Level 1 Strategic Flood Risk Assessment

Swindon Borough Council

Project Ref: 332610578 | Rev: B | Date: July 2025

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Glossary

Term	Definition
DCLG	Department of Community and Local Government
Defra	Department of Environment, Food and Rural Affairs
Development Plan Document (DPD)	A spatial planning document within the Council's Local Development Framework, which set out policies for development and the use of land. Together with the Regional Spatial Strategy, they form the development plan for the area. They are subject to independent examination.
Environment Agency (EA)	A non-departmental public body, established in 1995 and with responsibilities relating to the protection and enhancement of the environment in England
Environmental Permitting Regulations (EPR)	Framework for the regulation of "flood risk activities, which in 2016 replaced the 'flood defence consent' process.
Flood Zone Map ('Flood Map for Planning')	Nationally consistent delineation of areas at *'high', 'medium'* and *'low'* probability of flooding from fluvial (river) or tidal sources, published on a quarterly basis by the Environment Agency.
Formal Flood Defence	A structure built and maintained specifically for flood defence purposes
Informal Flood Defence	A structure that provides a flood defence function, however, has not been built and/or maintained for this purpose (e.g. boundary wall)
Lead Local Flood Authority (LLFA)	Body responsible at a local level for managing local flood risk from surface water, ground water and ordinary watercourses, as defined in the Flood & Water Management Act 2010.
Light Detection and Ranging (LiDAR)	A surveying method that measures distance to a target by illuminating that target with a laser, thus providing an assessment of ground topography (typically accurate to within 100-200mm)
Local Development Framework (LDF)	Consists of a number of documents which together form the spatial strategy for development and the use of land
National Planning Policy Framework (NPPF)	The National Planning Policy Framework is the overarching UK planning policy document. It replaces over two dozen previously issued Planning Policy Statements (PPS) and Planning Policy Guidance Notes (PPG) for use in England. NPPF Section 10 'Meeting the challenge of climate change, flooding and coastal change' sets out the specific requirements relating to flood risk.
Planning Policy Statement (PPS)	A series of statements issues by the Government, setting out policy guidance on different aspects of planning. They replace Planning Policy Guidance Notes
Planning Practice Guidance (PPG)	The Planning Practice Guidance is a web-based resource launched by DCLG which brings together planning practice guidance for England, providing supplementary guidance on the application of the NPPF
Preliminary Flood Risk Assessment (PFRA)	A high-level summary of significant flood risk required by LLFAs under the Flood Risk Regulations (2009), based on available information and describing both the probability and consequences of past and future flooding
Residual Risk	A measure of the outstanding flood risks and uncertainties that have not been explicitly quantified and/or accounted for as part of the review process

Standard Head Water Level (SHWL)	Minimum upstream water level retained within a navigable river/canal system by a lock/weir structure
Strategic Housing Market Assessment (SHMA)	An assessment to identify the scale and mix of housing and the range of tenures that the local population is likely to need over the plan period, allowing for projections in population, demand and other variables.
SuDS	Sustainable Drainage Systems
Supplementary Planning Document (SPD)	Provides supplementary guidance to policies and proposals contained within Development Plan Documents. They do not form part of the development plan, nor are they subject to independent examination.
Surface Water Management Plan (SWMP)	A plan which outlines the preferred surface water management strategy in a given location. In this context surface water flooding describes flooding from sewers, drains, groundwater, and runoff from land, small watercourses and ditches.
Sustainability Appraisal (SA)	Appraisal of plans, strategies and proposals to test them against broad sustainability objectives.
Sustainable Development	Development that meets the needs of the present without compromising the ability of future generations to meet their own needs (The World Commission on Environment and Development, 1987).

Executive Summary

Stantec has been commissioned by Swindon Borough Council to undertake a Level 1 Strategic Flood Risk Assessment (SFRA) to replace the previous Level 1 SFRA published in May 2019.

This SFRA has been developed to assist the Council in its selection and development of sites, and to provide a tool to undertake the Sequential Test and steer development away from vulnerable flood risk areas in accordance with the National Planning Policy Framework (NPPF) and its associated Planning Practice Guidance in relation to flood risk.

Planning applications will be assessed using this SFRA, and the flood risk mapping produced for this SFRA will be available for developers to use in order to assist in their carrying out of site specific Flood Risk Assessments (FRAs).

Level 1 SFRA key objectives:

1. To account for the latest flood risk policy and emerging guidance
2. To take into account the latest flood risk information using the available data
3. To provide a comprehensive set of flood risk maps, including:
    - Flood Zone Map (Flood Map for Planning)
    - Risk of Flooding from Surface Water (RoFSW) Map
    - Susceptibility to Ground Water Flooding Map
    - Reservoir Flood Map
    - Modelled Flood Extents Present Day
    - Modelled Flood Extents Climate Change
    - Functional Floodplain
    - EA Historic Flood Map
    - Key Infrastructure overlaid onto Flood Zones
    - Thames Water DG5 Sewer Flooding Records
4. To consider the impacts that climate change will have on flood risk in the future.

The Council has provided a list of sites to screen for flood risk impacts as part of the SFRA, in order to assist the Local Planning Authority (LPA) in its decision making process for sites to take forward as part of the new Local Plan.

Summary of Level 1 SFRA

All sources of flood risk have been considered throughout this SFRA, including fluvial, surface water, groundwater, sewer, canals and reservoirs within the Swindon Borough administrative boundary.

Due to the proximity of the River Ray, River Cole and River Thames to Swindon Borough, fluvial flood risk is present across the Borough. The provision of the ‘Recorded Flood Outlines’ by the EA indicates that flood events have impacted the Borough throughout history.

The risk of surface water flooding is heightened in some areas of the Borough due to the outward urban growth which has resulted in the culverting of some watercourses. Trash screens and culverts have the potential to become blocked by plant debris and rubbish, restricting the natural flow of water and subsequently increasing the risk of water exceeding its banks. This may apply to some sections of the Haydon Wick Brook which is, in effect, a culverted water course.

Swindon lies on the boundary of the River Thames river basin to the north and South Downs Chalk to the south. Chalk geology is typically susceptible to groundwater flooding, however as this only impacts a small southern area of the Borough, the risk is typically considered to be low.

The EA hydraulic models have been rerun, where applicable, to generate flood extents allowing for potential climate change impacts and to ensure the availability of the most up to date flood extents. The SFRA is intended as a living document, and should be regularly reviewed to ensure compliance with, and reference to, emerging new policies and new flood risk information, particularly as future EA modelling – including ongoing work to remodel the River Cole – can affect future development planning decisions within the Borough.

The flood risk screening exercise has provided an overview of flood risk to the list of sites submitted for consideration. These should be considered further were appropriate, including through a Level 2 SFRA assessment for any key areas of development where a more rigorous site-level analysis is required to consider the feasibility for future development.

1 Introduction

1.1 Borough Setting

1.1.1 Swindon Borough Council (SBC) is a unitary authority of the Borough of Swindon and is located within the north-western part of the county of Wiltshire, south-west England.

1.1.2 Swindon town is located centrally within the Borough, with smaller settlements around Swindon including Highworth and Blunsdon to the north, South Marston, Bishopstone and Wanborough to the east, and Wroughton and Chiseldon to the south.

1.1.3 The topography of the area is sharply divided between the upland area over the southern part of the Borough, associated with the underlying chalk geology along the fringes of the North Wessex Downs, and the lower lying part of the central and northern parts of the Borough which lies over clay.

1.1.4 Areas of the Borough are potentially at risk of fluvial flooding, as well as from other sources such as surface water, sewers and groundwater. The Borough is not at risk from tidal sources. Fluvial flood risk across the Borough can be characterised as having three main sources:

- The **River Thames** flows along the northern boundary of the site, between Cricklade and Lechlade, and a number of local tributaries, including the Share Ditch and the Bydemill Brook, flow north across the rural northern part of the Borough into the main Thames channel;
- The **River Ray**, a tributary of the Thames serving a mainly urban catchment, flows north along the western side of the Borough, fed by tributaries including the Lydiard Brook and the Haydon Wick Brook;
- The **River Cole**, also a Thames tributary, flows north around the eastern side of the Borough and is fed by tributaries including the Lenta Brook and the South Marston Brook.

1.1.5 It is important to recognise that some of the areas that are at risk of flooding in the Borough are under pressure from future development.

1.1.6 The character of Swindon has changed over many years, but it has been known as a 'growth town' and more recently has seen its growth take the form of a number of new urban extensions and settlements. The current adopted Local Plan 2026 included a strong focus upon strategic sites for housing delivery, which has included:

• **Tadpole Garden Village** - circa 1,650 homes (largely built out)

• **Commonhead / Badbury Park** – circa 1,200 homes (largely built out)

• **Wichelstowe** – up to 4,500 homes (delivery commenced)

• **Kingsdown** – circa 1,650 homes (at outline planning application stage)

• **New Eastern Villages** – circa 8,000 homes (various stages of planning and post-approval)

1.1.9 The new Local Plan looks to build upon this through the effective delivery of the New Eastern Villages, Wichelstowe and Kingsdown, however it also seeks to rebalance growth with further development weighting towards the regeneration of the town centre, linking new urban sites that are sustainably located to connect to active travel and public transport, and maximising the opportunities within existing brownfield sites. It is, however, essential that the Council are in a

position to take informed decisions, providing a careful balance between the risk of flooding and other unrelated planning constraints that may place pressure upon 'at risk' areas.

1.1.10 The Strategic Flood Risk Assessment (SFRA) endeavours to provide specific advice to assist the Council in this regard.

1.2 SFRA Scope and Structure

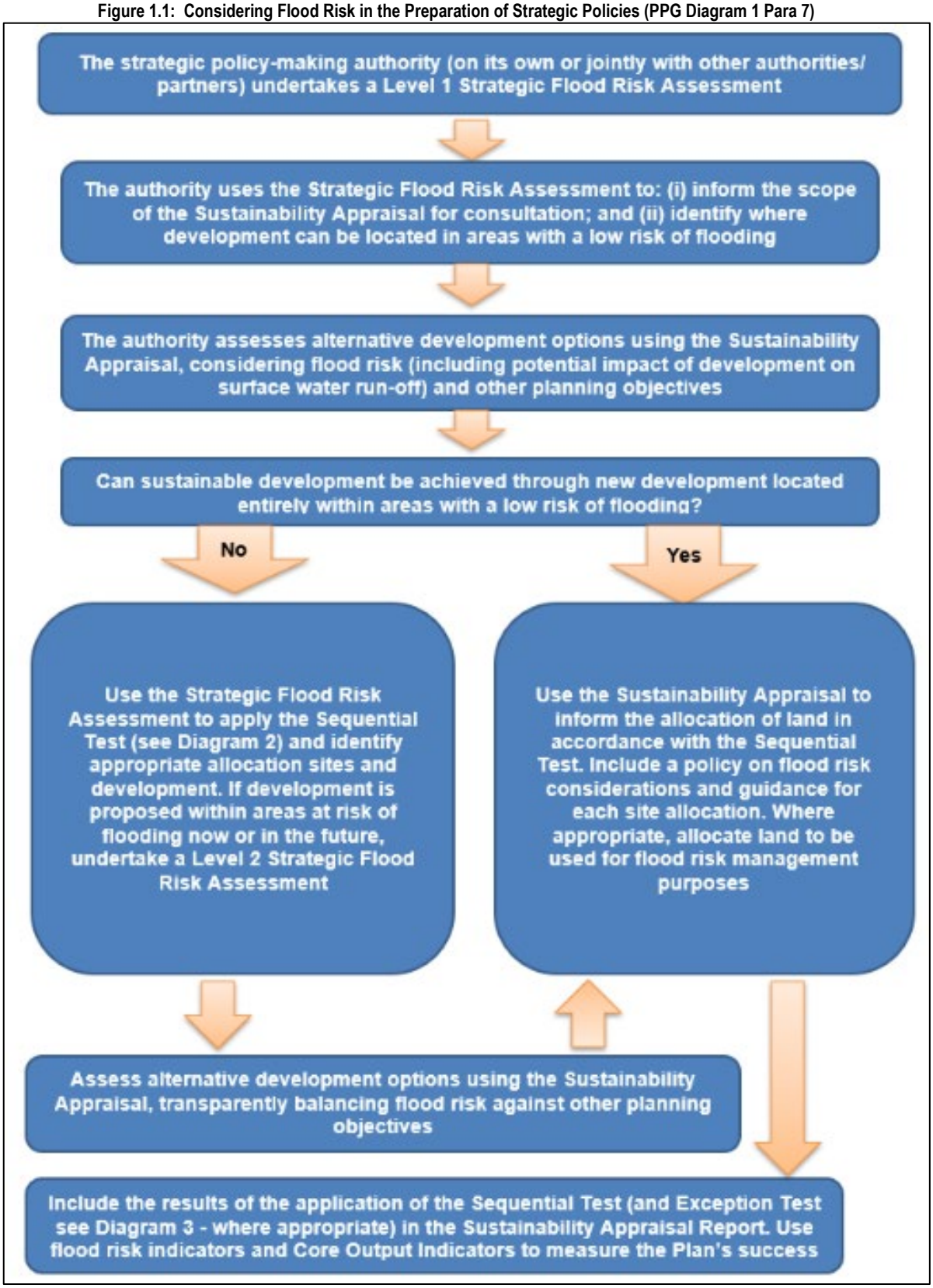
1.2.1 This Level 1 SFRA replaces the previous Level 1 report undertaken in 2019 and should be used by the Council to inform planning decisions and the application of the Sequential Test. Since the publication of the original SFRA in 2019 there have been changes in the national and local planning policy and associated guidance, combined with improvements in the understanding of flood risk within the Borough, building on the ongoing research in flood risk management. The SFRA has been prepared based on the Government's requirements set out online at the following:

https://www.gov.uk/guidance/local-planning-authorities-strategic-flood-risk-assessment

1.2.2 The report updates the previous assessment using the latest flood risk information to inform the evidence base for the new Local Plan. Following the application of the Sequential Test, the Council may consider it necessary to develop a Level 2 SFRA for areas where proposed site allocations fall within a flood affected area of the Borough. The Level 2 SFRA should consider the risk of flooding in greater detail within a local context to ensure that the site can be developed in a safe and sustainable manner.

1.2.3 The flow chart in **Figure 1.1** summarises the approach for consideration of flood risk within strategic policy making, the relationship with the Sustainability Appraisal and the relevance of the sequential testing process.

Figure 1.1: Considering Flood Risk in the Preparation of Strategic Policies (PPG Diagram 1 Para 7)



1.2.4 As there are continual developments in flood risk management guidance and policy a periodic review of the SFRA is imperative to ensure the information and recommendations remain valid. It is recommended that the SFRA is reviewed on a regular (annual) basis.

1.2.5 The structure of the SFRA is set out as follows:

- **Sections 1-3** – Overview of study area geographical setting and approach of SFRA;
- **Sections 4-5** – Planning policy context (national and local);
- **Sections 6-9** – Overview of flood risk issues across Borough, including potential sources of flooding, location and standard of flood defences, and summary of available flooding information;
- **Sections 10-14** – Implications of flood risk on new development, including planning considerations and mitigation requirements.

1.3 Stakeholders and Risk Management Authorities

1.3.1 There are several organisations involved in development and flood risk management across the Swindon area. They are referred to as Risk Management Authorities (RMAs), where they co-operate with each other in the interests of flood risk management and may share information for this purpose whilst aiming to contribute towards the achievement of sustainable development; see **Table 1.1**.

Table 1.1: Risk Management Authorities in Swindon and Responsibilities

Risk Management Authority	Responsibilities
Local Planning Authority **(Swindon Borough Council)**	• Responsible for facilitating the incorporation of SuDS in all major development to manage surface water runoff. • Responsible for ensuring that clear maintenance and management arrangements are in place for the lifetime of the development.
Highways Authority **(Swindon Borough Council)**	• Responsible for maintaining and managing drainage of non-trunk roads.
Lead Local Flood Authority **(Swindon Borough Council)**	• Preparation of Local Flood Risk Management Strategy. • Investigating and reporting flood incidents. • Designating and registering structures and features that affect flood risk. • Permissive powers to manage flood risk from surface water, 'ordinary watercourses' outside of IDB areas, and groundwater, including issuing consents for works. • Enforcement powers to require landowners to take action to minimise flood risk to others.
Environment Agency	• Strategic overview of all types of flooding and water management issues. • Permissive powers to manage watercourses designated "Main River", including issuing consents for works. • Declaring and communicating Flood Warnings. • Enforcement authority for all reservoirs that fall under the Reservoirs Act (1975), and statutory undertaker for its own reservoirs. • Enforcement powers to require landowners to take action to minimise flood risk to others. • Review risks, flood management strategies and asset schemes.
Thames Water Utilities Limited	• Responsible for the management, maintenance and operation of flood control structures. • Statutory duty to prove wastewater services and potable water to Swindon Borough.
Highways England	• Responsible in managing the effectual drainage of surface water from motorways and major A roads as well as maintaining drainage systems.

