flood Zones), and therefore cannot categorise an area as high, medium or low risk on its own. The map should be interpreted as an initial indicative tool to assess groundwater flood risk at preliminary stages of planning/site allocation. Where mapping indicates a risk of groundwater flooding a detailed assessment should be undertaken to confirm the risk to the site as part of any planning application, which may require ground investigations.

The JBA Groundwater Risk Emergence Mapping data is categorised into 5 different classes, with a detailed description of the classes in Table 3-5 below.

Table 3-5: JBA Groundwater Risk Emergence Mapping data classifications

Risk Class	Depth range	Description
0 - No risk	>5m	The zone is deemed as a having negligible risk from groundwater flooding due to the nature or local geological deposits
1	At least 5m	Flooding from groundwater is unlikely
2	Between 5m and 0.5m	Risk of flooding to subsurface assets but surface manifestation is unlikely
3	Between 0.5m and 0.025m	Risk of groundwater flooding to both surface and subsurface assets. Groundwater may emerge locally
4	<0.025m	Risk of groundwater flooding to surface and subsurface assets. Groundwater may emerge at significant rates and gas the capacity to flow overland and/or pond within any topographic low spots.

For assessed sites that are deemed to be at risk from groundwater emergence (Risk Classes 3 and 4), it is advised that on site investigations are conducted to determine the risk to the site. Sites between Dunstall Hill and the north of the Waterhead Brook are shown to have high ground water levels of between 0.5 and less than 0.025m below the ground surface. This is also the case for sites E20, E21 and E23 which are in close proximity to culverted watercourses in the south-east of Wolverhampton. Sites 36780 and 42550 in the west of the city centre are impacted by groundwater emergence which is between 0.025m and 0.5m below the ground surface. These sites are situated approximately 230m north of the culverted Graiseley Brook.

3.9.1 Impact of Climate Change on Groundwater Flooding

The impact of climate change is uncertain for groundwater flooding. There is no technical modelling data available to assess climate change impacts on groundwater.

Milder wetter winters may increase the frequency of groundwater flooding incidents in areas that are already susceptible, but warmer drier summers may counteract this effect by drawing down groundwater levels to a greater extent during the summer months.

3.10 Reservoirs

The risk of inundation due to reservoir breach or failure of reservoirs within the area has been assessed using the Environment Agency's Risk of Flooding from Reservoirs dataset.

The dataset gives no indication of the likelihood or probability of reservoir flooding. The Reservoir Flood Maps do not describe the risk of flooding (simply a credible worst case) and data includes layers for:

- 'Dry day' – Individual flood extents for all large, raised reservoirs in the event that they were to fail and release the water held on a "dry day" when local rivers are at normal levels.
- 'Wet day' – Individual flood extents for all large, raised reservoirs in the event that they were to fail and release the water held on a "wet day". A wet day is assumed to be a failure at the same time as experiencing a river flood with a 1 in 1000 chance of occurring in any year.
- 'Fluvial contribution' – The extent of river flooding added to the reservoir model to determine the impacts of failure on a wet-day.

At the time of writing, only the Dry Day scenario flood extents impact the south of the City at Ettingshall, Ettingshall Park and Rough Hills. This extent originates from the Sedgley Beacon Reservoir (managed by South Staffordshire Water Plc). As this reservoir is not connected to a river system, and the Wet Day scenario is based on fluvial modelling, the Wet Day scenario does not exist in this area. Developers should consult the Canal and River Trust where reservoir flood risk mapping suggests a site may be impacted during a breach scenario.

The risk of flooding from reservoirs should be taken into consideration as part of the site-specific Flood Risk Assessment.

Sites E18, E20 and E21 are at risk of reservoir flooding during the 'Dry Day' flood event. Despite the risk being residual, in the very unlikely event that the reservoirs fail, it is predicted that there is a risk to life. For sites at risk of reservoir flooding, developers will need to produce flood warning and evacuation plans in consultation with the LPA emergency planning team.

3.11 Residual Risk

Residual risk is the risk that remains after the impacts of flood risk infrastructure or site-specific mitigation measures 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, failure of pumping stations, or blockages of culverts. This could result in the inundation of a site, and may include the sudden release of water with little warning.

Culvert blockages or the failure of defences may result in flooding to areas which are not usually at risk.

Potential culvert blockages that may affect some sites were identified using OS Mapping, the Environment Agency's Detailed River Network Layer and a GIS dataset provided by CWC which stipulates the locations of culverts within Wolverhampton. These datasets determined where watercourses flow into culverts or through structures (i.e. bridges) in the vicinity of the sites. Any potential blockage locations which may affect sites were flagged in the following site summary tables: E23, E25, E6, E7, GT1, H21 and H23. These will need to be considered by the developer as part of a site-specific Flood Risk Assessment.

Canals also pose a residual risk from breaches to damage to the channel. There are six canals in the Wolverhampton study area which are the Birmingham Canal Navigations, Bradley Arm of the Birmingham Canal Navigations, Shropshire Union Canal, Staffordshire and Worcestershire Canal, Walsall Canal, and the Wryrley and Essington Canal. These have the potential to interact with other watercourses and become flow paths during flood events or in a breach scenario.

3.12 Depth, Velocity, and Hazard to People

The Level 2 assessment seeks to map the probable depth and velocity of flooding as well as the hazard to people during the defended fluvial 1% AEP event plus an allowance for climate change. The 1% AEP plus climate change flood event has been investigated in further detail because the Level 2 assessment helps inform the Exception Test, and flood mitigation measures and access/ egress requirements focus on the design event (usually e.g. the 1% AEP plus climate change event), rather than the 0.1% AEP event.

Where detailed model outputs were available, i.e. along the Smestow Brook and Waddens Brook, the 1% AEP plus climate change depth, velocity and hazard data has been used. This data is only present where models have a 2D element, representing the floodplain in detail.

In the absence of detailed hydraulic models (or models with detailed 1D-2D outputs), fluvial flood depth, velocity and hazard are not available as part of the Flood Map for Planning dataset. This may need to be considered further during a site-specific FRA.

The depth, velocity and hazard of the 1% AEP plus Upper End climate change surface water flood event, produced by uplifting the EA's RoFSW mapping using the pluvial Upper End allowance, has also been mapped and considered in this assessment.

Hazard to people has been calculated using the below formula as suggested in Defra's FD2321/TR2 "Flood Risk to People." The different hazard categories are shown in Table 3-6. Developers should also test the impact of climate change depths, velocities, and hazard on the site, at Flood Risk Assessment stage.

Table 3-6: Defra's FD2321/TR2 "Flood Risks to People" classifications

Description of Flood Hazard Rating	Flood Hazard Rating	Classification Explanation
Very Low Hazard/ Caution	<0.75	"Flood zone with shallow flowing water or deep standing water"
Danger For Some (i.e. children)	0.75 - 1.25	"Danger: flood zone with deep or fast flowing water"
Danger For Most	1.25 - 2.00	"Danger: flood zone with deep fast flowing water"
Danger For All	>2.00	"Extreme danger: flood zone with deep fast flowing water"

As part of a site-specific FRA, developers may need to undertake more detailed hydrological and hydraulic assessments of the watercourses to verify flood depth, velocity and hazard based on the relevant 1% AEP plus climate change event, using the relevant climate change allowance based on the type of development and its associated vulnerability classification. Not all this information is available for this the strategic scale assessment and the level of resolution may not be appropriate to enable site scale assessment of proposed development schemes.