1.4 Outputs of the SFRA

1.4.1 The outputs of this SFRA to inform the planning process include the following::

- Delineation of Flood Zones across the Borough, based on the currently available EA modelling/mapping
- Identification of historic flooding information and potential localised flooding issues to highlight 'at risk' areas;
- Identification of measures proposed or underway within the Borough to address flooding issues;
- Specify measures for incorporation in new development, to ensure development in the Borough is safe, sustainable and does not detrimentally impact on flood risk to third parties (ideally providing a reduction in flood risk).

1.5 A Proactive Approach – Reduction in Flood Risk

1.5.1 It is crucial to recognise that the NPPF considers not only the risk of flooding posed to new development, but that it also seeks to positively reduce the risk of flooding posed to existing properties within the Borough. It is strongly recommended that this principle be adopted as the underlying 'goal' for developers and Council development management teams within Swindon Borough.

1.5.2 Developers are encouraged to demonstrate that their proposal will deliver a positive reduction in flood risk to the Borough, whether that be by reducing the frequency or severity of flooding (for example, through the introduction of SuDS), or by reducing the impact that flooding may have on the community (for example, through a reduction in the number of people within the site that may be at risk).

1.6 Disclaimer

1.6.1 It is important to recognise that the information provided within this SFRA is the best available data at time of issue of the report. The mapping of flood risk is not an exact science, and the risk to a specific area can change over time as greater knowledge on localised flooding is obtained.

1.6.2 The SFRA is a strategic-level document intended to support and inform the spatial planning process and it will trigger the requirement for more detailed site-specific Flood Risk Assessments to accompany applications for new development; it is anticipated that such reports will further refine and improve the assessment of flood risk at a localised level with the most up-to-date information at the time.

2 Study Area

2.1 Geographical Location

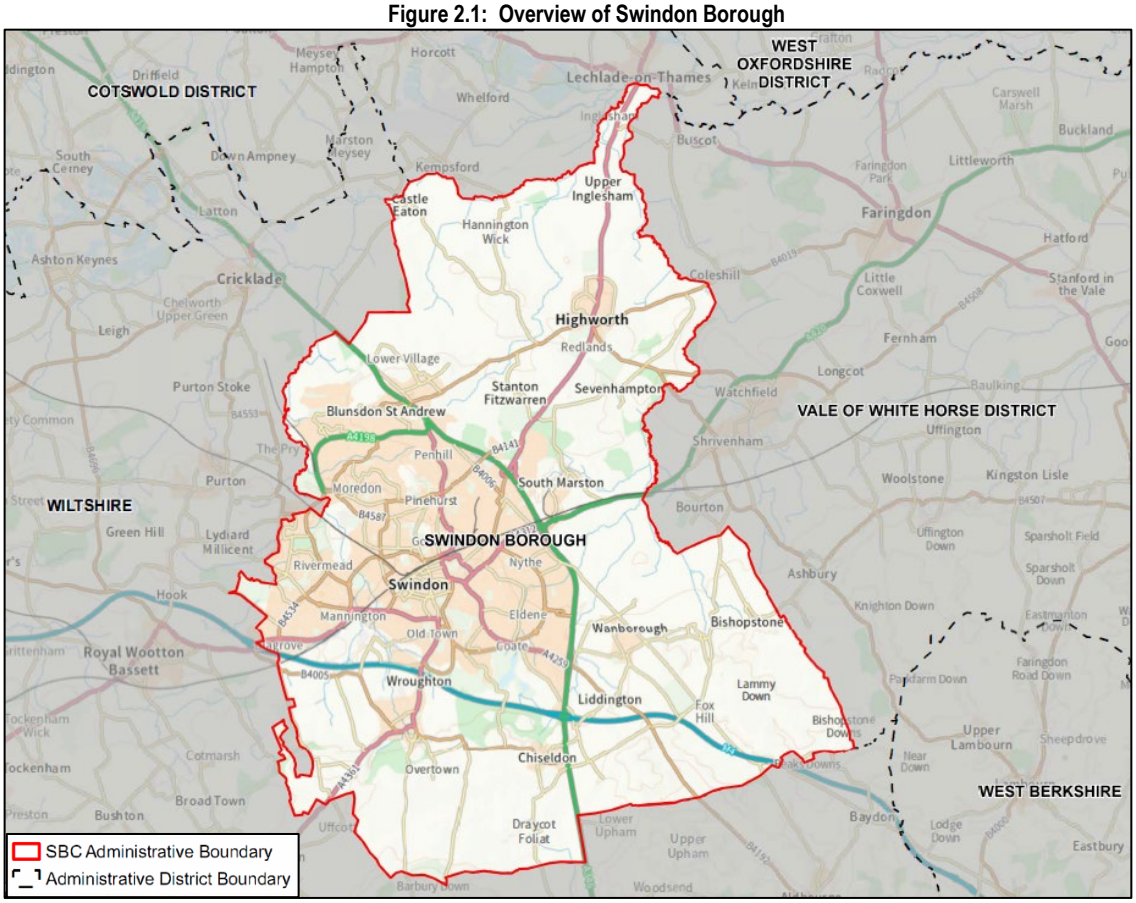
Appendix A Figure 001 – Study Area and Administrative Boundaries

Appendix A Figure 002 – Study Area and Administrative Boundaries (Aerial)

2.1.1 The unitary authority SBC covers an administrative area of 230km^2, centred on the town of Swindon in north-west Wiltshire – see **Figure 2.1**. As a unitary authority, SBC provides all local government services within the area and therefore is both the Local Planning Authority (LPA) and the Lead Local Flood Authority (LLFA) (elsewhere within Wiltshire the role of LLFA is held by Wiltshire County Council (WCC)).

2.1.2 SBC is bordered by the Vale of White Horse District to the east, Cotswold District to the north, West Berkshire to the south-east and Wiltshire to the west and south, with the North Wessex Downs National Landscape extending south across Wiltshire from the southern SBC boundary.

Figure 2.1: Overview of Swindon Borough



2.1.3 Swindon town (population approximately 230,000) is located centrally within the Borough, with smaller settlements across the Borough including the market town of Highworth and village of Blunsdon to the north, the villages of South Marston, Bishopstone and Wanborough to the east, and Wroughton and Chiseldon to the south. These smaller settlements remain largely residential in character and land use and rely on larger settlements nearby for employment and local services.

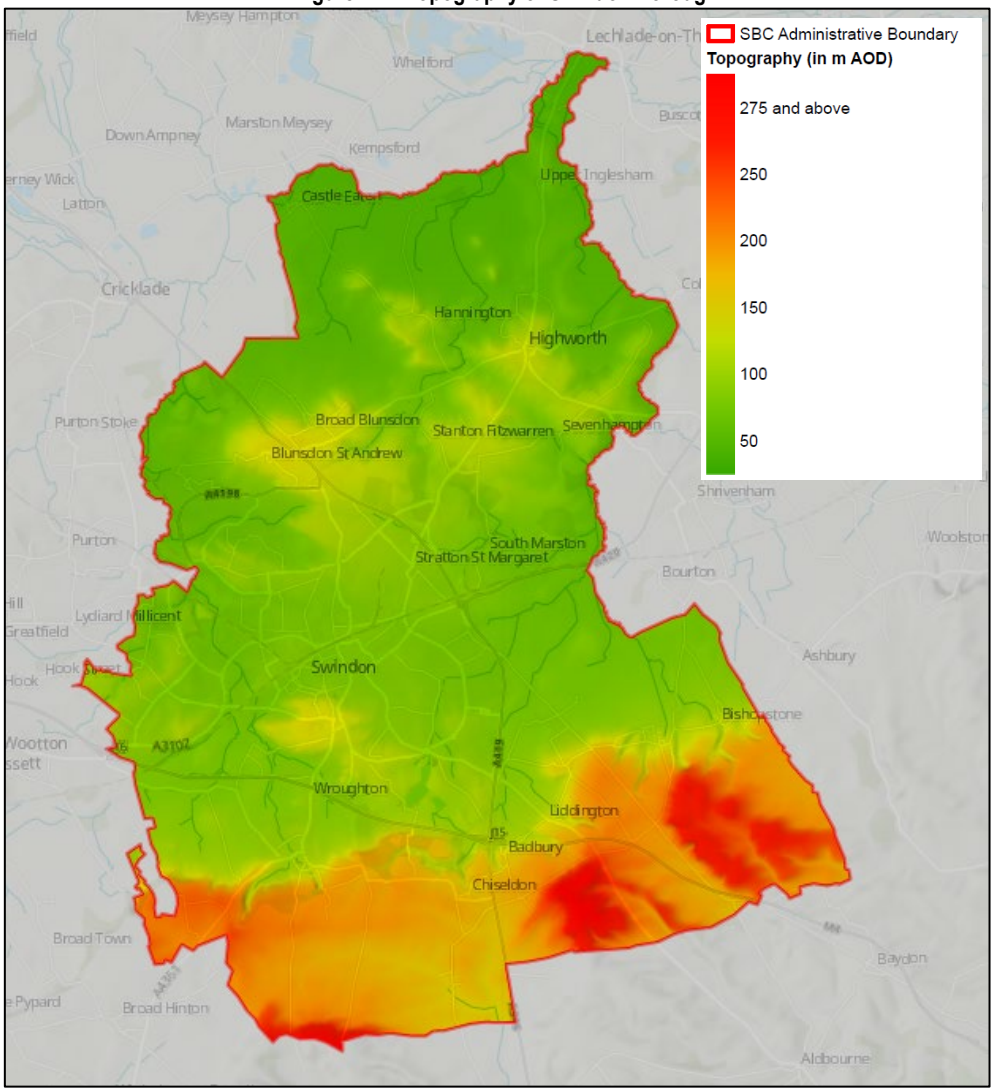
2.1.4 The M4 Motorway runs east-west across the southern part of the Borough. The A419 Marlborough Road runs north from the M4 Junction 15 around the eastern and northern flank of Swindon town and running north-west out of the Borough (as the Blunsdon Bypass) towards Cricklade, while the A420 runs north-east from the A419 towards Faringdon.

2.2 Topography

Appendix A Figure 003 – Topography (LiDAR)

2.2.1 **Figure 003** in **Appendix A** provides an overview of the topography across the Borough, based on 'Light Detection and Ranging' (LiDAR) remote sensed survey data – see extract in **Figure 2.2**.

Figure 2.2: Topography of Swindon Borough



2.2.2 The map illustrates a general fall across the area from south to north, and a sharp divide in topography between the upland area over the southern part of the Borough, associated with the underlying chalk geology along the fringes of the North Wessex Downs, and the lower lying part of the central and northern parts of the Borough which lies over clay.

2.2.3 LiDAR data indicates the lowest ground levels are in the north of the Borough along the River Thames corridor north of Hannington and Highworth, where the typical ground level is between 60.0m AOD-70.0m AOD. The main north and central area of the Borough is broadly consistent

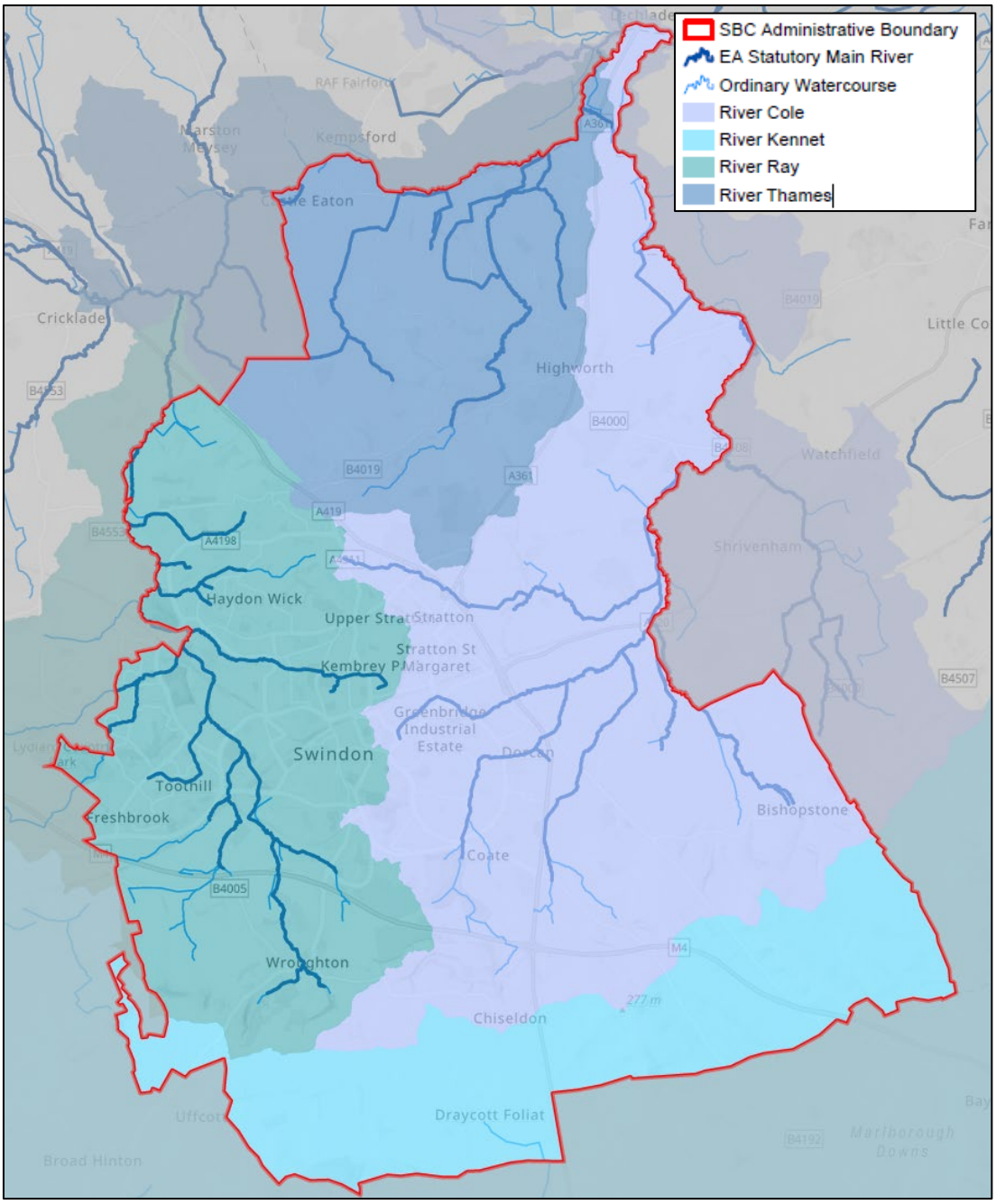
with this low-lying topography, with levels across this area in the range of 100m AOD to 150m AOD. This contrasts with the southern portion of the Borough, with the area south of Wroughton across (east) to Bishopstone rising steeply up to over 250m AOD as the geology transitions from the low-lying clay of the Thames Valley into the chalk uplands of the North Wessex Downs to the south of the Borough.

2.3 Watercourses and Catchments

Appendix A Figure 004 – River Catchments and Management Areas

2.3.1 Fluvial flood risk across the Borough can be characterised as three main sources – the catchments for which have been identified in **Figure 2.3**:

Figure 2.3: River Catchments within Swindon Borough



- The **River Thames** flows along the northern boundary of the Borough, between Cricklade and Lechlade, and a number of local tributaries, including the Share Ditch and the Bydemill Brook, flow north across the rural northern part of the Borough into the main Thames channel;

- The **River Ray**, a tributary of the Thames serving a mainly urban catchment, flows north along the western side of the Borough, rising at Wroughton and fed by tributaries including the Lydiard Brook and the Haydon Wick Brook;

- The **River Cole**, also a Thames tributary, flows north around the eastern side of the Borough and is fed by tributaries including the Lenta Brook and the South Marston Brook.

2.3.2 There is a section across the southern part of the Borough that is identified within the River Kennet catchment; this area feeds ordinary watercourses (the Og, Aldbourne and Lambourn) which drain south towards the Kennet at Marlborough, or further east.

2.3.3 The individual catchments are considered in greater detail within **Section 6.2**.

2.3.4 There are many other smaller watercourses, drains and ditches across the Borough – designated as 'Ordinary Watercourses' - and the regulatory control of these features primarily lies with SBC as the LLFA.

2.4 Geology

Appendix B Figure 005 – Bedrock Geology

Appendix B Figure 006 – Superficial Geology

Appendix B Figure 007 – Groundwater Source Protection Zones (SPZs)

2.4.1 An overview of the geology across the Borough has been obtained from the publicly available data from the British Geological Survey (BGS). This provides an overview of the Bedrock geology and presence of Superficial Deposits.

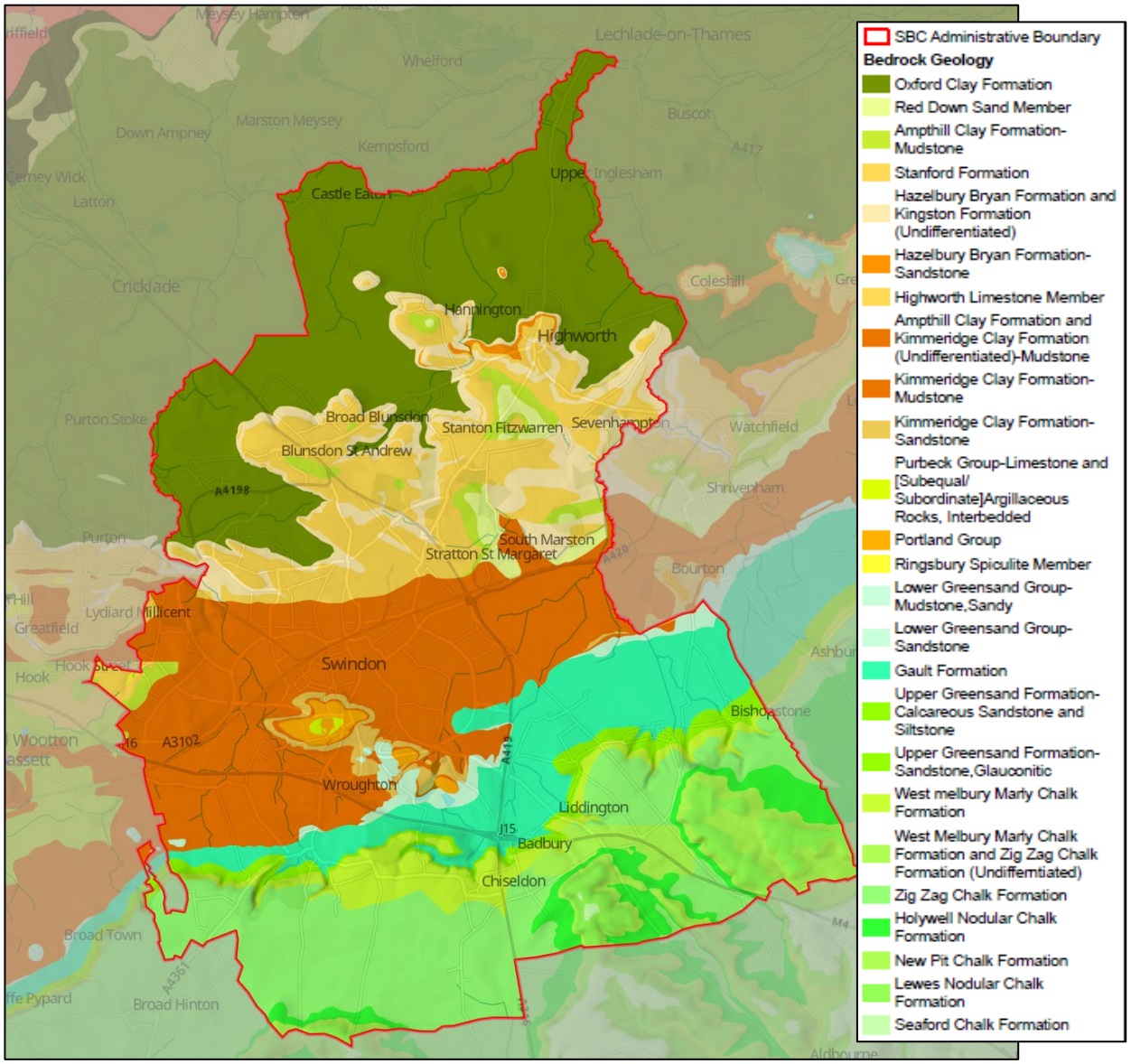
2.4.2 The Borough bedrock geology is characterised as clay across the north and central area, becoming chalk to the south on the approach to the North Wessex Downs.

2.4.3 Oxford Clay runs across the northern end of the Borough alongside the River Thames, giving way to Stanford and Hazelbury Bryan formations south of Highworth through to Stratton and the south of Haydon Wick.

2.4.4 Ampthill Clay and Kimmeridge Clay formations through the centre of the Borough, and through Swindon town, becoming Gault Formation south of Wroughton.

2.4.5 West Melbury Marly Chalk and Zig Zag Chalk formations cover the remaining area over the southern part of the Borough, south of the approximate line north-east to south-west from Bishopstone to Elcombe.

Figure 2.4: Bedrock Geology



2.4.6 Areas of superficial deposits are concentrated in the northern part of the Borough, consisting of Northmoor Sand and Gravel member and Alluvium deposits located north of Hannington. Alluvium deposits are also located in the south-east of the Borough. Head deposits comprised of clay, silt, sand and gravel are found throughout the south of the Borough.

2.4.7 Maps showing the geological context of the Borough are provided in **Appendix B**, and the information is summarised in **Table 2.1**.

Table 2.1: Overview of Swindon Borough Geology

Strata	Typical Description	Occurrence
Superficial Deposits (Quaternary Age)		
Alluvium	Clay, silt, sand and gravel	Concentrated across the north of the Borough, and along the river corridors of the Ray and Cole (and associated tributaries).
Northmoor Sand and Gravel Member	Sand and gravel (sandy limestone gravel)	Locally present across the north of the Borough.
Head Deposits	Intermix of clay, silt sand and gravel	Located in areas throughout the south of the borough.
Solid Geology		
Oxford Clay Formation	Mudstone	Located in a band in the north of the borough, north of Haydon Wick and Highworth.
Stanford and Hazelbury Bryan Formation	Sandstone, siltstone and mudstone	Underlies the area immediately south of Highworth and Haydon Wick.
Highworth Limestone Member	Limestone	Underlies the area immediately south of Highworth and Haydon Wick.
Ampthill Clay and Kimmeridge Clay Formation	Mudstone	Located in a band through the centre of the borough.
Gault Formation	Mudstone	Located south of the central belt.
Zig Zag Chalk Formation	Chalk	Located along the southern boundary of the borough.

2.4.8 The largely clay bedrock geology across the main areas of the Borough suggest that fluvial systems may respond rapidly to heavy rainfall events, with the potential to cause surface water flooding. The underlying geology is a key factor – alongside the topography and groundwater level – in determining the suitability of Sustainable Drainage Systems (SuDS), to control and manage surface water runoff (and volume) from new development. Surface water drainage is discussed further in **Section 12**.

2.4.9 The EA Groundwater Vulnerability Map shows variable risk categories based on the likelihood of a pollutant reaching the groundwater across the site area. The majority of the Swindon area is classed as being 'Unproductive'. The mapping shows the following groundwater vulnerability:

- 'High with Soluble Rock Risk' traversing through the centre of Swindon. The southern area of the Borough is largely classified with the same groundwater vulnerability.

- ‘Medium – Low Risk’ towards the north bordering the River Thames
- The southern central area, north-west, and north-east is classed Unproductive.
- ‘Medium – High’ Risk in small areas principally towards the east of Swindon
- ‘Low Risk’ in small areas principally towards the east of Swindon with some smaller areas towards the south and west.

2.5 Growth of Swindon Borough and Future Development

2.5.1 Swindon has been rapidly expanding for several decades and is a significant employment centre for the region. The population size in Swindon has increased by 11.6% from around 209,200 in 2011 to 233,400 in 2021 based on the recent census data. This is higher than the overall increase for England (6.65), where the population grew by nearly 3.5% to 56,489,800 (Office of National Statistics, 2021).

2.5.2 The Borough hosts the headquarters of several British companies and the UK offices of foreign multinationals, and - as part of the ‘M4 corridor’ –is an important location for business and residential development in the South West region. Itis well served by wider transport links, with the M4 Motorway providing a direct link east and west, to London (and Heathrow Airport) and Bristol/Wales respectively.

2.5.3 SBC is currently preparing a new Local Plan which will set out plans for future development in the Borough over the next 20 years up to 2043.

2.5.4 The new Local Plan seeks to continue to retain and intensify the delivery of strategic growth sites identified in the Local Plan 2026 including the New Eastern Villages (NEV), Wichelstowe and Kingsdown strategic allocations, but also include a concentration of key sites with the Swindon Central area and within close proximity to urban strategic transport corridors.

2.5.5 Of particular importance with regards to managing flood risk, the NEV is a strategic development site on the eastern flank of the Borough, centered on the River Cole and also impacting a number of watercourses (the South Marston Stream, the Liden Brook, The Lenta Brook and the Dorcan Stream). The NEV, which is subject to various stages of planning and post-approval since the adoption of the Local Plan 2026, is currently expected to deliver circa 8000 homes and complementary land uses by 2036.

2.5.6 SBC have provided housing projections per parish. The housing projections include Completions, new Site Allocations, Strategic Sites (with Planning Permission), Strategic Sites (rolled over parcels without Planning Permission) and Windfall Sites.

2.5.7 The total number of dwellings between 2023 and 2043 within the Borough is 25,796.

2.5.8 Based on the above, the number of dwellings in Swindon in 2043, is assumed to increase to **99,445 + 25,796 = 125,241**.

2.5.9 SBC has recently undertaken an Employment Land Audit assessment. The total Gross Development area for both the non-allocated and the allocated sites sums up to **1,152 ha.**

2.5.10 Additionally, a Strategic Land Development Site, ‘Panettoni’ (Former Honda site) is proposed to the north-east of the Borough. The total amount of development permitted within the ‘Panattoni’ Development will be limited to a maximum of 672,000 sqm of employment floorspace.

2.5.11 Flood risk is a key constraint to future development in the area, and future planning applications for those sites within zones of ‘High’ and ‘Medium’ probability of flooding (as well as sites over 1 hectare (ha) in areas of ‘Low’ probability of flooding) will need to be accompanied by Flood Risk Assessments (FRAs) to demonstrate compliance with national and local flood risk policy.

2.5.12 It is also important to note the new EA climate change guidance in **Section 4.10** and **Section 8** which need to be fully considered in development proposals and could have a significant bearing on the form and layout of future development in areas impacted by the fluvial floodplain.

3 Approach, Methodology and Data Sources

3.1 Objectives of SFRA

3.1.1 The NPPF PPG defines a SFRA as "*a study carried out by one or more local planning authorities to assess the risk to an area from flooding from all sources, now and in the future, taking account of the impacts of climate change, and to assess the impact that land use changes and development in the area will have on flood risk".*

3.1.2 A 'Level 1' SFRA is prepared based on available information from the Environment Agency (EA), the Local Planning Authority (LPA), the Lead Local Flood Authority (LLFA), sewerage undertakers and any other relevant bodies. The key aims of this are:

- **To provide an overview of the flood risk across a study area, identifying all known sources of flooding that may affect existing and future development within the Borough;**
- **To delineate the Flood Zones to identify areas at 'Low', 'Medium' and 'High' probability of river or sea flooding across the Borough, and to define and delineate Flood Zone 3b 'Functional Floodplain';**
- **To allow the application of the NPPF Sequential Test to the location of development and to identify whether development can be allocated outside high and medium flood risk areas;**
- **To identify the requirements for site-specific flood risk assessments in particular locations, including those at risk from sources other than river and sea flooding;**
- **To determine the acceptability of flood risk in relation to emergency planning capability;**
- **To provide guidance on the application and suitability of mitigation measures in new development, and to consider opportunities to reduce flood risk to existing communities and developments through provision for conveyance and storage for flood water and better management of surface water (which has become particularly relevant in light of the new powers transferred to SBC as the LLFA).**

3.1.3 The purpose of a Level 1 SFRA is to collate and review available information with respect to flooding from the Risk Management Authorities and other stakeholders in the area. Data was requested from and provided by the following stakeholders and data providers:

- EA
- SBC (AS LLFA, LPA and Highways Authority)
- Thames Water
- British Geological Society (BGS)

3.2 Topographical and Geological Data

3.2.1 The topography of the area has been mapped using LiDAR data. LiDAR has a typical vertical accuracy of ±0.05m to ±0.15m, with spatial resolution ranging from 0.25m to 2.0m. The data is collected by the EA and filtered to produce a "bare earth" model (i.e., excluding building footprints, trees, etc). The data is freely available and is of suitable accuracy and resolution for this study. LiDAR data is not suitable to support planning applications, for which detailed site-specific topographical survey must be obtained.

3.2.2 An overview of the geology across the Borough has been obtained from the publicly available data from the BGS.

3.3 Statutory 'Main River' Network

3.3.1 Statutory Main Rivers Map is a spatial (polyline) dataset that defines statutory watercourses in England designated as Main Rivers by the EA.

3.3.2 Watercourses designated as 'main river' are generally the larger arterial watercourses. The EA has permissive powers, but not a duty, to carry out maintenance, improvement or construction work on designated main rivers.

3.3.3 All other open watercourses in England are determined by statute as 'ordinary watercourses'. On these watercourses the LLFA (or, if within an Internal Drainage District, the Internal Drainage Board) have similar permissive powers to maintain and improve.

3.4 Flood Zone Map (Flood Map for Planning)

Appendix C Figure 008 – Flood Zone Map

3.4.1 The EA have provided their Flood Zone extents, which delineate the Borough into zones of 'Low', 'Medium' and 'High' probability of river or sea flooding- see **Table 3.1**.

3.4.2 The Flood Zone Map is also referred to as the 'Flood Map for Planning' on the GOV.UK website (https://flood-map-for-planning.service.gov.uk/).

3.4.3 The maps – and definition of Flood Zones 1, 2 and 3a – ignore the presence of flood defences. Reduction in risk of flooding from rivers and sea due to defences are mapped separately.

3.4.4 The Flood Zone map does not differentiate between Flood Zone 3a 'High Probability' and Flood Zone 3b 'Functional Floodplain' – the defined 'Flood Zone 3' is effectively a composite of Zone 3a and Zone 3b, and the SFRA determines the definition of Zone 3b, taking into consideration local circumstances, as discussed further in **Section 9.1.**

Table 3.1: Flood Zone Definitions

Flood Zone	Definition
Flood Zone 1 – Low Probability	Land having a less than 1 in 1,000 (0.1%) annual probability of river or sea flooding
Flood Zone 2 – Medium Probability	Land having a between 1 in 100 (1%) and 1 in 1,000 (0.1%) annual probability of river flooding or land having between a 1 in 200 (0.5%) and 1 in 1,000 (0.1%) annual probability of sea flooding
Flood Zone 3a – High Probability	Land having a 1 in 100 (1%) or greater annual probability of river flooding; or land having a 1 in 200 (0.5%) or greater annual probability of sea flooding.
Flood Zone 3b – Functional Floodplain	This zone comprises land where water from rivers or the sea has to flow or be stored in times of flood. The identification of functional floodplain should take account of local circumstances and not be defined solely on rigid probability parameters. Functional floodplain will normally comprise: • land having a 3.3% or greater annual probability of flooding, with any existing flood risk management infrastructure operating effectively; or • land that is designed to flood (such as a flood attenuation scheme), even if it would only flood in more extreme events (such as 0.1% annual probability of flooding). Land where water has to flow or be stored in times of flood. Local planning authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency.

3.4.5 The Flood Zones have typically not been mapped for smaller catchments (for example, less than 3 km^2 catchment area). The absence of mapped Flood Zones should not be assumed to indicate there is no fluvial flood risk.

3.4.6 The Flood Zone extents in general terms are based on a combination of a national scale generalised computer model, updated in March 2025 as part of the National Flood Risk Assessment (NaFRA) update to utilise significantly higher resolution mapping and based on more robust modelling techniques than the previous iteration of the national scale mapping, more detailed hydraulic modelling where available, and in some cases 'worst historic' flood outlines. The availability of EA detailed hydraulic modelling in the Borough is discussed in **Section 3.8**.

3.4.7 The EA's knowledge of the floodplain and extent of Flood Zones is continuously being improved through ongoing studies, river flow gauging and level monitoring, and the impacts of observed floods. The Flood Map for Planning is updated on a quarterly basis to include any revisions made. External requests to change the Flood Zones can be made through the "Evidence-Based Review" process, in which suitable evidence must be submitted to the EA to support the proposed revisions.

3.5 EA Risk of Flooding from Surface Water Flood Map

Appendix C Figure 009 – Risk of Flooding from Surface Water Map

3.5.1 The EA have provided their 'Risk of Flooding from Surface Water' ('RoFSW') Map, which was updated in January 2025 as part of the NaFRA 2025 update, providing significantly higher resolution mapping and based on more robust modelling techniques than the previous iteration of the mapping, discussed further in **Section 6.3.**

3.5.2 The Risk of Surface Water Flooding GIS layers display the extents of flooding from surface water that could result from a flood with a 1 in 30 (3.3%), 1 in 100 (1%) or 1 in 1000 (0.1%) chance of happening in any given year.