3.13 Note on SuDS Sustainability

The hydraulic and geological characteristics of each site were assessed to determine the factors that potentially constrain schemes for surface water management. This assessment is designed to inform the early-stage site planning process and is not intended to replace site-specific detailed drainage assessments.

The assessment is based on catchment characteristics and additional datasets such as the JBA Groundwater Risk Emergence Mapping (5m resolution) and British Geological Survey (BGS) Soil maps of England and Wales which allow for a basic assessment of the soil characteristics on a site-by-site basis. LiDAR data was used as a basis for determining the topography and average slope across each development site. It should be noted that Wolverhampton is a densely populated, developed urban area and LiDAR data is unlikely to be representative of the actual topography. This may have an impact on some of the flood risk datasets used within this SFRA. It is recommended that developers undertake site-specific topographic surveys as part of their detailed Flood Risk Assessments. Other datasets were used to determine other factors. These datasets include:

- Historic landfill sites
- Groundwater Source Protection Zones
- Detailed River Network
- The Flood Map for Planning

This data was then collated to provide an indication of particular groups of SuDS systems which might be suitable at a site. SuDS techniques were categorised into five main groups, as shown in Table 3-7. This assessment should not be used as a definitive guide as to which SuDS would be suitable but used as an indicative guide of general suitability. Further site-specific investigation should be conducted to determine what SuDS techniques could be used on a particular development, informed by detailed ground investigations.

Table 3-7: Summary of SuDS categories

SuDS Type	Technique
Source Controls	Green Roof, Rainwater Harvesting, Pervious Pavements, Rain Gardens
Infiltration	Infiltration Trench, Infiltration Basin, Soakaway
Detention	Pond, Wetland, Subsurface Storage, Shallow Wetland, Extended Detention Wetland, Pocket Wetland, Submerged Gravel Wetland, Wetland Channel, Detention Basin
Filtration	Surface Sand filter, Sub-Surface Sand Filter, Perimeter Sand Filter, Bioretention, Filter Strip, Filter Trench
Conveyance	Dry Swale, Under-drained Swale, Wet Swale

The suitability of each SuDS type for the site options has been described in the summary tables, where applicable. The assessment of suitability is broadscale and indicative only; more detailed assessments should be carried out during the site planning stage to confirm the feasibility of different types of SuDS.

Further SuDS guidance and design requirements for Wolverhampton are available in Section 2.4.6 of the Level 1 SFRA.

4 Level 2 Assessment Methodology

4.1 Site Screening

CWC provided 63 sites for assessment. The screening results can be found in Appendix B of this Level 2 SFRA. The sites were screened against available flood risk information and spatial data to provide a summary risk to each site including:

- The proportion of the site in each Flood Zone derived from the Level 1 SFRA, which includes Flood Map for Planning Flood Zones and modelling data for the Smestow Brook and Waddens Brook.
- Whether the site is shown to be at risk from surface water flooding from the RoFSW data set.
- If the site is at risk from groundwater emergence using the JBA Groundwater Emergence Risk Map.
- Proportion of the site in the Reservoir 'Wet Day' and 'Dry Day' extents.
- If there is an ordinary watercourse flowing through or adjacent to the site.
- Other considerations such as safe access and egress to or from a site that might affect the viability of development.

The screening provides an opportunity to identify sites that may show to be 100% in Flood Zone 1, but upon inspection using GIS software, have an ordinary watercourse flowing through or adjacent to the site. While Flood Zone maps may not be available for these watercourses, it does not mean the watercourse doesn't pose a risk, only that no modelling of the watercourse has been conducted to identify the risk.

The Flood Map for Planning Flood Zones are not provided for specific sites or land where the catchment of the watercourse falls below 3km^2. In addition, the Flood Map for Planning Flood Zones only detail flood extents. They do not provide data relating to the depth, velocity and hazard rating of flooding which is required to make an informed assessment of flood risk. For this reason, the Flood Zones should not be used as application evidence to provide the details of possible flooding for individual properties or sites, and any sites with a watercourse in or adjacent to the site. The RoFSW has been used in these cases as it provides a reasonable representation of the floodplain of such watercourses to use for strategic assessment. Detailed modelling of such watercourses will be needed as part of a detailed FRA to support any planning application for such sites.

4.2 Sites Taken Forward to a Level 2 Assessment

Out of the 63 sites provided by CWC, 12 sites were carried forward to a Level 2 assessment in 12 site tables.

A Red-Amber-Green system was applied to the sites on the basis, that:

- Red sites needed a Level 2 assessment and have significant obstacles or challenges for development which will need consideration going forward for

development. These sites will need the Exception Test to show that the site can be developed safely from a flood risk perspective.

- Amber sites did not need a Level 2 assessment but are flagged in this report for developer considerations (recommendations provided in Section 4.3), but these are likely to be able to be addressed at the planning application stage. These sites are included within this report as they may have some surface water issues relative to access and egress to the site.
- Green sites that had no significant obstacles for development. However, it is noted sites may need an FRA and drainage strategy depending on the location and size of the site.

In order to categorise the sites in this system, a flood risk criteria was applied to the ranking assessment as shown in Table 4-1. This categorisation is tailored to Wolverhampton and based on professional judgement and categories were agreed with CWC. Groundwater flood risk should be considered as part of the site-specific assessments, but there is no equivalent national mapping or datasets to directly compare with fluvial/pluvial risk for allocation purposes. Instead, once sites have been assessed for other sources, a groundwater assessment should be undertaken. The same also applies to reservoir flooding.

It is noted that there are some sites that may be upgraded or downgraded in this assessment. For example, a site may show as Amber, but if there was an area of deep ponding, a prominent flow route bisecting a site, immediate constraints to site access at the boundary, or potential for highly vulnerable types of development to occupy a site, it may be moved up to the Red category.

For other sites with less significant but still noteworthy surface water issues, these have been highlighted in Table 4-2 and the LLFA expect the developer to take these into account at an early stage when planning the form and layout of the site, the surface water drainage system and any surface water mitigation measures that may be necessary.

Appendix C provides a summary of the sites which have been taken forward to the Level 2 assessment on this basis.

Table 4-1: Site categories used for site flood risk assessment

Category	Site Table required?	Undefended Fluvial Risk	Surface Water Risk*	Residual Risk requirement for Flood Warning and Evacuation Plan
Green	No site table required - no significant flood risk. Most preferrable for allocation.	Site is within Flood Zone 1	None/negligible - likely to be manageable through site layout and SuDS	None/negligible
Amber	No site table required - but mentioned in L2 report, risk likely to be manageable at FRA stage	Site is within Flood Zone 1	1% AEP event plus 40% cc RoFSW extent covers <10% of the site area, likely to be manageable with through site layout and SuDS	May be necessary depending on the nature or location of the risk; should demonstrate that the site can be safely evacuated in the event of a reservoir defence breach and/or culvert blockage
		Site is mostly within Flood Zone 1 and <5% of site in Flood Zone 2 and/or 3		
Red	Site table required - some flood risk, some obstacles for development	Site is within Flood Zone 1	1% AEP event plus 40% cc RoFSW extent covers 10% to 50% of the site area	Should demonstrate that the site can be safely evacuated in the event of a reservoir defence breach and/or culvert blockage
		<5% of site is within Flood Zone 2 and/or 3	1% AEP event plus 40% cc RoFSW extent covers 50% to 70% of the site area	
	Site table required - significant flood risk, significant obstacles for development	<5% of site is within Flood Zone 2 and/or 3	1% AEP event plus 40% cc RoFSW extent covers >70% of the site area	

*Surface water assessment requires the Upper End peak rainfall intensity climate change allowance. In this case for residential development for the 2070s epoch, the 1% AEP plus 40% climate change allowance is the design event for all Management Catchments covering Wolverhampton.

Modelled defended fluvial flood risk has been excluded from Table 4-1. This is because the majority of the sites are not impacted by flooding from the modelled Smestow Brook or Waddens Brook extents. There are only three sites impacted by fluvial flooding from the modelled Waddens Brook extents. These are sites H24 (Alamein Road) and H24 (Arnhem Road) which already have, or will soon acquire, planning permission. Therefore, these have been excluded from a Level 2 assessment. Site H21 has been carried forward to a Level 2 assessment as it is at fluvial flood risk and contains a section of the unnamed culverted tributary of the River Tame.

4.3 Recommendations for Sites Not Taken Forward to a Level 2 Assessment

The ‘amber’ sites identified as having some challenges to development, but not requiring a Level 2 assessment, are shown in Table 4-2 below. The risk posed to these sites is from surface water flooding (or an ordinary watercourse that does not have associated Flood Zones in the EA’s Flood Map for Planning due to catchment size). Some of these sites are also at reservoir and groundwater flood risk or have access and egress issues.

Table 4-2: Sites flagged at lower flood risk

Site name	% of site in RoFSW 3.3% AEP extent	% of site in RoFSW 1% AEP extent	% of site in RoFSW 0.1% AEP extent	% of site in 'Dry Day' reservoir extent	% of site in 'Wet Day' reservoir extent	JBA Groundwater Risk Emergence mapping	Watercourse within 100m of site	Has access and egress issues
E15	0.03	1.8	24.1	0	0	Negligible	Yes (Birmingham Canal Navigations)	Yes
E18	0.1	2.3	16.6	15.5	0	Negligible	Yes (Birmingham Canal Navigations)	Yes
E21	2.4	5.5	15.4	5.2	0	Moderate	Yes (unnamed watercourse)	Yes
H15	2.2	6.0	15.4	0	0	Negligible	Yes (Bradley Arm of Birmingham Canal Navigations)	Yes
E13	0	0	1.5	0	0	High	No	Yes
E16	0	0.8	2.6	0	0	Negligible	No	Yes
E24	0	0	1.1	0	0	Negligible	No	Yes
E3	0	0	1.3	0	0	High	No	No
E4	0	0	0	0	0	High	No	No
H11	0.01	1.0	1.7	0	0	Negligible	Yes (Birmingham Canal Navigations)	No
H2	0	0	5.1	0	0	Negligible	Yes (Wyrley and Essington Canal)	No
H20	0	0	2.4	0	0	Moderate	No	No
H24 (Lincoln Green)	0	1.1	5.4	0	0	High	No	No
H6	1.8	3.6	10.5	0	0	Negligible	No	No

Site name	% of site in RoFSW 3.3% AEP extent	% of site in RoFSW 1% AEP extent	% of site in RoFSW 0.1% AEP extent	% of site in 'Dry Day' reservoir extent	% of site in 'Wet Day' reservoir extent	JBA Groundwater Risk Emergence mapping	Watercourse within 100m of site	Has access and egress issues
E1	0.04	0.1	4.4	0	0	High	No	Yes
E20	0	0.7	4.2	17.8	0	Moderate	Yes (culverted Ettingshall Brook)	Yes
27350	0.1	2.5	11.4	0	0	Negligible	No	No
32690	0	0	6.0	0	0	Negligible	No	Yes
36780	0.7	2.2	9.5	0	0	Moderate	No	Yes
36810	0	1.8	6.7	0	0	Negligible	No	No
42550	0.6	0.9	2.9	0	0	Moderate	No	No

The majority of the sites in Table 4-2 are at minor surface water risk. The exception is E15 where 24.1% of the site is impacted by surface water flooding during the 0.1% AEP event. However, the majority of flood depths during this event at the site are less than 0.15m. Ten of the sites listed in Table 4-2 have access and egress issues during the 0.1% AEP surface water flood event. At these sites, flood depths along the surrounding access roads exceed 0.3m. The raising of access routes should not impede surface water flows.

If flooding is likely to limit access/egress to the sites, this should be considered further as part of a site-specific flood-risk assessment. Developers will need to demonstrate safe access and egress is possible during the 1% AEP surface water/fluvial event, including an allowance for climate change.

All sites that are affected by significant flooding during the 0.1% AEP surface water event have areas of ponding and/or contain flow paths which connect to adjacent access roads. Where proposed development results in a change in building footprint, the developer should ensure that it does not increase flood risk off-site.

Sites E18, E21 and E20 are at risk of reservoir flooding from the Sedgley Beacon Reservoir during the 'Dry Day' event. Despite the risk being residual, in the very unlikely event that the reservoirs fail, it is predicted that there is a risk to life. Developers will need to produce flood warning and evacuation plans for these sites in consultation with the LPA emergency planning team.

There is a high risk of groundwater emergence at sites E13, E3 E4, H24 (Lincoln Green) and E1. These sites are either completely within, or have sections that are located within, the high risk groundwater category; therefore groundwater levels are either at or very near (within 0.025m of) the ground surface. There will be a significant possibility that emergence of groundwater could lead to flooding and damage to property or harm to other sensitive receptors at, or near, these locations. There may also be a risk of basement flooding. Further consideration of the local level of risk and mitigation, by a suitably qualified professional, is recommended in consultation with the LPA. This will impact which SuDS are appropriate for the sites, for example, liners will be needed on filtration, detention and conveyance SuDS to prevent the egress of groundwater.

As well as there being a high risk of groundwater emergence and some surface water flood risk at site E1, it is also at minor fluvial flood risk from the Waterhead Brook. This watercourse flows approximately 330m south of the site. Although there is no detailed hydraulic modelling of the Waterhead Brook, the EA's Flood Map for Planning shows 0.3% of the site to be within Flood Zones 2 and 3. There is also a section of the Waterhead Brook which is culverted approximately 370m south-east of the site. Although there was no hydraulic modelling of the culverted sections of watercourse available for this SFRA, the site may still be at residual risk from this watercourse if there was a culvert blockage. Therefore, development should be steered away from areas of the site that are within Flood Zones 2 and 3. As part of a site-specific FRA, the developer will need to carry out detailed hydraulic modelling of the Waterhead Brook to inform fluvial flood risk at the site. The risk posed by this source of flooding remains close to the south-eastern boundary of the site, mainly affecting access and egress routes.

4.4 Site Summary Tables

As part of the Level 2 SFRA, detailed site summary tables and static mapping have been produced for the sites listed in Appendix A. The summary of the sites put forward for assessment from screening can be found in Appendix C.

Where available, the results from existing detailed Environment Agency hydraulic models were used in the assessment to provide depth, velocity, and hazard information. For more information on these models, please refer to Section 3.6 of this report.

The Environment Agency's Risk of Flooding from Surface Water mapping has also had Upper End climate change uplifts applied to it in order to indicate the future risk of surface water flooding during the 3.3% AEP and 1% AEP events.