3.5.3 The management responsibility for flood risk from surface water lies with the LLFA; this forms part of the EA's 'strategic overview' role established following the Pitt Review ('The Pitt Review - Learning Lessons from the 2007 floods', Sir Michael Pitt, June 2008), and allows LLFAs to use these maps to meet the requirements of the Flood Risk Regulations – i.e. to produce flood hazard maps for surface water in any designated 'Flood Risk Areas' defined in the PFRA.

3.5.4 PFRA Section 6 does not identify designated 'Indicative Flood Risk Areas' but cross refers to the EA surface water flood mapping as the main identifier for areas at risk of surface water flooding in the Borough.

3.6 EA Reservoir Flood Map

Appendix C Figure 011 – Reservoir Flood Map

3.6.1 Paragraph 046 of the PPG 'Flood Risk and Coastal Change' states:

> *'The failure of a reservoir has the potential to cause catastrophic damage due to the sudden release of large volumes of water. The local planning authority will need to evaluate the potential damage to buildings or loss of life in the event of dam failure, compared to other risks, when considering development downstream of a reservoir. Local planning authorities are also advised to consult with the owners/operators of raised reservoirs, to establish constraints upon safe development."*

3.6.2 One of the key recommendations of the Pitt Review of the Summer 2007 floods was that flood maps be prepared for reservoirs, to assess risks and plan for contingency, warning and evacuation.

3.6.3 The EA have provided Reservoir Flood Maps (RFMs) showing the potential extent of flooding in the event of a breach from large reservoirs (over 25,000 cubic metres of water). This mapping study assumes a worst-case scenario; i.e. that a breach occurs for the full height and width of the impounding structure when the water level is near the crest.

3.6.4 The EA reservoir flood maps represent 2 flooding scenarios.

- The '**dry- day'** scenario predicts the extent of flooding if the dam or reservoir failed whilst rivers were at normal levels.
- The '**wet-day'** scenario predicts the extent of flooding if a river is already experiencing an extreme natural flood.

3.6.5 The extent provided by the EA has been further refined based on delineation of speed and depth of flooding over the affected area, as identified on the RFM on the EA website.

3.6.6 The flood risk associated with potential reservoir breach is discussed in **Section 6.4**. It is important to emphasise that the results of this study do not provide an assessment of the probability of such an event occurring, nor does it in any way reflect the structural integrity of the embankment.

3.7 BGS Susceptibility to Groundwater Flooding Map

Appendix C Figure 010 – Susceptibility To Groundwater Flooding Map

3.7.1 The 'Susceptibility to Groundwater Flooding' map has been purchased under licence from the British Geological Survey (BGS) for the study area. The BGS caveat that this is *"based on geological and hydrogeological information, the data can be used to identify areas where geological conditions could enable groundwater flooding to occur and where groundwater may come close to the ground surface."*

3.7.2 The susceptibility data is suitable for use for regional or national planning purposes where the groundwater flooding information will be used along with a range of other relevant information to inform land-use planning decisions. It might also be used in conjunction with a large number of other factors, e.g. records of previous incidence of groundwater flooding, rainfall, property type, and land drainage information, to establish relative, but not absolute, risk of groundwater flooding at a resolution of greater than a few hundred metres. The confidence dataset will help in this assessment.

3.7.3 It is accepted that this is a desk based high level assessment of groundwater susceptibility and does not reflect any detailed modelling of flood risk from this source – BGS caveat that *"the susceptibility data should not be used on its own to make planning decisions at any scale, and, in particular, should not be used to inform planning decisions at the site scale. The susceptibility data cannot be used on its own to indicate risk of groundwater flooding"* – as such, since there is no nationally standardised method to assess groundwater, the actual risk should be considered on a site by site basis via site-specific assessment and intrusive investigations.

3.8 EA Detailed Hydraulic Modelling

Appendix C Figure 012 – Modelled Flood Extents (Present Day)

Appendix C Figure 013 – Modelled Flood Extents (Climate Change)

3.8.1 The EA have provided detailed hydraulic modelling outputs from a number of studies through the Borough as summarised in **Table 3.2.**

3.8.2 It should be noted that the detailed hydraulic models developed on behalf of the EA assume *'typical'* conditions within the respective river systems that are being analysed. The predicted water levels may change if the operating regimes of the rivers involved are altered, either due to, for example, engineering works which may be implemented in the future, or poor maintenance (if culverts become blocked, or if the condition of the river channel is allowed to deteriorate).

Table 3.2: Hydraulic Models Overview

EA Model	Study Date	Models Supplied	Annual Probability Events
Cole (MRL to acorn bridge)	2007	Upper Cole Model Lower Cole Model	1 in 5 Annual Probability 1 in 20 Annual Probability 1 in 100 Annual Probability 1 in 100 Annual Probability plus climate change ('CC')
Cole Eda (A419 to South Marston Brook)	2011	Defended Model	1 in 5 Annual Probability 1 in 20 Annual Probability 1 in 100 Annual Probability 1 in 100 Annual Probability plus CC 1 in 1000 Annual Probability
Haydon Wick FAS	2014	Defended Model	1 in 5 Annual Probability 1 in 20 Annual Probability 1 in 30 Annual Probability 1 in 50 Annual Probability 1 in 100 Annual Probability 1 in 200 Annual Probability 1 in 100 Annual Probability plus CC 1 in 1000 Annual Probability
Ray (Swindon)	2013	Defended Model Undefended Model	1 in 5 Annual Probability 1 in 20 Annual Probability 1 in 100 Annual Probability 1 in 100 Annual Probability plus CC 1 in 1000 Annual Probability
South Marston Brook (Churn Farm to Cole Confluence)	2014	Defended Model	1 in 5 Annual Probability 1 in 20 Annual Probability 1 in 100 Annual Probability 1 in 100 Annual Probability plus CC 1 in 1000 Annual Probability
Thames (MRL to St Johns)	2014	Defended Model	1 in 5 Annual Probability 1 in 20 Annual Probability 1 in 50 Annual Probability 1 in 100 Annual Probability 1 in 100 Annual Probability plus CC 1 in 1000 Annual Probability
Thames (MRL to St Johns) New CC runs	2017	Defended Model	1 in 100 Annual Probability plus 15% CC 1 in 100 Annual Probability plus 25% CC 1 in 100 Annual Probability plus 35% CC 1 in 100 Annual Probability plus 70% CC

3.8.3 It is noted that the EA have identified issues with two areas of modelling within the Borough –

- **Haydon Brook 2014 model** – the EA previously identified issues with the modelling in relation to the new NaFRA project update. The EA advised that they were looking into options on how to solve the issues raised with the Haydon Wick 2014 model. A review of the latest (as of May 2025) Flood Zone maps indicates the modelled outputs along this watercourse have been partly amended from the previous data. However, the EA

confirmed (June 2025) as follows: "*The Flood map for Planning (FMfP) is still informed by the Haydon Wick Brook 2014 model.*

One reason for the changes in the current FMfP and the one published prior to March 25th is that part of the area is now also covered by a Direct Rainfall Model. For awareness, for some small watercourses across the country it wasn't appropriate to use fluvial modelling approaches due to limited hydrological data available. These small watercourses have instead been modelled using the techniques used for the surface water national modelling (a Direct Rainfall Model). In these cases, the relevant data is copied across from the surface water outputs, flood extents were extracted from the national surface water modelling for the 1% AEP event and added to flood zone 3, and for the 0.1% AEP event and added to flood zone 2…. Another reason for change is the data processing of the Haydon Wick Brook 2014 model as part of the new National Flood Risk Assessment 2 (NaFRA2).

The Haydon Wick Brook 2014 model remains the best available data to be included within the SFRA."

- **River Cole and Dorcan Brook (Stream) Covingham and Nythe model** – the EA confirm that the best available model for this area is the River Cole 2007 model, but further modelling of these rivers has been undertaken to accompany strategic new developments in the area. However, the new modelling has not yet been signed off to be shared externally and used in the Flood Map for Planning.

3.8.4 As part of this SFRA process, the EA hydraulic models have been rerun, where applicable, to generate the flood extents allowing for potential climate change, based on the EA climate change allowances guidance discussed in **Section 4.10** – see Technical Note summary in **Appendix E**.

3.8.5 There are sections of main river watercourse where no detailed modelling is available. In such cases, Flood Zone mapping is typically based on a national scale generalised computer modelling exercise. This new NaFRA data was released by the EA in March 2025 and represents a significant enhancement of the national scale modelling, using enhanced methods and significantly improved resolution of mapping compared to the previous iteration of this analysis (referred to as 'JFLOW'). Even so, this data is not typically considered robust at a site-specific level and it is recommended that this is reviewed when any further detailed hydraulic modelling is undertaken through the area.

3.8.6 Other such areas identify no Flood Zone extents alongside the watercourse, and a 20m buffer offset either side of the channel is identified in the SFRA mapping within which it is advised that further hydraulic modelling would be required to appropriately assess the flood risk.

3.9 EA Flood Defence Information

3.9.1 Information has been provided by the EA from their national flood defences database as part of the Flood Zones package of information discussed above. This includes the following data:

- Flood defences - the location of linear raised flood defences such as embankments and walls;
- Flood storage areas - land designated and operated to store flood water;
- Land that may benefit from the presence of major defences during a 1% fluvial or 0.5% tidal flood event - these are areas that would flood if the defence were not present but may not flood because the defence is present (areas benefiting from flood storage areas may be remote from the flood defence structure).

3.9.2 A review of the information confirmed that the relevant flood defence layers did not contain any information.

3.10 EA Flood Warning Areas/ Flood Information Service

3.10.1 The use of flood warnings and their application in local flood risk management is discussed further in **Section 11.7** and **Section 13.2**.

3.11 EA Historic Flooding Records

Appendix C Figure 015 – EA Historic Flood Map

Appendix C Figure 016 – Historic Flood Extents (by year)

3.11.1 The EA have provided their dataset of 'Recorded Flood Outlines' (RFO's) for the Borough. This shows the "*the extents of known flooding from rivers, the sea and groundwater*" over the study area and in this case the EA have provided RFOs for the following fluvial flood events:

- March 1947
- September 1968
- June 1971
- August 1977
- September 1992
- October 1993
- June 2006
- July 2007
- January 2008

3.11.2 This data has been presented in **Map 15** (EA Historic Flood Map) and **Map 16** (floods mapped by year) in **Appendix C**.

3.11.3 Due to the proximity of the River Thames, River Ray and River Cole to Swindon Borough, fluvial flood events have impacted the Borough throughout history.

3.11.4 Although flooding has occurred historically within the Upper Cole catchment, due to the size of the catchment there is little documented evidence of locations and extents of flooding. Significant flood events occurred in July 1968 and December 1979. The flood extent during 1968, the larger of these two events, has been mapped by the EA. There has been significant land use change and urbanisation since the 1968 flood event. Localised flooding occurred on the Dorcan Brook during the 1980s due to issues with the operation and design of the outlet structures, which have since been modified.

3.12 Thames Water DG5 Records

Appendix C Figure 017 – Thames Water DG5 Sewer Flooding Records

3.12.1 Water companies are required to record all instances of internal flooding of properties. These are categorised on their cause (i.e. either hydraulic overloading of the sewers – where the sewer pipe is too small or at too shallow a gradient – or other causes such as blocked or collapsed sewers, pumping station failure, etc.). In addition, the companies are required to maintain a register of properties which are at risk of internal flooding due to hydraulic overloading, and this is usually known as the 'DG5 Register'.

3.12.2 Details of the DG5 Register for the Swindon area were provided by Thames Water for inclusion within the SFRA. The register does not provide a specific location of flooding incidents; rather it

provides a total number of flooding incidents over the past ten-year period for a particular postcode prefix area.

4 Planning Policy Context - National

The following section provides an overview of the relevant national and local policy frameworks in relation to development and flood risk. A framework of national and regional policy is in place, providing guidance and direction to local planning authorities. Ultimately, it is the responsibility of the Council to establish robust policies that will ensure future sustainability with respect to flood risk.

4.1 National Planning Policy Framework

4.1.1 National policy in relation to flood risk is contained within the National Planning Policy Framework (NPPF), updated December 2024, issued by the Department for Levelling Up, Housing and Communities, with reference to Section 14 'Meeting the challenge of climate change, flooding and coastal change'.

4.1.2 The NPPF is supported by the Planning Practice Guidance (PPG) which includes a detailed section on flood risk and coastal change. The associated climate change guidance provides contingency allowances for the potential increases in peak river flow, peak rainfall intensity and sea level rise which are considered accordingly subject to the site conditions – discussed further in **Section 4.10.**

4.1.3 The NPPF sets out the requirement of a site-specific-flood-risk assessment in paragraph 181 – see below.

> *"**181.** When determining any planning applications, local planning authorities should ensure that flood risk is not increased elsewhere. Where appropriate, applications should be supported by a site-specific flood-risk assessment. Development should only be allowed in areas at risk of flooding where, in the light of this assessment (and the sequential and exception tests, as applicable) it can be demonstrated that:*
>
> *a) within the site, the most vulnerable development is located in areas of lowest flood risk, unless there are overriding reasons to prefer a different location;*
>
> *b) the development is appropriately flood resistant and resilient such that, in the event of a flood, it could be quickly brought back into use without significant refurbishment;*
>
> *c) it incorporates sustainable drainage systems, unless there is clear evidence that this would be inappropriate;*
>
> *d) any residual risk can be safely managed; and*
>
> *e) safe access and escape routes are included where appropriate, as part of an agreed emergency plan."*

4.1.4 The NPPF sets out the requirement for the Sequential Test in paragraphs 173 to 177 as set out below.

173. A sequential risk-based approach should also be taken to individual applications in areas known to be at risk now or in future from any form of flooding, by following the steps set out below.

174. Within this context the aim of the sequential test is to steer new development to areas with the lowest risk of flooding from any source. Development should not be allocated or permitted if there are reasonably available sites appropriate for the proposed development in areas with a lower risk of flooding. The strategic flood risk assessment will provide the basis for applying this test.

175. The sequential test should be used in areas known to be at risk now or in the future from any form of flooding, except in situations where a site-specific flood risk assessment demonstrates that no built development within the site boundary, including access or escape routes, land raising or other potentially vulnerable elements, would be located on an area that would be at risk of flooding from any source, now and in the future (having regard to potential changes in flood risk).

176. Applications for some minor development and changes of use62 should also not be subject to the sequential test, nor the exception test set out below, but should still meet the requirements for site-specific flood risk assessments set out in footnote 63.

177. Having applied the sequential test, if it is not possible for development to be located in areas with a lower risk of flooding (taking into account wider sustainable development objectives), the exception test may have to be applied. The need for the exception test will depend on the potential vulnerability of the site and of the development proposed, in line with the Flood Risk Vulnerability Classification set out in Annex 3.

4.1.5 The requirement for the Exception Test, where applicable, is detailed in NPPF paragraphs 178 to 179– see below.

178. The application of the exception test should be informed by a strategic or site specific flood risk assessment, depending on whether it is being applied during plan production or at the application stage. To pass the exception test it should be demonstrated that:

a) the development would provide wider sustainability benefits to the community that outweigh the flood risk; and

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

179. Both elements of the exception test should be satisfied for development to be allocated or permitted.

4.1.6 The PPG sets out the requirements of the Sequential Test to be applied to the location of the development in Paragraph 24 of the 'Flood Risk and Coastal Change' section – see below.

> *"The Sequential Test ensures that a sequential, risk-based approach is followed to steer new development to areas with the lowest risk of flooding, taking all sources of flood risk and climate change into account. Where it is not possible to locate development in low-risk areas, the Sequential Test should go on to compare reasonably available sites:*
>
> - *Within medium risk areas; and*
> - *Then, only where there are no reasonably available sites in low and medium risk areas, within high-risk areas".*

4.1.7 These Tests are to be applied where appropriate, depending on the proposed development flood risk 'vulnerability' and the Flood Zone in which it is located. The key implication of the above legislations and guidance for the SFRA are:

- The requirement for a sequential, risk-based approach to the location of development, taking into account the current and future impacts of climate change and managing any residual risk (**Section 10**).
- The requirement to safeguard land from development that is required, or likely to be required, for current or future flood management.
- The requirement to use opportunities provided by new development to reduce the causes and impacts of flooding (**Section 11**).
- The requirement to relocate development to more sustainable locations, where some existing development may not be sustainable in the long term due to climate change (**Section 10.1**).
- The requirement for development to incorporate sustainable drainage systems unless there is clear evidence that this would be inappropriate (**Section 12**).

4.2 Flood Risk Regulations (2009)

4.2.1 The Flood Risk Regulations (2009) transpose Directive 2007/60/EC of the European Parliament and of the Council on the assessment and management of flood risks for England and Wales. The regulations define the LLFA, which is SBC for the Swindon area.