Detailed site summary tables have been produced for the site options (see Appendix A). Each table sets out the following information:

- Basic site information
- Location of site in the catchment
- Area, type of site, current land use (greenfield/ brownfield), proposed site use
- Sources of flood risk
- Existing drainage features
- Fluvial – proportion of site at risk including description from FMfP mapping and modelling including extent, depth, velocity and hazard information
- Surface Water – proportion of site at risk including description from RoFSW mapping/modelling including extent, depth, velocity and hazard information
- Reservoir
- Flood History
- Flood risk management infrastructure
- Description of residual risk including breach of defences and/or blocked culverts
- Emergency Planning
    - Flood Warning Areas
    - Access and egress
- Climate change
- Summary of climate change allowances and increase in flood extent compared to Flood Zones/modelling for fluvial and surface water
- Requirements for drainage control and impact mitigation
- Broadscale assessment of possible SuDS to provide indicative surface water drainage advice for each site assessed for the Level 2 SFRA.
    - Groundwater Source Protection Zone
    - Historic Landfill Site
- NPPF Planning implications
    - Exception Test requirements
- Requirements and guidance for site-specific FRA (including consideration of opportunities for strategic flood risk solutions to reduce flood risk)

- Key messages – summarising considerations for the Exception Test to be passed
- Mapping information – description of data sources for the following mapped outputs:
    - Flood Zones
    - Climate change
    - Fluvial depth, velocity and hazard mapping
    - Surface water
    - Surface water depth, velocity and hazard mapping

4.4.1 Static mapping

To accompany the site summary tables, there are static maps, which display all the mapped flood risk datasets per site.

Flood risk information in the static maps include:

- Site boundary and Council boundary
- Title bar showing site name, name of mapped dataset and legend
- Each legend contains:
    - Site boundary,
    - Main River, and;
    - Dataset information.
- Mapped datasets:
    - EA's Flood Warning and Flood Alert Area
    - JBA Groundwater Emergence Mapping
    - EA's Flood Map for Planning (Flood Zone 2 and 3)
    - EA's RoFSW with extent, depth, velocity and hazard (for the 3.3% AEP, 1% AEP, and 0.1% AEP events)
    - EA's RoFSW with climate change uplifts with extent, depth, velocity and hazard
    - Fluvial modelling – Waddens Brook with extent and climate change extents
    - Flood Defences with standardised attributes, detailing bridge abutments, embankments, engineered high ground, natural high ground, flood gates, spillways, and flood walls.

5 Flood Risk Management Requirements for Developers

5.1 Introduction

The report provides a strategic assessment of flood risk across 12 specific sites in Wolverhampton. 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 the watercourses to verify flood extent (including latest climate change allowances), to inform the sequential approach within the site and prove, if required, whether the Exception Test can be satisfied.

5.2 Principles for New Developments

Section 8.1 in the Level 1 SFRA provides guidance for developers on applying the Sequential and Exception Tests, consulting with statutory consultees, considering the risk from all sources of flooding, ensuring development seeks to reduce flooding and is safe for future users, enhancing the natural river environment and floodplain, and contributing to wider flood mitigation strategies within the City.

5.3 Requirements for Site-Specific Flood Risk Assessments

5.3.1 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 actually in Flood Zone 1); the Environment Agency should be contacted to agree the breach assessment approach.
- Where evidence of historical or recent flood events have been passed to the LPA.
- In an area where surface water flood risk is a material consideration.
- Land identified in an SFRA as being at increased risk in the future.

- If the SFRA identifies the site to be at risk from any other source of flooding (including reservoirs, canals, groundwater).

5.3.2 Objectives of Site-specific FRAs

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

- whether a proposed development will be at risk of flooding, from all sources, both now and in the future, taking into account climate change
- 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 CWC as detailed in Sections 2 and 8 in the Level 1 SFRA report. 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 PPG, Defra).

Guidance for local planning authorities for reviewing Flood Risk Assessments submitted as part of planning applications has been published by Defra in 2015, and was last updated in August 2024 - Flood Risk Assessment: Local Planning Authorities.

5.4 Local Requirements for Site Specific Flood Risk Assessments

The Level 1 SFRA provides details on the following mitigation measures in Section 8.3, and should be referred to alongside this report:

- Site layout and design (8.3.1)
- Modification of ground levels (8.3.2)
- Raised floor levels (8.3.3)
- Development and raised defences (8.3.4)
- Developer contributions (8.3.5)

5.5 Flood Warning and Emergency Planning

Section 8.6 of the Level 1 SFRA discusses NPPF requirements and what a Flood Response Plan (also known as an Emergency Plan) will need to consider and other relevant information on emergency planning. Further information is provided by the West Midlands Conurbation Local Resilience Forum in reducing flood risk from other sources.

Section 8.5 of the Level 1 SFRA discusses how to reduce flood risk from other sources, such as groundwater, surface water and sewer flooding.

5.6 Reservoirs

The level and standard of inspection and maintenance required under the Reservoirs Act means that the risk of flooding from reservoirs is very low. However, there is a residual risk of a reservoir breach, and this risk should be considered in any site-specific FRA (where relevant).

Section 8.5.5 of the Level 1 SFRA discusses considerations that developers should follow when allocating development downstream of a reservoir.

5.7 Duration and Onset of Flooding

The duration and onset of flooding affecting a site depends on a number of factors:

- The position of the site within a river catchment, with those at the top of a catchment likely to flood sooner than those lower down. The duration of flooding tends to be longer for areas in lower catchments.
- Upstream reservoirs in these catchments will provide some online flood storage that reduce the flood risk downstream and delays the onset of flooding. At the confluence of the larger watercourses and smaller tributaries, there may be different timings of peak flows, for example smaller tributaries would peak much earlier than the larger catchments.
- The principal source of flooding: where this is surface water, depending on the intensity and location of the rainfall, flooding could be experienced within 30 minutes of the heavy rainfall event e.g., a thunderstorm. Typically, the duration of flooding for areas at risk of surface water flooding or from flash flooding from small watercourses is short (hours rather than days).
- The preceding weather conditions prior to the flooding: wet weather lasting several weeks will lead to saturated ground. Rivers respond much quicker to rainfall in these conditions.
- Whether a site is defended, noting that if the defences were to fail, a site could be affected by very fast flowing and hazardous water within 15 minutes of a breach developing (depending on the size of the breach and the location of the site in relation to the breach), causing danger to life.
- Catchment geology, for example chalk catchments take longer to respond than typical clay catchments.

It is recommended that a site-specific Flood Risk Assessment refines this information, based on more detailed modelling work where necessary.

6 Surface Water Management and SuDS

The Level 1 SFRA summarises guidance and advice on managing surface water runoff and flooding in Section 9. Below is a guide to what is included in sections not expanded on here, for reference alongside this Level 2 SFRA:

- Section 9.1 – Role of the LLFA and LPA in surface water management
- Section 9.2 – Sustainable Drainage Systems (SuDS)

6.1 Sources of SuDS Guidance

6.1.1 Black Country SuDS Handbook (2017)

According to the Black Country SuDS Handbook (2017), there is no 'one size fits all' approach to SuDS design at development sites. As such, to determine the right techniques it is necessary to first:

1. Understand existing drainage patterns
2. Establish soil conditions (permeability)
3. Verify the quality of the land – is it affected by contamination?
4. Establish the position of the water table beneath the site
5. Establish a suitable point of discharge (with permission where applicable), whereby surface runoff not collected for reuse must be discharged to one or more of the following in order of priority:
    - into the ground (infiltration);
    - to a surface water body;
    - to a surface water sewer, highway drain, or other surface water drainage system
    - to a combined sewer
6. Determine allowable runoff rates, indicative attenuation volumes and land take requirements
7. Consider site biodiversity, heritage and landscape features and how SuDS can complement these.