4.2.2 The regulations set out a set of responsibilities and deliverables with an associated timetable, for both the EA (in relation to flood risk from main rivers, reservoirs and the sea) and the LLFA (for all other sources of flooding):

- Part 2 enacts duties on the EA and LLFAs to prepare Preliminary Flood Risk Assessment reports of past and potential future flooding in their administrative area;
- Part 3 enacts duties on the EA and LLFAs to prepare Flood Risk and Flood Hazard Maps;
- Part 4 enacts duties on the EA and LLFAs to prepare Flood Risk Management Plans;
- Part 6 enacts duties on the EA and local authorities to co-operate with each other for the purposes of the regulations, and a power to require information reasonably required in connection with functions under these regulations.

4.3 Water Industry Act (1991) and Water Act (2014)

4.3.1 The Water Industry Act (1991) set out the regulatory, competition and consumer representation frameworks for the water sector in England and Wales, following privatisation of the water supply and sewerage networks. The Act places a duty upon the water undertaker to develop and maintain efficient and economical systems of water supply in its area, and a duty upon the sewerage undertaker to provide, improve and extend a system of public sewers to ensure that its area is "effectively drained", and the contents of those sewers effectually dealt with.

4.3.2 Under Section 51a and Section 106 of the Act, developers have the right to connect to the existing supply and sewerage system, respectively. The cost of providing the infrastructure improvements required to supply water and sewerage services are shared between the developer and the undertaker in accordance with the provisions of the legislation.

4.3.3 Investment in water supply and sewerage infrastructure is undertaken through Asset Management Plan cycles. The plans are approved by the water regulator, Ofwat, and include investment programs to manage the flood risk from sewers.

4.3.4 The Water Act (2014) amended the Water Industry Act (1991), with the aim of reforming the water industry to make it more innovative and responsive to customers, and to increase the resilience of water suppliers to natural hazards such as drought and floods. The act also made provisions for flood insurance.

4.3.5 The key implications of this legislation for the SFRA are:

- The duty of water companies to "effectively drain" their areas and deal with the contents of sewers. Further discussion of Thames Water's Asset Management Plan proposals for managing flood risk from its foul and surface water drainage network is included in **Section 4.5**.
- The rights of developers to connect to the existing sewerage system for foul and surface water drainage of new developments.

4.4 Land Drainage Act (1991)

4.4.1 The Land Drainage Act (1991) outlines the duties and powers to manage land drainage for several bodies including the Environment Agency, Internal Drainage Boards, Local Authorities, navigation authorities and riparian landowners, and more recently the LLFA. The Act confers permissive powers for works and byelaws for Internal Drainage Boards and the LLFA for their areas.

4.4.2 Section 23 of the Land Drainage Act of 1991 states:

> "No person shall—
>
> (a) erect any mill dam, weir or other like obstruction to the flow of any ordinary watercourse or raise or otherwise alter any such obstruction; or
>
> (b) erect a culvert in an ordinary watercourse, or
>
> (c) alter a culvert in a manner that would be likely to affect the flow of an ordinary watercourse, without the consent in writing of the drainage board concerned.

4.4.3 Section 25 of the Land Drainage Act of 1991 states:

"Powers to require works for maintaining flow of watercourse

(1)F1..., where any ordinary watercourse is in such a condition that the proper flow of water is impeded, then, unless the condition is attributable to subsidence due to mining operations (including brine pumping), the drainage board F2... concerned may, by notice served on a person falling within subsection (3) below, require that person to remedy that condition.

F3(2). . . . . .

(3)Subject to subsection (4) below, a notice under this section in relation to a watercourse may be served on—

(a)any person having control of the part of the watercourse where any impediment occurs; or

(b)any person owning or occupying land adjoining that part; or

(c)any person to whose act or default the condition of the watercourse mentioned in subsection (1) above is due."

4.4.4 The key implications of this legislation for the SFRA are:

- Consent must be sought by developers from the relevant authority for any works to ordinary watercourses that might affect flow of water, such as construction of a culvert or drainage outfall, or channel realignment.
- Local byelaws must be adhered to with regards to development control, for example proximity of developments to watercourses, and discharge of surface water run-off.

4.5 Climate Change Act (2008)

4.5.1 The Climate Change Act (2008) requires the government to regularly assess the risks to the UK of current and predicted impacts of climate change, to set out climate change adaption objectives, and to set out proposals and policies to meet these objectives. The Act was amended in 2019 to commit the UK to achieving a 100% reduction in emissions by 2050 (net zero emissions).

4.5.2 The key implications of this legislation for the SFRA are:

- To support the 2050 net zero emissions target through any proposed flood risk and surface water infrastructure.
- To assess the potential impacts of climate change on flood risk and identify adaptation and mitigation policies and tools for the new Local Plan.

4.6 Flood and Water Management Act, 2010

4.6.1 The Flood and Water Management Act 2010 implements several key recommendations of Sir Michael Pitt's Review of the Summer 2007 Floods such as protecting consumer water supplies and protecting community groups from excessive charges for surface water drainage.

4.6.2 The Act gives the EA a strategic overview role for flood risk and gives LLFAs responsibility for preparing and implementing strategies for managing flood risk from ground water, surface water, and ordinary watercourses in their areas. The LLFA role is carried out by county councils and unitary authorities under the Flood and Water Management Act.

4.6.3 In January 2023, Schedule 3 of the Flood and Water Management Act 2010 was reviewed for future implementation. Schedule 3 provides a framework for the approval and adoption of drainage systems, an approving body (SAB), and national standards on the design, construction, operation, and maintenance of SuDS. The SAB is identified as sitting within the unitary authority or, if there is not one for the area, then will sit within the county council.

4.7 Water Framework Directive (2000)

4.7.1 The Water Framework Directive (WFD) (Commission of the European Communities, 2000) (ref 13.2) establishes a framework for a European-wide approach to water policy activity. Its aim is to ensure all inland and near-shore watercourses and waterbodies (including groundwater) are of 'Good' status or better, in terms of ecology, and chemical, biological and physical parameters, by the year 2027. Therefore, any activities or developments that could cause detriment to a nearby water resource or prevent a water resource from reaching its potential status must be mitigated in order to reduce the potential for harm and allow the directive's goals to be implemented.

4.7.2 Water quality data for watercourses is available on the EA Catchment Data Explorer website. This comprises catchment background data, existing water quality standards, and expected water quality requirements that the watercourse is projected to reach by set dates that are reviewed on a seven-year cycle. Any national or local protected areas are also included.

4.7.3 The key implications of this legislation for the SFRA are:

- The protection of water bodies against deterioration in status due to development, and the aim to achieve good ecological and chemical status / potential by 2021. The potential impacts of development on water body status are discussed further in the Outline Water Cycle Strategy.

4.8 National Strategy for Flood and Coastal Erosion Risk Management (2011 & 2020)

4.8.1 The EA has a statutory duty to develop, maintain, apply and monitor a national flood and coastal erosion risk management strategy, under Section 7 of the Flood and Water Management Act (2010).

4.8.2 A new National Flood and Coastal Risk management Strategy was issued in July 2020. The strategy offers a new long-term approach to improve resilience to climate change and is closely aligned with the Defra flood and coastal erosion risk management policy statement (2020). The vision of the strategy is "a nation ready for, and resilient to, flooding and coastal change – today, tomorrow and to the year 2100".

4.8.3 The strategy has three long term ambitions which inform and are underpinned by continuing development of understanding of risk now and in the future, using this evidence to identify investment needs:

i. **Climate resilient places** – working with partners to bolster resilience to flooding and coastal change across the nation, both now and in the face of climate change. Risk management authorities will work with partners to:

- Deliver practical and innovative actions that help to bolster resilience to flood and coastal change in local places.
- Make greater use of nature-based solutions that take a catchment led approach to managing the flow of water to improve resilience to both floods and droughts.
- Maximise opportunities to work with farmers and land managers to help them adapt their businesses and practices to be resilient to flooding and coastal change.
- Develop adaptive pathways in local places that equip practitioners and policy makers to better plan for future flood and coastal change and adapt to future climate hazards.

ii. **Today's growth and infrastructure resilience in tomorrow's climate** – making the right investment and planning decisions to secure sustainable growth and environmental improvements, as well as infrastructure resilient to flooding and coastal change. Risk management authorities will work with partners to:

- Put greater focus on providing timely and quality planning advice that helps avoid inappropriate development in areas at risk of flooding and coastal change.
- Leave the environment in a better state by contributing to environmental net gain for new development proposals.
- Ensure that spending on flood and coastal resilience contributes to job creation and sustainable growth in local places.
- Mainstream property flood resilience measures and to 'build back better' after flooding to reduce damages and enable faster recovery for local communities.
- Provide expert advice on how infrastructure providers (road, rail, water and power supplies) can ensure their investments are more resilient to future flooding and coastal change avoiding disruption to peoples' lives and livelihoods.

iii. **A nation ready to respond and adapt to flooding and coastal change** – ensuring local people understand the risks posed by flooding and coastal change, are responsible for managing the impacts and know how to take action. Risk management authorities will work with partners to:

- Support communities to better prepare and respond to flooding and coastal change, including transforming how people receive flood warnings.
- Ensure people and businesses receive the support they need from all those involved in recovery so they can get back to normal quicker after flooding.
- Help support communities with managing the long-term mental health impacts from flooding and coastal change.
- Develop the skills and capabilities needed to better support communities to adapt to future flooding and coastal change.
- Become a world leader in the research and innovation of flood and coastal risk management to better protect current and future generations.

4.9 Making Space for Water

4.9.1 Making Space for Water (MSfW) is a strategy launched in 2004 to develop new and sustainable approaches for flood and coastal risk management in England. This strategy takes a holistic approach to managing flood risk, including how land use and management can affect it.

4.9.2 An extract of a Table of flood risk management activity and benefits for management practices was provided in the MSfW – see **Table 4.1**.

Table 4.1: Relevant Flood Risk Management Practice Practices & Potential Benefits

Practice	Relevant Flood Risk Management Activity	Potential benefit Flood Generation/Propagation
Cultivation technique changes	Changes to farming practices e.g. contour ploughing, buffer strips, under-sowing, uncultivated zones, reduced grazing pressure within the Mercaston and Markeaton Brooks Project Changes from arable to grassland along rivers and set-aside into margins & headlands in the River Poulter Project Changes from arable to pasture and best practice land management in the Parrett Catchment Project	Limiting flood generation: retaining more water in the upper catchment and delaying time for storm water to reach the floodplain
Pasture and Wetland/Saltmarsh creation	Change from arable or intensive grassland to extensively managed grassland part of Parrett Catchment Project Reduction in sheep stocking densities (Yorkshire Dales Rivers Trust and Upper Wharfedale Best Practice projects) Permanent pasture used to provide flood buffer storage within the Mercaston and Markeaton Brooks Project. Creation of buffer wetland habitats to reduce downstream movement of water and sediment included within River Poulter, Hafren Forest and Parrett catchment projects Coastal realignment at Abbott Hall to create coastal flood storage	Limiting flood generation: retaining more water in the upper catchment and delaying time for storm water to reach the floodplain Reduce flood propagation through flood storage
Agricultural drainage	Additional water storage on farms dramatically reduced flows in the upper and mid catchment Parrett Catchment. Bunded areas on Hope Farm reduced flows entering watercourses.	Limiting flood generation: retaining more water in the upper and mid catchment
Afforestation/ Deforestation	Woodland creation included within Pontbren monitoring, Parrett catchment and Ripon MultiObjective Projects The impact of wet woodland was monitored at Bower Hinton Farm in the Parrett Catchment	Limit flood generation by reducing surface runoff. Reduce flood propagation: floodplain and riparian woodland limit propagation of flood flows downstream. Must be strategically situated to mitigate risk causing debris blockages

		downstream that increase flood risk locally.
Upland peat management	Moorland management including grip blocking addressed within Peatscapes, Sustainable Catchment Management Programme (SCaMP) and Upper Wharfedale Best Practice projects	Generally assumed that restoring areas of eroded and exposed peat should improve infiltration of surface run-off and help reduce flood risk. Modelling research has shown that a small number of grips have the largest effect on landscape wetness and should be blocked first.

4.10 Flood Risk Assessments: Climate Change Allowances, 2022

4.10.1 The EA guidance supporting the NPPF and associated PPG '**Flood Risk Assessments: Climate Change Allowances'** is located here:.

https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances

4.10.2 One of the key principles of the NPPF is ensuring that development is safe from flooding *'for the lifetime of the development'* – i.e. with due consideration of the potential impacts of climate change on aspects such as peak rainfall, sea level rise and increases in peak river flow.

4.10.3 The peak river flow allowances table provides a range of allowances according to percentile (i.e. the degree of certainty of an event occurring, based on the range of climate change scenarios assessed through scientific investigations). The provided allowances are also subject to the vulnerability classification of the proposed use and the river basin district of the site.

4.10.4 The potential increases in rainfall intensity require consideration in the proposed surface water drainage strategy for new development.

4.10.5 The implications of this new guidance are detailed further in **Section 8**.

5 Planning Policy Context - Local

5.1 Local Plan 2026 (adopted 2015)

5.1.1 The Swindon Borough Local Plan adopted in March 2015 sets out the strategic approach to development within the Borough of Swindon. The Plan details the potential quantity and location of housing, employment and retail development is required by the Borough up to 2026 including associated infrastructure requirements for developments to take place. The Local Plan includes key developments priorities which are:

- *"Deliver growth that is balanced and sustainable, and provides the necessary infrastructure, while addressing the impacts of climate change;*
- *Deliver regeneration in a way that meets the needs of Swindon's future, but conserves and enhances the best of the past; and*
- *Recognise the important role of green infrastructure to enhance the quality of life for existing and future residents."*

5.1.2 In order to deliver the spatial vision for Swindon and the Borough Council's priorities 10 strategic objectives were established through consulting partners. The objectives may contribute to the reduction and management of flood risk indirectly and directly include:

***"Strategic Objective 1: High Quality Sustainable Development** - to improve the image of Swindon, enable inclusive communities and address climate change by the provision of high quality, well designed and sustainable development.*

***Strategic Objective 4: Housing -** to meet the Borough's housing needs by the provision of well-designed sustainable housing, at sustainable locations and at a range of types and densities according to local needs and circumstances, and that promotes the effective use of land.*

***Strategic Objective 9: Green Infrastructure -** to provide an attractive and inspirational environment to live, work, learn and play, by the provision of a far-reaching network of connected and multi- functional green spaces linked to the wider countryside."*

5.1.3 The Local Plan specifically includes 'Policy EN6: Flood Risk' which includes measures to minimise flood risk in Swindon:

"Policy EN6: Flood Risk

a. The risk and impact of flooding will be minimised through:
- *directing development to areas with the lowest probability of flooding;*
- *ensuring that all development addresses the effective management of all sources of flood risk;*
- *ensuring that development does not increase the risk of flooding elsewhere including on adjoining and surrounding land; and*
- *ensuring wider environmental benefits of development in relation to flood risk.*

b. The suitability of development proposed in flood zones will be assessed using the Sequential Test, and, where necessary, the Exceptions Test. A sequential approach should be used at site level.

c. A site specific flood risk assessment will be required for development proposals of one hectare or greater in Flood Zone 1 and for all proposals for development (including minor development and change of use) in Flood Zones 2 and 3 and Critical Drainage Areas, and also where proposed development or a change of use toa more vulnerable class may be subject to other sources of flooding. Appropriate mitigation and management measures must be implemented.

d. All development proposals must be assessed against the Local Flood Risk Management Strategy to address locally significant flooding including that affecting neighbouring authorities. Appropriate mitigation and management measures must be implemented.

e. All development shall be required to provide a drainage strategy. Developments will be expected to incorporate sustainable drainage systems and ensure that run-off rates are attenuated to greenfield run-off rates. Higher rates would need to be justified and the risks quantified.

f. Sustainable drainage systems should seek to enhance water quality and biodiversity in line with The Water Framework Directive.

New Swindon Local Plan

5.1.4 The Council is currently in the process of developing a New Local Plan. This will build upon work undertaken on the Local Plan Review and include an update to plan evidence, site information and other supporting documents.

5.1.5 Once adopted, the New Local Plan will propose a number of updated strategies and policies, including site allocations, to provide sufficient housing, employment and town centre sites to meet the Borough's future needs and guide decisions on planning applications.

5.1.6 This SFRA report will inform the evidence base for the new Local Plan.

5.1.7 The Swindon Borough Local Development Scheme[1] (March 2025) sets out the timeframe for the New Local Plan:

- Public consultation on New Local Plan – Scope, Issues and Preferred Options (Regulation 18): Commence Summer 2025
- Public consultation on Pre-submission (Regulation 19): Commence Spring 2026

[1] https://www.swindon.gov.uk/downloads/file/10354/swindon_local_development_scheme_-2024

- Submission to Secretary of State (Regulation 22): Autumn 2026

5.1.8 Subject to Inspector Programme, it is estimated that the New Local Plan will be adopted by December 2027.

5.2 Thames Catchment Flood Management Plan

5.2.1 The **Thames Catchment Flood Management Plan (CFMP)** was released in 2009 by the Environment Agency. The document provides a high-level overview of the flood risk in the Thames catchment and sets out the Environment Agency's preferred plan for sustainable flood risk management over the next 50 years. Swindon study area falls within this catchment. The CFMP aims to develop sustainable policies for managing the increased future flood risk that may result from climate change, urbanisation and land management changes.