6.1.2 C753 CIRIA SuDS Manual (2015)

The C753 CIRIA SuDS Manual (2015) 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. Due to the legacy of contaminated land in Wolverhampton from historic mining and heavy industry, there is a risk of causing contamination of groundwater and/or surface water if SuDS are not properly designed. The presence of contaminated land needs to be considered when designing SuDS features. Guidance to help design SuDS on contaminated land is available within the C753 CIRIA SuDS Manual (2015).

6.1.3 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.

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

The Local Authority SuDS Officer Organisation (LASOO) produced their Practice guidance in 2016 to give further detail to the non-statutory technical guidance.

6.2 Groundwater Vulnerability Zones

The Environment Agency published 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 MagicMap website.

6.3 Groundwater Source Protection Zones (GSPZ)

The Environment Agency also defines Groundwater Source Protection Zones (SPZs) 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. Groundwater Source Protection Zones can be viewed on the Defra Interactive MagicMap website. The western half of Wolverhampton is covered by Source Protection Zone 3. There are also three isolated areas in the centre and west of the study area which are within Source Protection Zones 1 and 2. These are situated in Heath Town, Tettenhall and to the west of the city centre.

6.4 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. The NVZ coverage can be viewed on Defra's Interactive MagicMap website. There is currently a pre appeal NVZ area covering Wolverhampton.

6.5 SuDS Suitability Across the Area

The suitability of SuDS techniques is dependent upon many variables, including the hydraulic and geological characteristics of the catchment.

The permeability of the underlying soils can determine the infiltration capacity and percolation capacities. As such, a high-level review of the soil characteristics has been undertaken using British Geological Survey (BGS) soil maps of England and Wales which allow for a basic assessment of the soil characteristics and infiltration capacity. A high-level assessment of the suitability of SuDS is included in the site tables in Appendix A. This is based on national datasets, and it should be assessed in more detail when designing SuDS.

This strategic assessment should not be used as a definitive site guide as to which SuDS would be suitable but rather as an indicative guide of general suitability based solely on soil type. Several other factors can determine the suitability of SuDS techniques including land contamination, the depth and fluctuation of the water table, the gradient of local topography and primary source of runoff etc. When considering NVZs and if areas have pollutants, infiltration may only be suitable where treatment measures are provided, prior to any discharge to surface or groundwaters.

Further site-specific investigation should be conducted to determine what SuDS techniques could be utilised at a particular development. The result of this assessment does not remove the requirements for geotechnical investigation or detailed infiltration testing and does not substitute the results of site-specific assessments and investigations. The LLFA should be consulted at an early stage to ensure SuDS are implemented and designed in response to site characteristics and policy factors.

7 Summary of Level 2 Assessment and Recommendations

7.1 Assessment Methods

The summary tables set out the flood risk to each site, including Flood Zone coverage, maps of extent, depth, and velocity of flooding as well as hazard mapping for the 1% AEP plus an allowance for climate change. Climate change mapping has also been produced to indicate the impact which different climate change allowances may have on the sites (where models are available), or using Flood Zone 2 as an indication of climate change. Each table also sets out the NPPF requirements for the site, including whether the Exception Test is required and guidance for satisfying the flood risk portion of the Exception Test, as well as guidance for site-specific FRAs.

A broadscale assessment of suitable SuDS options has been provided giving an indication where there may be constraints to certain sets of SuDS techniques. This assessment is indicative and more detailed assessments should be carried out during the site planning stage to confirm the feasibility of different types of SuDS. It may be possible that those SuDS techniques highlighted as possibly not being suitable can be designed to overcome identified constraints.

Consideration has also been given to the safety implications for development with respect to surface water flood risk. This reflects the requirement to consider the application of the Exception Test in circumstances where flood risk cannot be avoided.

7.2 Summary of Key Site Issues

CWC provided 63 sites for assessment. 12 sites were carried forward for Level 2 assessment which were assessed in 12 site tables. Detailed site summary tables that set out the flood risk to each site, NPPF requirements for the site, and guidance for site specific FRAs have been produced. A broadscale assessment of suitable SuDS options has been provided, giving an indication where there may be constraints to certain types of SuDS techniques.

The following points summarise the Level 2 Assessment:

- **Fluvial Flooding:** The following sites which have detailed summary tables are at minor fluvial flood risk from the following watercourses:
  - Bilston Brook (tributary of the River Tame) - E25, E23
  - Unnamed culverted tributary of the River Tame - H21
- **Surface Water:** surface water flood risk is widespread across Wolverhampton. Water predominantly flows into and along topographically low-lying areas, including Pendeford, Compton and the north of Bilston. Surface water is also channelled into watercourses such as the Smestow Brook, Waterhead Brook, Darlaston Brook, Graiseley Brook, Merryhill Brook, and the six canals within Wolverhampton. Most of the sites with a detailed Level 2 summary table are at

surface water flood risk. The degree of flood risk varies, with some sites being only marginally affected, and other sites being more significantly affected. The sites at most significant surface water risk are: GT1, E6, E7, E14 E17, E22, H17 and H21.

- **Access and Egress:** Several sites with detailed Level 2 summary tables have potential access and egress issues as a result of fluvial and surface water flooding on the surrounding roads. These sites are: E17, E22, E23, E6, E7, GT1, H1, H17, H21 and H23. The following sites also have access and egress issues but have not been carried forward to a Level 2 assessment due to a lack of flood risk at the site: 36780, 36810, E13, E16, E24, E3, E4, H11, H20, H24 (Lincoln Green), H6, E1 and E20. These sites have been flagged in this Level 2 report as having access and egress issues. Consideration should be made to these sites as to how safe access and egress can be provided during flood events, both to people and emergency vehicles. Also, consideration should be given to the nature of the risk, for example whether the flooding forms a flow path or bisects the site where access from one side to another may be compromised.
- **Effects of Climate Change:** fluvial and surface water climate change mapping indicates that flood extents are generally predicted to increase. As a result, the flood depths, velocities, and hazard of flooding may also increase. The significance of the increase tends to be dependent on the topography of the site and the climate change percentage allowance used.
    - Surface water: The 3.3% AEP +35% and the 1% AEP +40% climate change surface water events have been derived from the Risk of Flooding from Surface Water (RoFSW) dataset as an indication of the impact of climate change on surface water flood risk. The RoFSW 1% AEP plus 40% climate change surface water event is larger than the present day 1% AEP event, but is not as large as the present day 0.1% AEP event, showing Wolverhampton to be relatively sensitive to increases in surface water flooding due to climate change. The sites which are particularly sensitive include E1, H24 (Alamein Road), H21, E17, GT1, E6, E7, H1, H15, H17, H23, H7, H4, E14, E15, 32690, 36780, 36820.
    - Fluvial: Climate change allowances for the 1% AEP event has been derived from hydraulic modelling of the Smestow Brook and Waddens Brook. The models show the 1% AEP plus Central climate change allowances to be predominantly larger than the modelled present day 1% AEP fluvial events but smaller than the modelled present day 0.1% AEP fluvial events.
    - Sites that are the most sensitive to changes in surface water and fluvial flood risk due to climate change include: H1, H17, H21, H23, E6, E7, E17, and E14.
    - Site specific FRAs, site drainage and management plans should confirm the impact of climate change using the latest guidance. It is recommended that CWC work with other Risk Management Authorities (RMAs) to review the long-term sustainability of existing and new developments in these areas when developing climate change plans and strategies for Wolverhampton.

- **Historic Flooding:** historic data provided by CWC and Staffordshire County Council showed 69 instances of recorded flooding within the study area between 1990 and 2020. Details of whether the flooding was internal to the properties or affected only highways and curtilage was available for some records. The worst affected areas are Compton, Wood End and Fordhouses. However, none of these historic flood incidents have occurred within any of the sites.
- **Groundwater:** JBA groundwater emergence mapping indicates the majority of the eastern half and parts of the west of Wolverhampton are at negligible risk from groundwater emergence due to the nature of the local geological deposits. There are large sections in the north and west of Wolverhampton that are at moderate to high risk; there is a risk to subsurface assets in these areas, and surface manifestation of groundwater is likely. Emergence is likely on land between Dunstall Hill and the north of the Waterhead Brook, land in close proximity to the Smestow Brook in the west, and land surrounding the culverted sections of the Smestow Brook, Merryhill Brook and Graiseley Brook in the western half of the study area. The following sites are impacted by this risk: 42550000, 36780, E6, E7, E3, E4, GT1, H22, H24 (Lincoln Green), E1 and E2. Part of E21 is also at moderate groundwater emergence risk at Ettingshall in the south of the study area.
- **Canals:** There are six canals in the Wolverhampton study area which are the Birmingham Canal Navigations, Bradley Arm of the Birmingham Canal Navigations, Shropshire Union Canal, Staffordshire and Worcestershire Canal, Walsall Canal, and the Wyrley and Essington Canal. These have the potential to interact with other watercourses and become flow paths during flood events or in a breach scenario. The following sites are located in close proximity to canals within Wolverhampton:
    - E2 (Staffordshire and Worcestershire Canal)
    - H2, H3 and H5 (Wyrley and Essington Canal)
    - E6, E7, E8, 36810, 36800, 28840, 36820, 44030, 44640, 36830, E15, H11, E17, E18 and (Birmingham Canal Navigations)
    - H14, H15, E23, H16 and H17 (Bradley Arm of the Birmingham Canal Navigations)
    - E25 (Walsall Canal)
    - H4, 32650 and 32660 (Wyrley and Essington Canal and Birmingham Canal Navigations)
- **Reservoirs:** There is a potential risk of flooding in Wolverhampton that is posed by reservoirs located outside of this study area. The level and standard of inspection and maintenance required under the Reservoirs Act means that the risk of flooding from reservoirs is relatively low. However, there is a residual risk of a reservoir breach and this risk should be considered in any site-specific Flood Risk Assessments (where relevant). The following sites are at risk of reservoir flooding: E18, E20 and E21.

- **Culverted watercourses:** There is an extensive network of culverted tributaries of main rivers and Ordinary Watercourses across Wolverhampton. The LLFA holds some data on culverted watercourses, but given how extensive the network is, detailed records do not exist for every culvert. Culverted watercourses pose a residual risk of flooding should the culvert collapse or become blocked. Where possible, developers should seek to open up culverted sections of watercourse. The following sites contain, or are in close proximity to, culverted watercourses: E23, E25, E6, E7, GT1, H21 and H23.

7.3 Requirements for Developers

- Any sites located where there is a Main River (including culverted reaches of Main River) will require an easement of 8m either side of the watercourse from the top of the bank. Developers will be required to apply for appropriate permits so the activity being carried out over easements does not increase flood risk.
- At the planning application stage, developers may need to undertake more detailed hydrological and hydraulic assessments of the watercourses particularly where there are no detailed hydraulic models present. The modelling should verify flood extent with the latest climate change allowances. This may be the case for H21 which is located along the unnamed culverted tributary of the River Tame, and E23 and E25 which are located along the culverted Bilston Brook.
- Developers should wherever possible open up underground culverts, and in a manner which improves biodiversity, amenity and natural drainage in accordance with the current River Basin Management Plans for the area. Culverted watercourses are located within, or adjacent to, the following sites: E23, E20, E21, H21, H24 (Arnhem Road), E6 and E7.
- Where there is known or suspected culverted watercourse(s) either on or immediately downstream of a site, and where the Level 1 SFRA highlights that there may be a risk of flooding, developers should:
    - Confirm the location and presence of the watercourse (or otherwise) through ground-truthing strategic datasets and undertaking an assessment of the culvert extent and location
    - Confirm by survey, modelling and mapping the flood extents of the watercourse(s), as many of the flood outlines associated with such watercourses have been carried out at a broad scale and may not account specific local features, such as culverts, bridges and detailed topographical survey.
    - Design the development to accommodate the floodplain of the watercourse and mitigate against flooding to properties to the site. This should include a consideration of residual flood risk e.g. if a culvert were to block downstream.
- Developers should adhere to CWC's guidance on SuDS as laid out in Policy ENV 13 – Sustainable Drainage Systems (SuDS) and Surface Water Management:

- All developments must incorporate Sustainable Drainage Systems (SuDS) and provide for their adequate adoption, ongoing maintenance, and management over the lifetime of the development, in accordance with any surface water drainage strategy required for the development under Policy ENV12.
- SuDS must be designed in accordance with Local Lead Flood Authority and Severn Trent Water standards, as follows:
    - demonstrate application of the surface water discharge hierarchy: Re-Use (Water Harvesting); Infiltration; Discharge to a watercourse; Discharge to a surface water sewer; Discharge to a combined sewer;
    - manage surface run-off as close to the source as possible to reduce flood risk and improve water quality;
    - include mitigation within storage calculations for future climate change, designed to 100yr + Climate Change (currently 40%);
    - designed to accord with the Environment Agency's Guidance on Flood Risk and Coastal Change, Construction Industry Research and Information Association (CIRIA) guidance, and Department for Environment Food & Rural Affairs (DEFRA) non-statutory technical standards;
    - designed to be daylight (open), natural and contribute to the conservation and enhancement of biodiversity and green infrastructure in the wider area, as far as is practical and viable.
- For all major developments, surface water flows must be reduced back to equivalent greenfield rates wherever practical. If greenfield runoff rates are not considered to be feasible for viability or other reasons, then the developer must submit evidence demonstrating what the constraints to achieving this are and how their development will accommodate runoff rates that are as close as reasonably possible to greenfield rates.
- For all minor developments, a minimum reduction of 30% over pre-development run-off rates will be required. Under no circumstances will post-development runoff rates that are greater than pre-development run-off rates be permitted.

- CWC expects SuDS to be incorporated on minor development as well as major development and, if possible, development in areas at material risk of flooding should be avoided. Masterplans should be designed to ensure that space is made for above ground SuDS features and that the requirements of existing surface water flow paths and storage volumes are appropriately accommodated. Underground tanks should only be used on sites as a last resort.
- For sites allocated within the Local Plan, the Local Planning Authority should use the information in this SFRA to inform the Exception Test.
- For developments that have not been allocated in the Local Plan, developers must undertake the Sequential Test followed by the Exception Test (if required)

and present this information to the Local Planning Authority for approval. The Exception Test should be applied where there is development which is classed as;

- More vulnerable in Flood Zone 3a
- Highly vulnerable in Flood Zone 2 (this is NOT permitted in Flood Zone 3a)
- Essential infrastructure in Flood Zone 3a or 3b
- Any development with significant* risk in the surface water 1% AEP event plus 40% climate change allowance flood extent.