5.2.2 The CFMP divides the Thames catchment into 43 distinct sub-areas where each sub-area has similar physical characteristics, sources of flooding and level of risk (refer to Map 3 of the CFMP). The Thames CFMP outlines six policy options for the management of flood risk:

> *"**Policy 1**: Areas with little or no flood risk where we will continue to monitor and advise.*
>
> ***Policy 2:** Areas of low to moderate flood risk where we can generally reduce existing flood risk management actions.*
>
> ***Policy 3**: Areas of low to moderate flood risk where we are generally managing existing flood risk effectively.*
>
> ***Policy 4**: Areas of low, moderate or high flood risk where we are already managing the flood risk effectively but where we may need to take further actions to keep pace with climate change.*
>
> ***Policy 5**: Areas of moderate to high flood risk where we can generally take further action to reduce flood risk.*
>
> ***Policy 6**: Areas of low to moderate flood risk where we will take action with others to store water or manage run-off in locations that provide overall flood risk reduction or environmental benefits."*

5.2.3 Each sub-area is allocated one of six flood risk management policies, the relevant policy and actions for the Swindon sub-area is summarised as:

"The vision and preferred policy
Policy 4 - Areas of low, moderate or high flood risk where we are already managing the flood risk effectively but where we may need to take further actions to keep pace with climate change. The proposed expansion of these places will need flood risk to be considered and inform the location, layout and design of new development. Local Authority Strategic Flood Risk Assessments (SFRAs) should ensure development is located with consideration of the flood risk

The issues in these sub-areas
Swindon is falls under an urban area that is located in an around fluvial floodplains. Many of these towns have been through a major period of expansion between the 1950s and 1980s that lead to some significant alterations to the watercourses. The sources of flooding are a combination of river, surface water and sewer systems. Many of the rivers in these areas have often been heavily modified as development has occurred.

Properties at risk
The number of properties in Swindon with a 1% risk of flooding from rivers at the current is 1310. However, future (2100) estimation is not provided.

Proposed actions to implement the policy

- *Development should be located in areas of lowest flood risk and incorporate a layout and design that is resilient to flooding. Strong recommendations in SFRAs and policies in Local Development Documents (LDDs) will help to ensure this. We will identify with our partners opportunities to reduce flood risk by recreating river corridors in urban areas. New and re-development should allow space for water, wildlife and recreation in their site layout and design.*
- *We want to make sure other sources of flooding are considered. We will support partnerships to identify those areas that are most vulnerable to other types of flooding, for example through Surface Water Management Plans (SWMPs) and encourage initiatives to manage these risks.*
- *We want to maintain the existing capacity of the river system by keeping the channels clear and free from obstruction to reduce the impacts of more frequent flood events.*
- *We will promote a greater awareness of flood risk amongst organisations and communities. This will focus on actions to reduce the impact of flooding."*

5.3 SBC Local Flood Risk Management Strategy

5.3.1 The LFRMS (June 2014) outlines how SBC will work with other authorities to manage all sources of flooding within the region, both now and in the future. In Swindon, 'Local' flood is defined as the risk of flooding from surface water runoff, small ditches and streams (officially names as ordinary watercourses) The Strategy ensures that residents are informed about flood risk, that they understand why flooding is a problem for everyone, and what is being done to manage it.

5.3.2 The aim of the Swindon LFRMS is to manage flood risk that will benefit people, property and the environment. The key nine objectives have been derived with consideration of the EA's National Flood and Coastal Erosion Risk Management Strategy:

> "**Objective 1:** Improve knowledge and understanding of all flood risk in Swindon
>
> **Objective 2:** Ensure appropriate development that takes account of flood risk
>
> **Objective 3:** Improve awareness of flood prediction, warning and post-flood recovery
>
> **Objective 4:** Encourage communities to manage their own localised flood risk
>
> **Objective 5:** Develop a prioritised action plan to manage flood risk by maintaining, and improving where appropriate, local flood risk management infrastructure and systems
>
> **Objective 6:** Ensure that actions and measures proposed to manage flood risk deliver multiple benefits, including environmental, social and economic
>
> **Objective 7:** Ensure the LFRMS is integrated with, and supports, Swindon's wider objectives and aspirations
>
> **Objective 8:** Work in partnership with other Risk Management Authorities to manage flooding in Swindon
>
> **Objective 9:** Understand and address cross-boundary flood risk issues by working in partnership with neighbouring LLFAs."

5.3.3 The study also sets out the roles and responsibilities of risk management authorities, the various funding avenues for flood risk management activities, and the need for local partnership and contributions in delivering flood management schemes. The study is a comprehensive study of flood risk management in Swindon, including further details on Risk Management Authorities and other stakeholders' roles and responsibilities, associated plans and documents, and the LLFA's approach to fulfilling its duties in flood risk management, investigation and reporting. It is recommended that this study is referred to for further information beyond the overview provided in this SFRA.

5.4 SBC Preliminary Flood Risk Assessment

5.4.1 The preparation of a Preliminary Flood Risk Assessment (PFRA) was a requirement for all Lead Local Flood Authorities (LLFAs) under the Flood Risk Regulations (see **Section 4.2**), in order to provide a high level screening exercise to facilitate effective management of flood risk within the area.

5.4.2 The SBC PFRA was released in 2011 to provide a high-level overview of flood risk from all sources in Swindon, and draws together information on local sources of flooding – i.e. surface water, groundwater, ordinary watercourses and canals – with the exception of main river and reservoir flooding – to identify areas where flooding is likely to be significant for people, the economy, or the environment. The classification considers both the likelihood and the impact, or consequence, of flooding. The document was reviewed in 2018 where it was deemed still relevant.

5.5 Local Flood Investigation Reports

5.5.1 Under Section 19 of the Flood and Water Management Act 2010, the LLFA must investigate flood incidents where necessary and publish the results – see below.

> *"Local authorities: investigations*
>
> *(1)On becoming aware of a flood in its area, a lead local flood authority must, to the extent that it considers it necessary or appropriate, investigate—*
>
> *(a)which risk management authorities have relevant flood risk management functions, and*
> *(b)whether each of those risk management authorities has exercised, or is proposing to exercise, those functions in response to the flood.*
>
> *(2)Where an authority carries out an investigation under subsection (1) it must—*
> *(a)publish the results of its investigation, and*
> *(b)notify any relevant risk management authorities.*

5.5.2 The LLFAs in the South West of England have agreed with Swindon on the following threshold when considering if it is necessary or appropriate to investigate a flood incident:

- "*five or more residential properties flooded internally;*
- *Two or more non-residential properties flooded internally;*
- *One or more critical service (e.g hospital) flooded, and/or;*
- *A key transport link is totally impassable for a significant period."*

5.5.3 However, as all flood incidences are unique, there may be certain circumstances where the council choose to carry out an investigation where none of the set criteria is met.

5.6 River Basin Management Plan –Thames River Basin District, updated 2022

5.6.1 In order to implement the WFD, **River Basin Management Plans (RBMPs)** have been prepared for all waters in the UK. In England and Wales, the EA is the 'competent authority' that will be tasked with analysing the characteristics of the 11 River Basin Districts in England and Wales, assessing the impact of human activity on the water bodies within these districts and preparing and consulting on RBMPs. The RBMP of relevance to the site is the Thames River Basin District.

5.6.2 RBMPs are focussed on the quality of the water environment, including water quality, ecology and geomorphological indicators. Therefore, the RMBP is reviewed in detail in the accompanying Water Cycle Strategy reports. However, as part of the process of aligning WFD requirements with local planning, all consents for works to watercourses must show compliance with the WFD objectives, to prevent the deterioration in the overall status of water bodies. Any application that does not properly consider these obligations may be refused.

5.6.3 The original RBMPs released in 2009 set out a Programme of Measures (POM) to be undertaken in order for each water body to maintain and reach 'good' status. The first of a series of six- years planning cycles was reviewed and updated in 2015.

5.6.4 The RBMP was updated in December 2015 at the end of this initial cycle to set out the aims of the subsequent six-year cycle to 2021. The most recent update to the RBMP was carried out in December 2022. The RBMP makes clear that, although there has been progress in protecting water bodies in the Thames Basin, a range of challenges still remain.

5.6.5 The key issues include:

- point source pollution from water industry waste water;
- physical modification of water bodies;

- diffuse pollution from rural areas; and,
- diffuse pollution from urban sources.
- changes to the natural river flow level from the water industry

5.6.6 The EA Catchment Data Explorer web application is used to view catchment summaries and download data. Swindon Borough lies within the 'Thames Upper' operational catchment, an overview of is located here:

https://environment.data.gov.uk/catchment-planning/OperationalCatchment/3504

5.6.7 An overview of the ecological and chemical status of the main river watercourses within the Borough is provided in **Table 5.1**, showing the original 2015 status, the most recent 2022 status and the ecological quality and chemical quality objectives.

Table 5.1: RBMP Current and Future Ecological/Chemical Quality

Watercourse	Ecological Quality			Chemical Quality		
	2015	2022	Objectives	2015	2022	Objectives
River Thames						
Thames (Churn to Coln)	Moderate	Moderate	Moderate by 2015 (achieved)	Good	Does not require assessment	Good by 2063
Share Ditch	Moderate	Moderate	Moderate by 2015 (achieved)	Good	Does not require assessment	Good by 2063
Westrop Brook	Moderate	Moderate	Moderate by 2015 (achieved)	Good	Does not require assessment	Good by 2063
Bydemill Brook (Source to Thames)	Moderate	Moderate	Moderate by 2015 (achieved)	Good	Does not require assessment	Good by 2063
Watercourse	Ecological Quality			Chemical Quality		
	2015	2022	Objectives	2015	2022	Objectives
River Ray						

Ray (Wiltshire) (Lydiard Brook to Thames)	Moderate	Moderate	Moderate by 2015 (achieved)	Good	Does not require assessment	Good by 2063
Ray (Wiltshire) source to Lydiard Brook	Poor	Moderate	Good by 2039	Good	Does not require assessment	Good by 2063
Lydiard Brook	Moderate	Moderate	Good by 2027	Good	Does not require assessment	Good by 2063
Haydon Wick Brook	Moderate	Moderate	Good by 2027	Good	Does not require assessment	Good by 2063
River Cole Catchment						
Coln (from Coln Rogers and Thames (Coln to Leach)	Poor	Poor	Good by 2027 (not achieved)	Good	Does not require assessment	Good by 2063
Cole (Bower Bridge to Thames) including Coleshill	Moderate	Moderate	Moderate by 2015	Good	Does not require assessment	Good by 2063
Cole (Acorn Bridge to Bower Bridge)	Poor	Poor	Moderate by 2015 (not achieved)	Good	Does not require assessment	Good by 2063
Liden Brook	Poor	Poor	Moderate by 2015 (not achieved)	Good	Does not require assessment	Good by 2063
Cole (Source to Lenta Brook)	Poor	Poor	Good by 2039	Good	Does not require assessment	Good by 2063
Lenta Brook, East of Swindon	Good	Poor (2019)	Good by 2027	Good	Does not require assessment	Good by 2063
Watercourse	Ecological Quality			Chemical Quality		
	2015	2022	Objectives	2015	2022	Objectives

South Marston Brook	**Poor**	**Moderate (2019)**	**Good by 2027**	**Good**	**Does not require assessment**	**Good by 2063**
Tuckmill Brook and Tributaries	**Moderate**	**Poor**	**Moderate by 2015 (not achieved)**	**Good**	**Does not require assessment**	**Good by 2063**

5.7 Thames Water Asset Management Policy (2020)

5.7.1 The Asset Management Policy (reference number POLO96) by Thames Water was established in June 2020. In order to achieve their strategic ambitions, Thames Water propose to manage their assets in line their asset management system:

- *"Develop future asset strategies that optimise performance, risk and efficiency and provide best value for our customers, stakeholders and environment.*
- *Provide and deliver a high-performing, sustainable and efficient asset base to achieve our commitments, including net zero operational carbon by 2030, for the most effective whole life cost.*
- *Adopt a systems-thinking approach and take a long-term perspective on operational performance and investment across all business planning cycles.*
- *Provide resilient assets with high availability, driving down single points of failure and vulnerability.*
- *Act with intelligence using data from customers, operations and the environment, to make accurate and proactive business decisions that maximise productivity, minimise asset deterioration and improve the service we provide to our customers.*
- *Provide the resources needed to operate our asset management system and meet our objectives.*
- *Build and develop capable teams dedicated to servicing our customers and the environment.*
- *Comply with all legal and regulatory requirements and continue to prioritise health, safety and wellbeing and the environment throughout all our activities.*
- *Establish and adopt industry-leading processes, systems and capability in planning, science and engineering and integrated risk management.*
- *Measure and report progress on a regular basis, ensuring that the information is freely accessible and understandable.*
- *Drive continual improvement through innovation, digital enterprises, collaborative working with our stakeholders and partnerships and effective contract management."*

5.8 Water Cycle Study

5.8.1 The Swindon Water Cycle Study published in 2014 (Phase 2), provides an update to the 2007 Water Cycle Study (Phase 1) due to the significant changes in NPPF and environmental

legislation such as the Flood and Water Management Act of 2010. The study determines the extent to which growth can be supported by existing infrastructure.

5.8.2 In addition, it determines whether adequate water resources are available to meet forecast demand, the available capacity of existing drainage and Wastewater Treatment Works, and determination of watercourse capacity in surrounding areas due to additional water discharge without impacting water quality and biodiversity. As a result, the water cycle study assures that proposed developments have no negative impact on the current water cycle environment and that new water services infrastructure may be implemented using sustainable methods.

5.8.3 The key challenges raised from the study were uncertainty about the environmental capacity of water resources and uncertainty about the capacity of the river systems to accommodate an increase in treated effluent without initiating water quality concerns.

5.8.4 In terms of water services infrastructure, the study highlighted that Thames Water have an on-going programme of upgrades to water services infrastructure to keep up with development, specifically:

- *"Additional wastewater treatment improvements will be needed to provide capacity to 2026, and these will be included in Thames Water's PR19 for delivery in the period 2020 – 2026.*
- *A major wastewater network upgrade scheme is being delivered to provide strategic capacity in the main trunk sewer at the inlet to the treatment works. This scheme will provide capacity for all development planned to 2026 and will resolve local sewer flooding issues in the Cheney Manor and Rodbourne areas."*

5.8.5 A new SBC Water Cycle Study (WCS) has been produced in 2025 to identify the baseline water scenario and to provide advice on the broad strategy options being considered for the location of growth and on the sites coming forward for potential allocation in the new Local Plan.

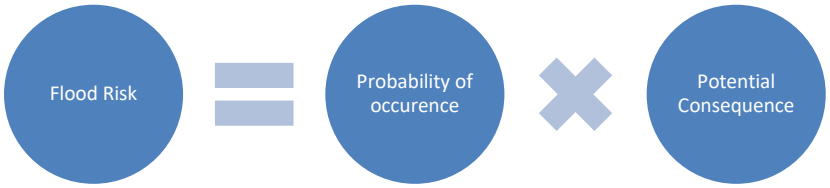
5.8.6 This Phase 1 Scoping Water Cycle Study follows the recent National Planning Policy Framework (NPPF) and Planning Practice Guidance (PPG) guidelines on water supply, wastewater and water quality. The objectives of this study are:

- To audit relevant and emerging national planning policy, guidance and other relevant studies and plans.
- To collect and analyse baseline information about the current water system with regards to water resources and supply systems, wastewater and treatment provision and capacity, water quality, and flood risk and surface water management.
- To identify any infrastructure, environmental or geographic constraints on development that should be considered when preparing the draft Local Plan.

6 Sources of Flood Risk

6.1 Sources of Flooding

6.1.1 The Flood and Water Management Act 2010 Paragraph 2(1) defines flood risk as a '***combination of the probability of the occurrence with its potential consequences***.'



6.1.2 The likelihood of flooding is typically expressed as a chance (e.g. a '1 in 100 chance of flooding in any given year') or as a probability (e.g. a 1% annual probability of flooding). A 1 in 100-year flood return period is also used to express this same event storm, but it should be noted that, this is still essentially a probability and therefore a 1 in 100-year flood has the same potential to occur in any given year.