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.

It is recommended that as part of the early discussions relating to development proposals, developers discuss requirements relating to site-specific FRA and drainage strategies with both the Local Planning Authority and the Lead Local Flood Authority (LLFA), to identify any potential issues that may arise from the development proposals.

7.4 Planning Policy Recommendations

The planning policy recommendations in Section 10 of the Level 1 SFRA still stand for the site allocations and any windfall development that come forward. Recommendations in the Level 2 SFRA are as follows:

- Combine infiltration (e.g. permeable surfaces) and attenuation (e.g. balancing ponds and flood storage reservoirs) SuDS techniques to overcome constraints to the area of a site set aside for infiltration systems caused by development pressures.
- Where appropriate, opportunities for betterment should be sought where surface water flooding issues are present, which could be implemented through Supplementary Planning documents for individual settlements.
- Encourage the use of permeable surfacing in gardens and use measures to optimise drainage and reduce runoff.
- Consider opportunities for water conservation through rainwater harvesting and water butts where appropriate for new and existing development.
- Promote land management practices where appropriate to attenuate runoff and alleviate potential issues downstream.
- Any sites that fall within Critical Drainage Areas should employ the retrofitting of SuDS and seek opportunities to improve the drainage system at the site or within the vicinity of the site.
- In line with CWC's guidance as laid out in Policy ENV13, SuDS should be designed to be daylight (open), natural and contribute to the conservation and enhancement of biodiversity and green infrastructure in the wider area, as far as is practical and viable.
- For all major developments, surface water flows must be reduced back to equivalent greenfield rates. If greenfield runoff rates are not considered to be feasible for viability or other reasons, then the developer must submit evidence

demonstrating what the constraints to achieving this are and how their development will accommodate runoff rates that are as close as reasonably possible to greenfield rates.

- For all minor developments, a minimum reduction of 30% over pre-development run-off rates will be required. Under no circumstances will post-development runoff rates that are greater than pre-development run-off rates be permitted.

7.4.1 Adapting to Climate Change

The PPG Climate Change guidance contains information and guidance for how to identify suitable mitigation and adaptation measures 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 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.
- 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.
- 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. Locating development in such areas of risk may not be a sustainable long-term option.

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.

7.5 Guidance for Windfall Sites and Sites Not Assessed in the L2 SFRA

- For sites not covered by the Environment Agency's Flood Zones, or where Flood Zones do exist, but no detailed hydraulic modelling is present, it is recommended that developers construct detailed hydraulic models at these sites as part of a site-specific FRA using channel, structure, and topographic survey, to confirm flood risk. Site-specific flood modelling will be required in locations where it is necessary to understand the effects of proposed development schemes on the existing flood flow paths and flood volume storage.
- If a site's extents either include or border a Main River (including a culverted reach of Main River), an easement of 8m is required from either bank for access and maintenance. Any future development will require a flood risk permit from any activity within 8m of a Main River.
- If an ordinary watercourse is within or immediately adjacent to the site area, consultation with the Lead Local Flood Authority should be undertaken. If alterations or discharges are proposed to the watercourse, a land drainage consent will be required.
- Where necessary, blockages of nearby culverts may need to be simulated in a hydraulic model to confirm residual risk to the site.
- Surface water risk should be considered in terms of the proportion of the site at risk in the 3.3% AEP (30-year), 1% AEP (100-year) or 0.1% AEP (1,000-year) events, whether the risk is due to isolated minor ponding or deeper pooling of water, or whether the risk is due to a wider overland flow route.
- Surface water risk and mitigation should be considered as part of a detailed site-specific Flood Risk Assessment and Surface Water Drainage Strategy.
- Access and egress should be considered at the site, but also in the vicinity of the site, for example, a site may have low surface water risk, but in the immediate locality, access/ egress to and from the site could be restricted for vehicles and/ or people.
- Sites where there is a canal within or immediately adjacent to the site area, developers should consult the Canals and Rivers Trust. Any proposed alterations to the canal or discharges must be agreed with the Canals and Rivers Trust.
- If a site is located within 250m of a landfill site, there could be dirt and contamination issues. Sites could be sensitive from the perspective of controlled waters and therefore any redevelopment must ensure there is no pollution risk to the water environment.

7.6 Use of SFRA Data and Future Updates

It is important to recognise that the SFRA has been developed using the best available information at the time of preparation. This relates both to the current risk of flooding from rivers, and the potential impacts of future climate change.

The SFRA should be a 'living document', and as a result should be updated when new information on flood risk, flood warning or new planning guidance or legislation becomes

available. New information on flood risk may be provided by CWC, Staffordshire County Council, the Highways Authority, Severn Trent Water, and the Environment Agency. Such information may be in the form of:

- New hydraulic modelling results
- Flood event information following a future flood event
- Policy/legislation updates
- Environment Agency flood map updates
- New flood defence or alleviation schemes.

The Environment Agency regularly reviews their flood risk mapping, and it is important that they are approached to determine whether updated (more accurate) information is available prior to commencing a detailed Flood Risk Assessment. It is recommended that the SFRA is reviewed when there are significant updates to the Environment Agency's Flood Zone mapping. This will ensure the latest data is still represented in the SFRA, allowing a cycle of review and a review of any updated data by checking with the above bodies for any new information.

The Environment Agency will prepare an updated and improved Flood Map for Planning in the course of updating the National Flood Risk Assessment 2 (NaFRA2). It is anticipated that this data will be available in 2025. Although there will be no new updates to this mapping before this date, should any new information become available for localised areas, the EA will notify CWC and an updated PDF map of the Flood Zones will be made available upon request. It is not anticipated that the updated mapping will fundamentally change the locations identified to be at risk from fluvial flooding, but the improved analysis techniques will reduce some of the uncertainties associated with the assessment.

At the time of writing this Level 2 SFRA, the Government is consulting on a revised NPPF; however, this consultation document does not propose significant changes to the flooding considerations covered in the 2023 NPPF. Despite this, it is likely there will be changes to NPPF policy in 2025.