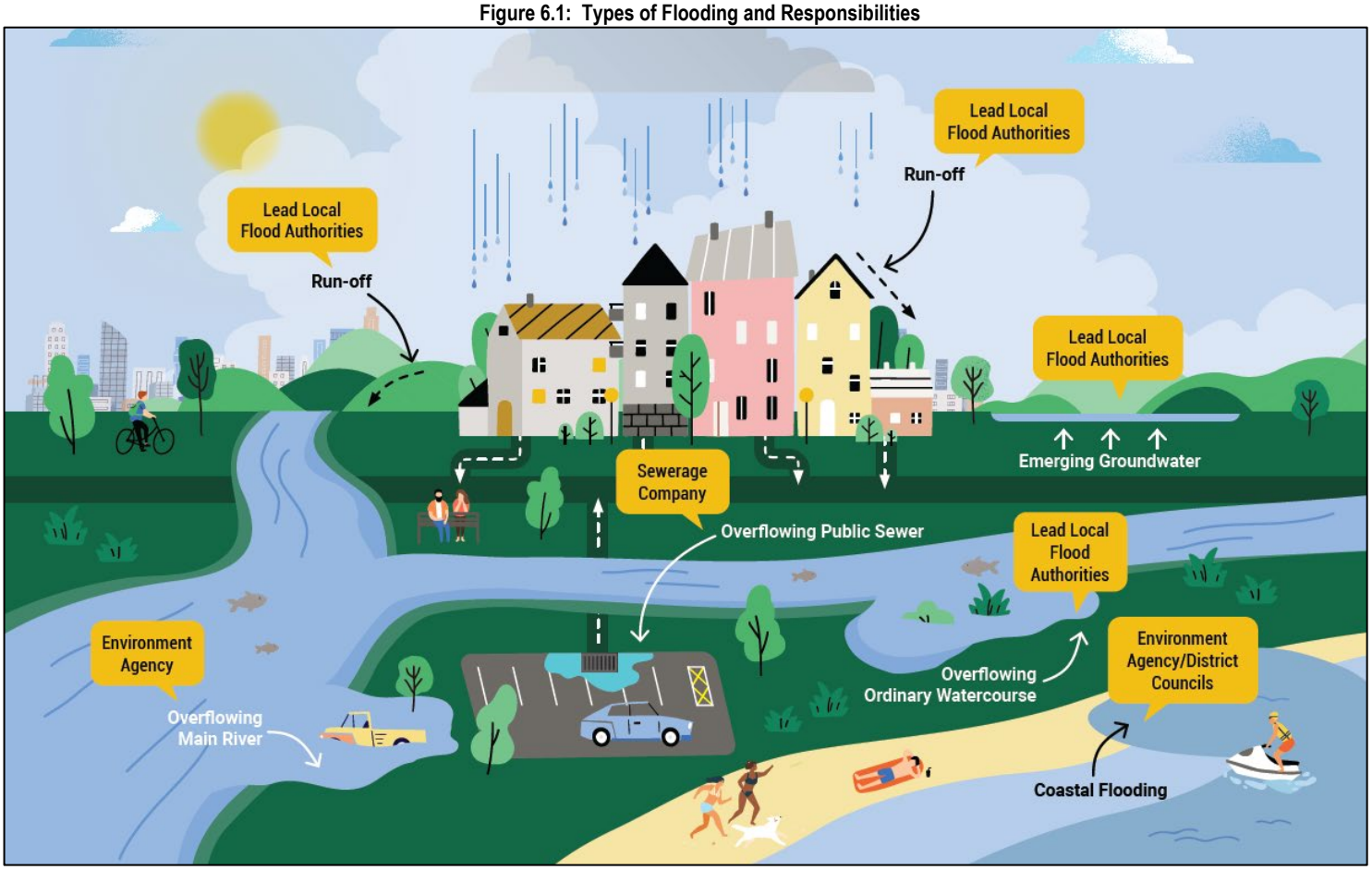
6.1.3 Ascertaining the source of any instance of flooding to an area is of importance as this can assist in (i) understanding why the area floods and (ii) identifying the most appropriate form(s) of mitigation to prevent or protect against such flooding in the future. This can be complicated where flooding occurs due to a combination of sources.

6.1.4 The main sources of flooding has been summarised in **Table 6.1** (**Figure 6.1** illustrates these types and associated responsibilities).

Table 6.1: Main Sources of Flooding

Flood Type	Source
Fluvial	River Thames, River Ray, River Cole, Haydon Wick Brook, Lydiard Brook and others, and ordinary watercourses
Surface water (pluvial)	Urban runoff Greenfield runoff
Tidal	Not applicable due to geographical location
Groundwater	Rising groundwater level
Flooding from Sewers	System exceeding capacity or burst water main
Artificial Sources	Reservoirs

Figure 6.1: Types of Flooding and Responsibilities



6.1.5 The geographical location of Swindon ensures that tidal flooding is not a risk to the area. However, all other sources listed above are potential concerns across the Borough and need to be taken into consideration for new development.

6.2 Fluvial (River) Flooding

6.2.1 Fluvial (river) flooding occurs, typically after a period of intense or heavy rainfall, when the volume of water being conveyed within a watercourse exceeds the capacity of the river channel.

6.2.2 Watercourses in England and Wales are designated under statute as either **'Main River'** or **'Ordinary Watercourse'.**

- The EA have permissive powers to undertake maintenance to main river watercourses which they have identified as key for the management of flood risk, and consent is required from the EA for any proposed works in the channel, over the bank, or within a specified distance from the edge of the channel (typically 8 metres, subject to local bylaws). As of April 2016, this consenting process has fallen within the Environmental Permitting Regulations system (EPR).

- All other watercourses are defined as ordinary watercourses and permissive powers to carry out works are held by the Lead Local Flood Authority (LLFA) or Internal Drainage Board (IDB).

6.2.3 The 'riparian landowner' owns the land or property next to a river, stream or ditch, which could be a main river or ordinary watercourse, and if their land boundary is next to a watercourse, it is typically assumed they own the land up to the centre of the watercourse. Riparian owners

are responsible for maintenance of the watercourse bed and banks and should keep the banks clear of anything that could cause an obstruction and increase flood risk.

6.2.4 The main river watercourses within Swindon Borough, and their respective catchment areas, are detailed in **Table 6.2**.

Table 6.2: Main River Catchment Areas

Watercourse	Location	OS Grid Reference	Approx. Catchment Area (square kilometres)
River Thames **Tributaries: Bydemill Brook, Share Ditch, Westrop Brook**	***Bydemill Brook (Thames splits into different branches)***	419,520m E, 196,820m N	4,630
River Ray **Tributaries: Haydon Wick Brook, Lydiard Brook**	***Confluence with Lydiard Brook***	412,220m E, 186,960m N	83
River Cole **Tributaries: South Marston Brook, Lenta Brook, Liden Brook**	***Confluence with Dorcan Stream***	419,880m E, 186,210m N	103

River Thames

Appendix A Figure 004A – River Thames – Catchment and Management Areas

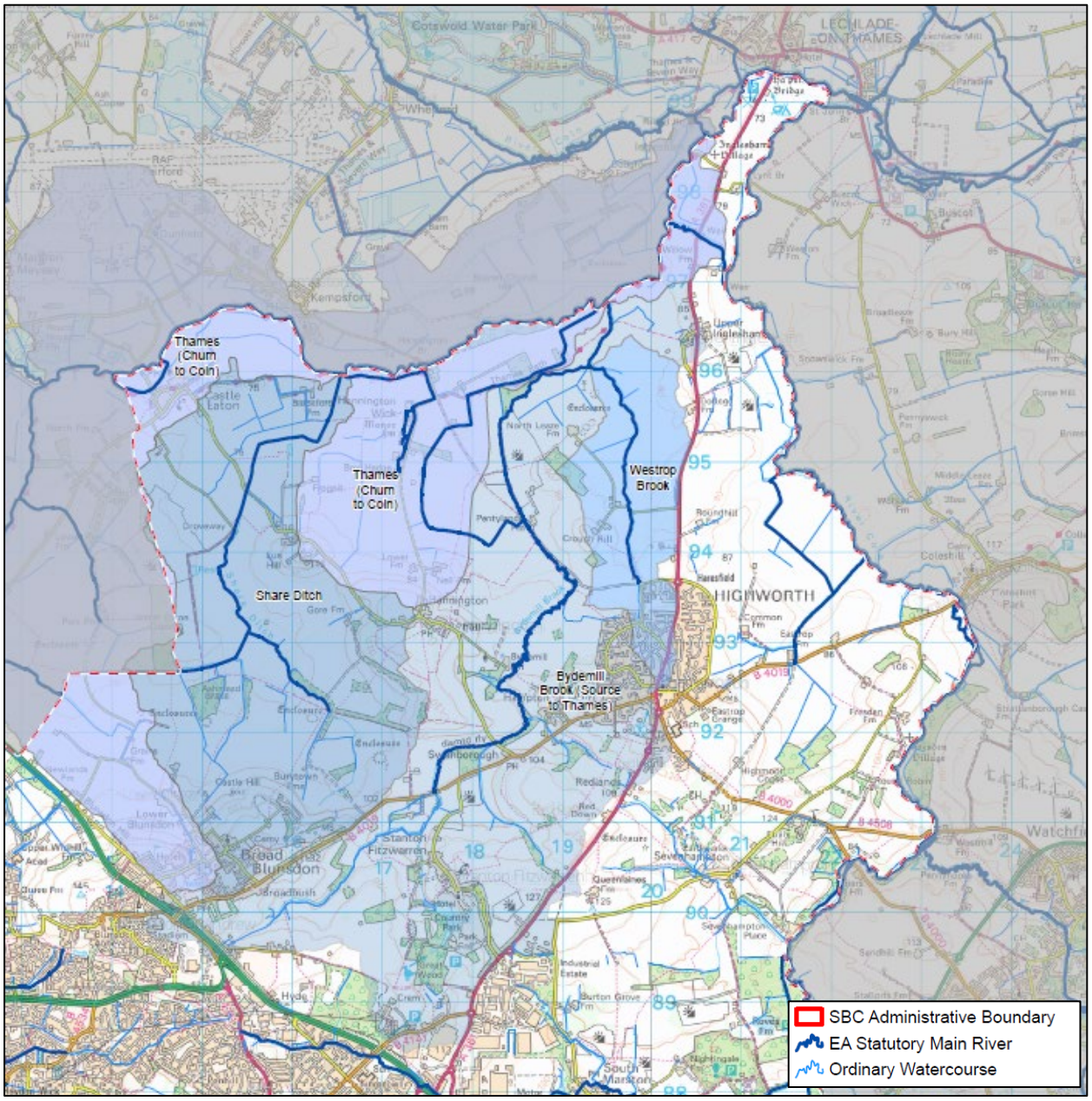
6.2.5 The River Thames flows eastward along the northern boundary of the Borough, passing through Castle Eaton before flowing north towards Lechlade as it leaves the Borough.

6.2.6 The two main tributaries of the Thames within the Borough – the River Ray and River Cole – flow north around the west and eastern flanks of the Borough respectively to discharge into the Thames, and they are discussed in detail in subsequent sections.

6.2.7 A map of the River Thames catchment and management area is displayed in **Figure 6.2**.

6.2.8 In addition to the Ray and Cole, the Thames is also served by a number of lesser tributaries that provide land drainage for the essentially rural area in the northern part of the Borough, to the north of Swindon town.

Figure 6.2: River Thames Catchment and Management Area (excl. Ray and Cole Catchments)



6.2.9 The Thames tributaries within the study area are detailed below:

Bydemill Brook

6.2.10 Bydemill Brook serves a rural catchment of 17km^2, rising to the north of Stratton St Margaret and flows from south to north, passing to the west of Highworth. The water body has an overall length of approximately 14km and joins the River Thames near the village of Upper Inglesham.

Share Ditch

6.2.11 The Share Ditch is a small watercourse in the north-west of the Borough, with a length of 5.5km, that drains the 12km^2 catchment of primarily arable land, north of Broad Blunsdon and up to the Thames, east of Castle Eaton.

Westrop Brook

6.2.12 Westrop Brook is a small watercourse, only 3km in length, that makes up a proportion of the physical border between Oxfordshire and Wiltshire.

6.2.13 The Brook's catchment collects water from the residential area of north Highworth, before running north through arable fields until it joins Bydemill Brook at Upper Inglesham.

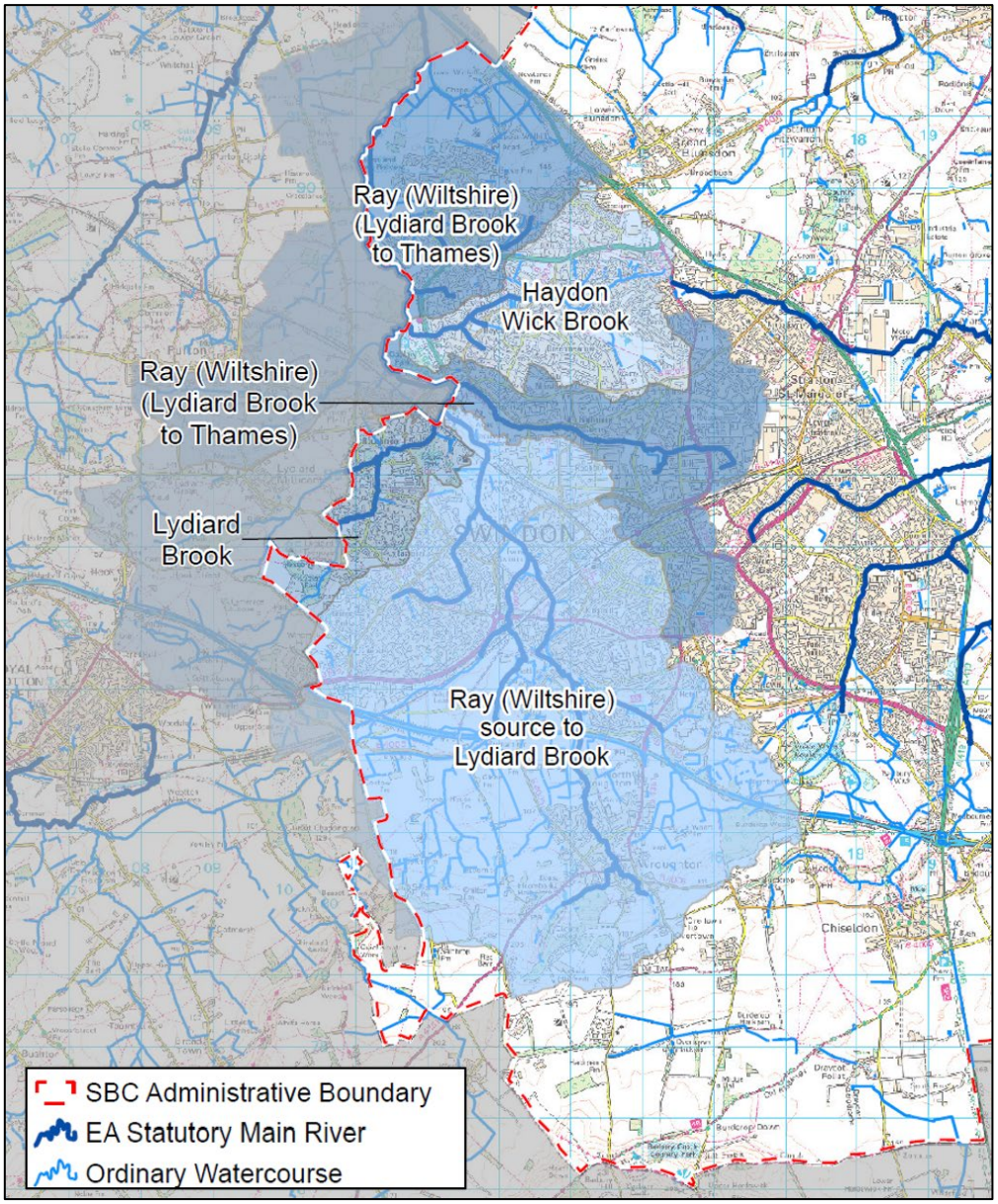
6.2.14 The water course is underlain by Oxford Clay formation for its whole length.

River Ray

Appendix A Figure 004B – River Ray – Catchment and Management Areas

6.2.15 The River Ray is a tributary of the Thames rising in the Wroughton area, south of Swindon, and flowing north around the western side of the Borough; see catchment displayed in **Figure 6.3**.

Figure 6.3: River Ray Catchment and Management Area



6.2.16 From Wroughton it flows north under the M4 and continues past the western side of Wichelstowe.

6.2.17 The Elcombe Brook flows into the River Ray, east of Mannington Recreation Ground, where the River Ray continues to travel in a northerly direction. The Wiltshire Wildlife Trust have carried out a 3 year restoration programme along this 1.2 km stretch of the river to create new meanders, banks, water meadows and riffles to improve the river habitat and encourage biodiversity.

6.2.18 The River Ray continues north, flowing to the west of Swindon via Shaw, where much of the catchment is urbanised. The river leaves the Borough at the boundary west of Stratton St Margaret.

6.2.19 The River Ray eventually joins the Thames, north of the Borough and east of Cricklade.

6.2.20 The main tributaries of the River Ray within the Borough are detailed below.

Haydon Wick Brook

6.2.21 Haydon Wick Brook is a small water course with a small catchment of approximately 6.7km^2. The precise location of the river source is unknown as much of the river has been built over.