7.6.1 Neighbourhood Plans

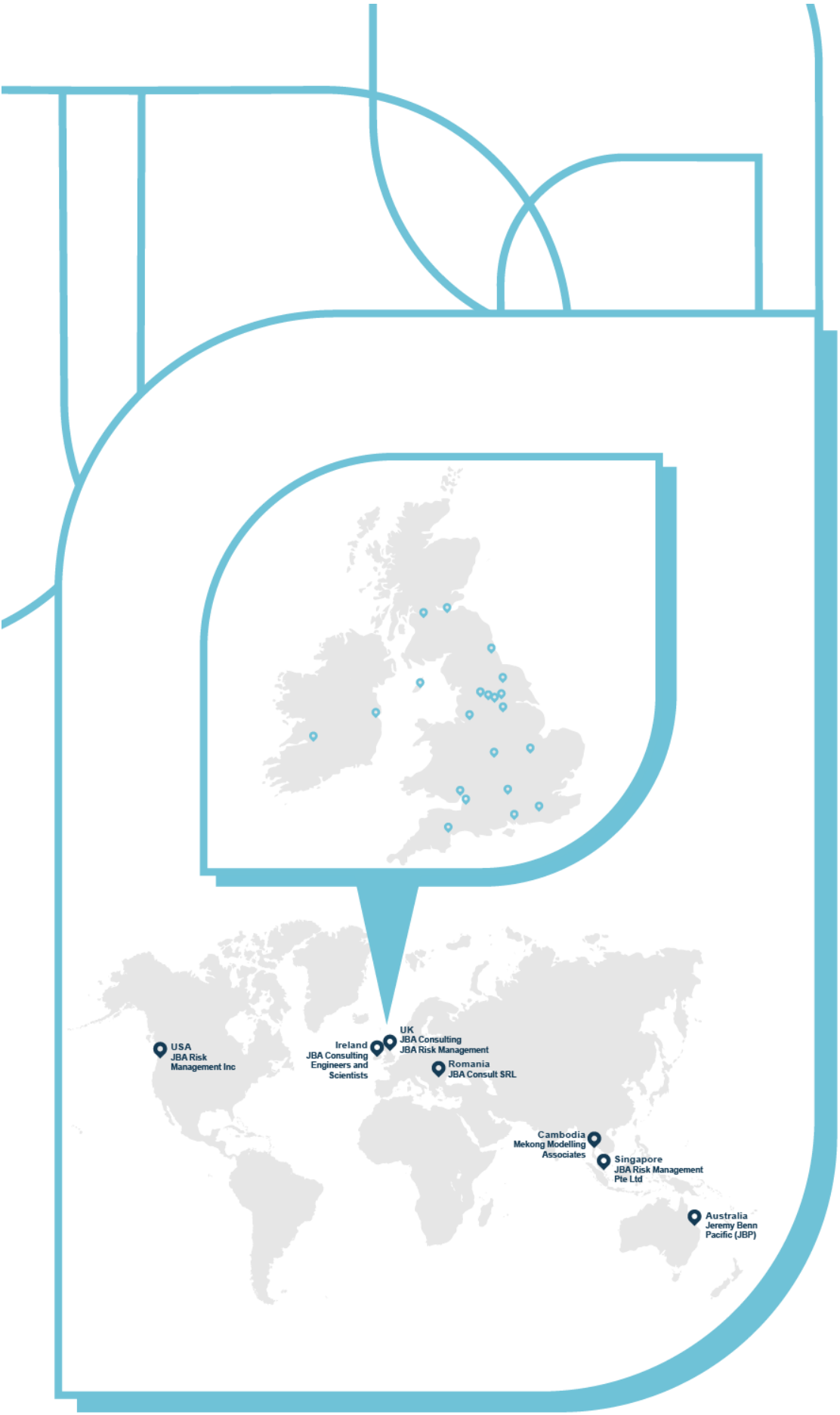
Flood risk should be fully addressed in the plan preparations and in bring forward policies for the allocation of land and therefore the SFRA findings should be used in production of Neighbourhood Plans.

Neighbourhood planners can use the information in the Level 1 and Level 2 SFRAs on the sources of flood risk across Wolverhampton and the flood risk mapping, to assess the risk of flooding to sites within their community. The SFRA will also be helpful for developing community level flood risk policies in high flood risk areas.

The Level 1 Wolverhampton SFRA highlights on a broad scale where flood risk from fluvial, surface water, groundwater, and the effects of climate change are most likely. The 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 the broadscale mapping.

A Site Summary Tables and Static Mapping

B Red Amber Green Site Screening Summary



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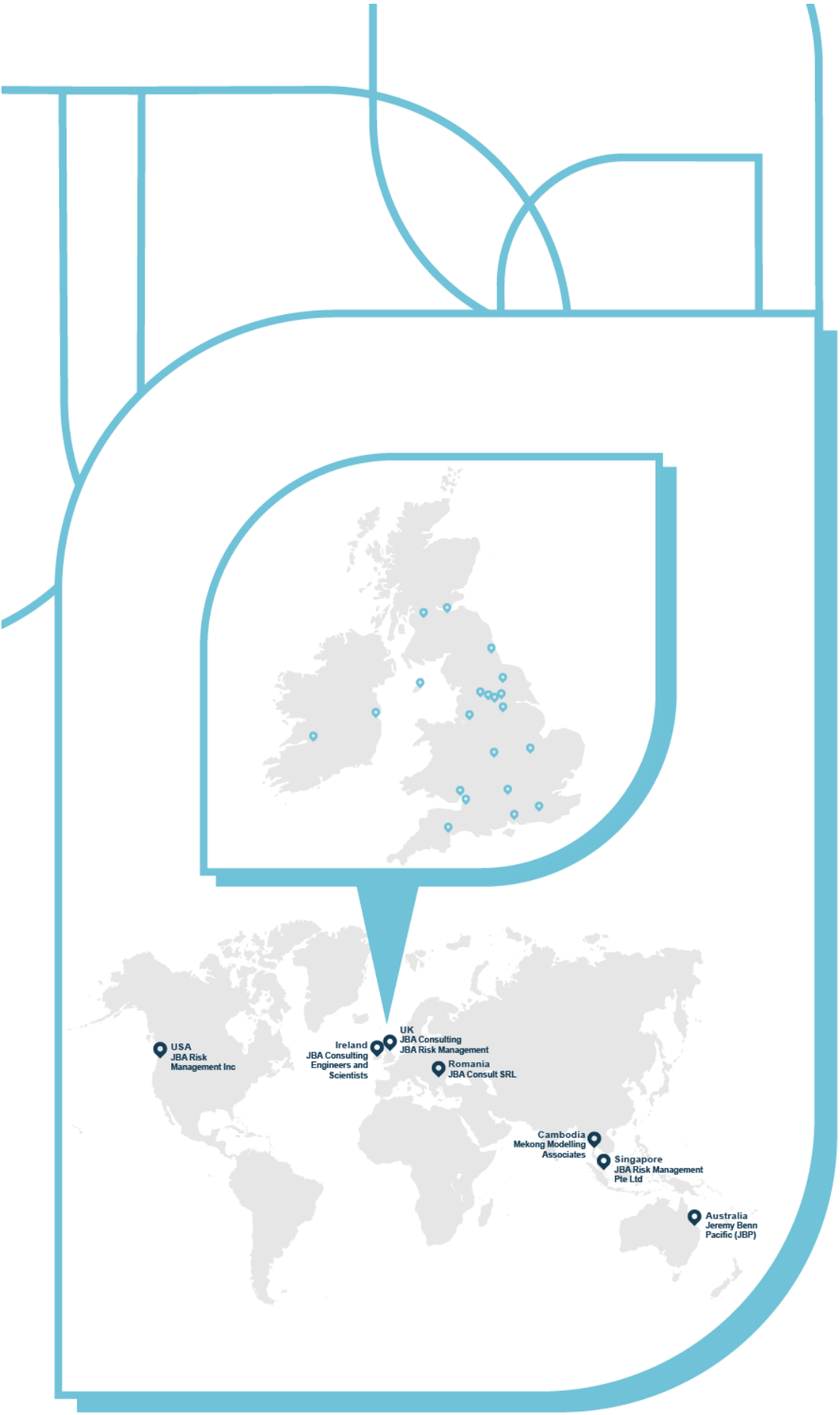

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