6.2.22 The Brook flows from east to west, navigating its way around property boundaries in the area and as such it has an urban catchment.

6.2.23 The river continues to flow in a westerly direction until it eventually joins the River Ray in the west of the borough, and from then flows from south to north.

Lydiard Brook

6.2.24 Lydiard Brook is a small watercourse with a length of 5.7km and a catchment of 1,328 ha. The Brook rises west of the Borough in Greatfield, before collecting run-off from Lydiard Millicent and the M4 at Royal Wootton Bassett.

6.2.25 Lydiard Brook enters Swindon Borough through Lydiard Park Lake via a weir. The lake drains into the brook from the north, where it continues north towards west Swindon and through the residential area of Roughmoor and Peatmoor, passing through Peatmoor Lagoon (see **Section 6.4**).

6.2.26 The Brook continues to flow in a northerly direction before outfalling into the River Ray north of Sparcells, along the western boundary of the Borough.

Whitehill Stream

6.2.27 The Whitehill Stream/ Whitehill Brook is a tributary of the River Ray that flows north-west through south-west Swindon. It is identified as a main river from a park to the west of the Link Centre (ice rink), and it flows east, passing to the south of the Asda West Swindon complex and through the Westlea residential area.

6.2.28 It flows alongside the Westlea Playground area and then north between residential development, passing under the A4006 Mead Way and emerging into the Rivermead Skate Park. The watercourse continues north, passing alongside the Swindon Sewage Treatment Works and outfalling into the River Ray channel.

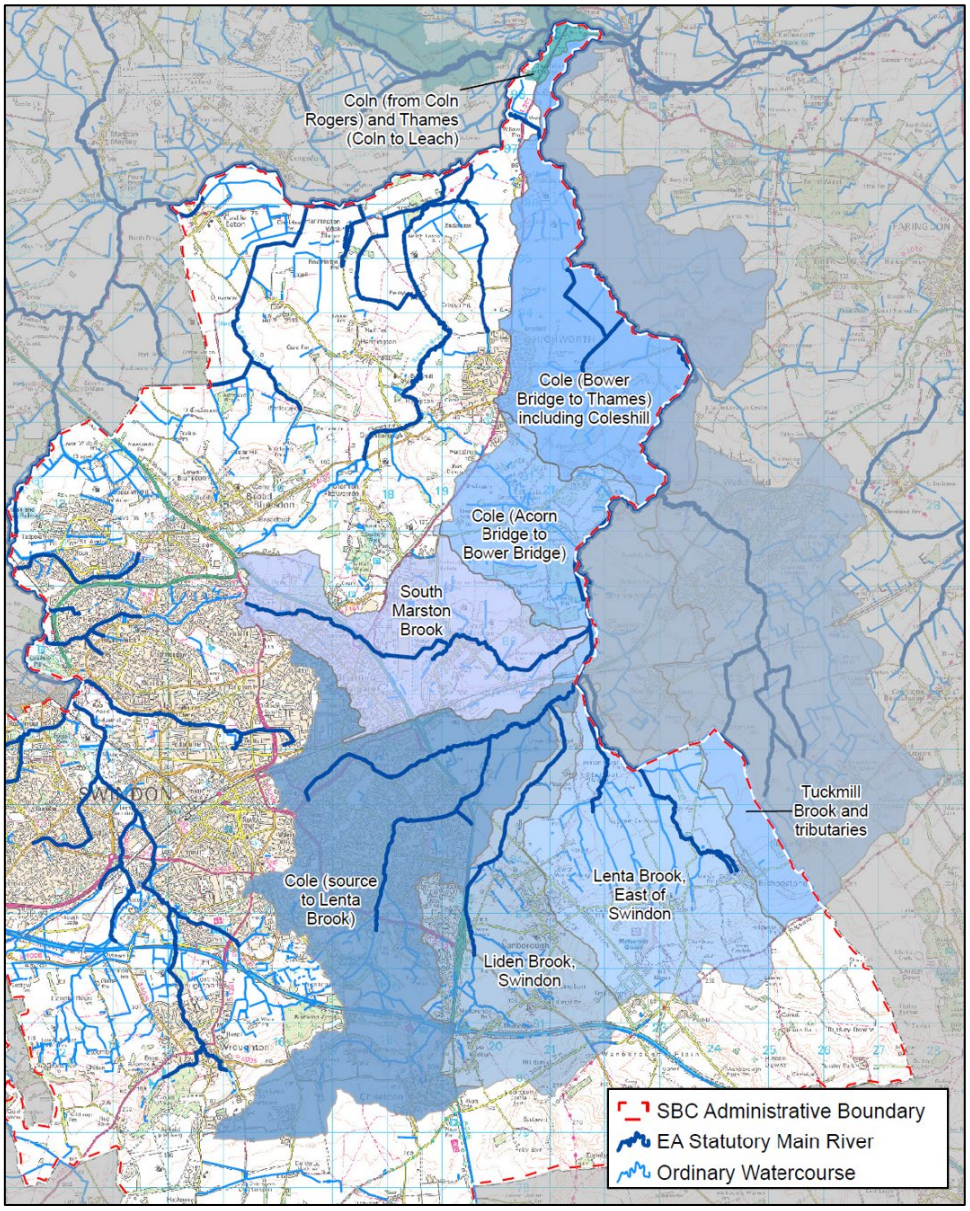
6.2.29 It is understood that there have been numerous instances of flooding from the Whitehill Stream due to channel capacity concerns and the proximity of residential development. Maintenance and enhancement works have been done by the EA (and local resident groups) to clear and improve the channel.

River Cole

Appendix A Figure 004C – River Cole – Catchment and Management Areas

6.2.30 The River Cole is a tributary of the River Thames, flowing around the eastern flank of the Borough and illustrated in **Figure 6.4**.

Figure 6.4: River Cole Catchment and Management Area



6.2.31 The south of the catchment is underlain by chalk and includes the escarpment of the Marlborough Downs, which reach over 250m AOD. The boundary of the chalk with the underlying impermeable clays forms the spring line where the source of the Cole and its tributaries originate. Extensive alluvium, underlain in places by valley gravels, is found within the valley bottoms indicating former floodplains.

6.2.32 The precise location of the source of the River Cole is unknown as much of the river's upper course has been culverted and built over, but the River Cole main river begins where the watercourse emerges from a culvert under the A4312 Drake's Way in Walcot East, near St Joseph's Roman Catholic College. There are two online flood storage areas in the upper reaches of the watercourse.

6.2.33 The watercourse flows north-east in a mainly open channel east of the Greenbridge Retail Park, then eastward along a green corridor on the north side of the B4006 Dorcan Way. From here it travels in an easterly direction at the Piccadilly Roundabout in the Nythe area, continuing alongside Covingham Road and passing beyond the established urban area under the A419 near Coleview.

6.2.34 It continues north-east through open fields south of the A420, merging with additional tributaries draining from the south and follows a path north through open farmland, forming the boundary between Wiltshire and Oxfordshire, and outfalls into the River Thames above Buscot Lock near Lechlade.

6.2.35 There has been a long history of management of the River Cole, the earliest example being the existence of a mill at Coleshill recorded in Domesday Book in 1086. Between 1930 and 1950 large-scale drainage of the floodplain took place enabling water meadows to be converted into high grade arable land.

6.2.36 The river was enhanced as part of a restoration project in the 1990s near Coleshill, by raising the riverbed to create natural flood meadows and floodplains, putting in meanders to recreate a natural environment and allowing the river to flow its natural course. In addition to reducing the problem of polluted waters, this restoration project has had benefits to the biodiversity, as well as reducing the flood risk by allowing flooding further upstream and in fields adjacent to the river.

6.2.37 In the 1970s and 1980s a series of Flood Storage Areas (FSAs) were constructed to reduce the frequency and extent of flooding, particularly of the agricultural land in the lower reaches. This exercise was largely undertaken as the result of the rapid urban development of Swindon. FSAs were constructed on the Dorcan Brook at Shaftesbury Avenue, Nythe, and Wanborough Road, and Coate Water was extended. Other FSAs were constructed on the Cole at Walcot and Stratton, and on the Liden near Moor Leaze.

6.2.38 The main tributaries of the River Cole within the Borough are detailed below.

Dorcan Stream

6.2.39 The Dorcan Stream (also known as the Dorcan Brook) is a tributary of the River Cole draining part of the south-eastern area of the Borough (Broom Manor, Coate and Dorcan) via a number of branches of ordinary watercourse which combine along its route.

6.2.40 The watercourse rises in the chalk at the southern part of the catchment, draining into Coate Water reservoir (discussed in **Section 6.4**). The reach designated as main river emerges from an overspill from the reservoir and flows around the eastern side of the car park, north of the water body, before merging with a second channel from the west.

6.2.41 It flows north within a green corridor between the areas of Park South and Eldene, merging with a third branch of the stream (draining the Badbury Park area) as it spills into the Shaftbury Lake nature/amenity area.

6.2.42 The watercourse emerges from the lake via a weir at its north end, and continues north through the Shaftbury Trail Park, before turning east. It continues through an open landscaped area before passing under the B4006 Dorcan Way and flowing past the Dorcan Academy. The watercourse continues north-east between Covingham and Dorcan, passing under the A419 and outfalling into the River Cole near Symmetry Park.

6.2.43 It is understood that the Dorcan Stream has the flashiest response (i.e. a very rapid rise and fall in river levels after heavy rainfall across the catchment) of the River Cole tributaries, based on anecdotal data and recorded flood level information.

South Marston Brook

6.2.44 South Marston Brook is a tributary of the River Cole, formed by two main tributaries which combine at South Marston and become the aforementioned Brook.

6.2.45 The main tributary is the 'Kingsdown Brook', which defines the route of the main river flowing east toward South Marston after it emerges from a culvert under the A4311 Cricklade Road in Penhill. It flows south-east through the Kingsdown and Stratton areas and east through the former Honda Plant towards South Marston.

6.2.46 The second tributary – an ordinary watercourse – flows south along the east side of the South Marston Industrial Estate into the village.

6.2.47 The combined channel flows in an easterly direction until it joins the River Cole at Acorn End.

6.2.48 The watercourse is a narrow channel, featuring a number of culverts and footbridges along its route, and catchment of Marston Brook is primarily rural as it runs through mainly agricultural land. The geology of the riverbed is predominantly composed of sandstone, with intermittent layers of clay.

6.2.49 A number of flood storage ponds are located along the length of the watercourse (to the east and north of South Martson village) and constructed in the early 1990s as mitigation to address historic flooding in the upstream catchment, but limited information is available regarding these features.

Liden Brook

6.2.50 The Liden Brook rises in chalk geology and flows north through the agricultural land on the east side of Swindon. It collects run off from the M4 at Medbourne and the A419 and continues to run north under Wanborough Road before joining the River Cole approximately 1km upstream of Acorn Bridge.

6.2.1 There is an offline Flood Storage Area separated from the river by the A419 road, with the inlet and outlet routes flowing through culverts to join the river.

6.2.2 The underlying geology of the riverbed consists of ZigZag chalk across the mudstone Gault Formation and onto Oxford Clay to the east of Dorcan.

Lenta Brook

6.2.3 The Lenta Brook is the most rural of the rivers in the Cole catchment, draining land in the south-eastern margins of the Borough. It rises at Bishopstone, collecting water from the hills of Wanborough and Hinton Parva. The river then winds in a north-west direction through agricultural fields where it joins the River Cole at Acorn Bridge.

6.2.4 The underlying geology of the Lenta Brook crosses a band of mudstone known as Gault Formation, before it reaches the clay of East Swindon.

6.3 Surface Water Flooding

Appendix C Figure 009 – Risk of Flooding from Surface Water Map

6.3.1 The Flood and Water Management Act (FWMA) defines surface water flooding as:

> *"The flooding that takes place from the 'surface runoff' generated by rainwater (including snow and other precipitation) which: (a) is on the surface of the ground (whether or not it is moving), and (b) has not yet entered a watercourse, drainage system or public sewer."*

6.3.2 The EA data provided in the 'Risk of Flooding from Surface Water' ('RoFSW') mapping has been produced from a combination of (i) the EA's national scale surface water flood mapping (updated in 2025), and (ii) appropriate locally produced mapping from SBC LLFA. These two sources have been combined with the aim to provide the best single source of surface water flood risk.

6.3.3 The latest mapping assesses flooding resulting from severe rainfall events based on the following three scenarios:

- 1 in 30 (3.3%) annual probability rainfall event;
- 1 in 100 (1%) annual probability rainfall event;
- 1 in 1000 (0.1%) annual probability rainfall event.

6.3.4 It should be noted that the national scale modelling does not take account of any specific local information on below-ground drainage infrastructure and infiltration, although a runoff co-efficient adjustment is included in urban areas to account for the impact of sewerage and a standard infiltration allowance based on soil type. As such, subject to the incorporation of the locally produced LLFA mapping, the modelling can only provide a guide to potentially vulnerable areas based on the general topography of an area.

6.3.5 Surface water flooding also includes flooding from drains and ditches. A number of ordinary watercourses within the Borough have been largely subsumed within the urban drainage system as a result of outward urban growth, and now are largely culverted for significant lengths. Trash screens and culverts have the potential to become blocked by plant debris and rubbish. These blockages can restrict the natural flow of water, subsequently increasing the risk of water exceeding its banks and flooding surrounding land. This may apply to some sections of the Haydon Wick Brook which is, in effect, a culverted water course.

6.3.6 The pathways of surface water flooding will be defined by the local topography. The modelling techniques used by the EA allow the surface water maps to pick out depressions in the ground surface and simulate flow along natural drainage channels, rivers, low areas in floodplains, and flow paths between buildings. Although the maps appear to show flooding from ordinary watercourses, they should not be taken as definitive mapping of flood risk as the conveyance effect of ordinary watercourses or drainage channels is not explicitly modelled. Also, structures (such as bridges, culverts and weirs) and flood risk management infrastructure (such as defences) are not represented.

6.4 Flooding from Impounded Bodies of Water (Reservoirs and Canals)

Appendix C Figure 011 – Reservoir Flood Map

6.4.1 Impounded bodies of water, in either a section of canal elevated above adjacent ground or in a reservoir, present a residual flood risk as a breach could occur in the retaining structure. The failure of such a structure has the potential to cause catastrophic damage due to the sudden release of large volumes of water.

6.4.2 The safety record for reservoirs in the UK is very good and the EA ensure the enforcement of the Reservoirs Act 1975 in England and Wales. A 'reservoir' of water is defined under The Reservoirs Act as such if "***it is designed to hold, or capable of holding, more than 25,000 cubic metres of water above the natural level of any part of the land adjoining the***

reservoir", and the Act states that all large reservoirs must be inspected and supervised by reservoir panel engineers, and it is assumed that that these reservoirs are regularly inspected with essential safety works carried out, in order to present reservoirs as a managed risk.

6.4.3 SBC works with members of the Local Resilience Forum (LRF) in order to develop emergency plans for reservoir flooding and ensure that communities are prepared. The reservoirs within the Borough are as listed in **Table 6.3** overleaf and discussed below.

Table 6.3: Statutory Reservoirs within Swindon Borough

Reservoir	Location/ Postcode	OS Grid Reference	Approx. Volume (m^3)
Coate Water Reservoir (and Nature Reserve)	**South-East Swindon** **SN3 6AA**	417,550m E, 182,500m N	527,000 (main reservoir) 105,000 (Nature Reserve)
Peatmoor Lagoon	**Peatmoor, West Swindon** **SN5 5UX**	411,550m E, 186,350m N	46,500
Stanton Park Reservoir	**Stanton Country Park (North Swindon)** **SN6 7SF**	417,750m E, 189,900m N	42,000
Whitehill Flood Storage Area	**Rivermead/Westmead (West Swindon)** **SN5 7SW**	412,600m E, 185,400m N	47,400

Coate Water Reservoir

6.4.4 Coate Water Reservoir is a large 56 acre reservoir that can hold approximately 527,000 m^3 of water, located approximately 3.6km south-east of the centre of Swindon town (OS grid reference 417,600m E, 182,150m N) – see **Figure 6.5.**

Figure 6.5: View across Coate Water Reservoir

6.4.5 Coate Water Reservoir was built in the early 1820's by diverting the River Cole, with the original purpose of providing water for the Wilts and Berks Canal – however, the canal was abandoned in 1914 and as a result the reservoir was opened to the public for recreational use and as a nature reserve.

6.4.6 In order to protect the wildlife and flora, the south-eastern part of the water body is set aside as a nature reserve, and most of the surrounding site has been declared a Site of Special Scientific Interest (SSSI).

Peatmoor Lagoon

6.4.7 Peatmoor Lagoon is located approximately 3.6km north-west of the centre of Swindon town, adjacent to the western boundary of Shaw Forest Park (OS grid reference 411,470 E, 186,320 N).

6.4.8 The lake was created in 1986 with the combined purpose of flood control and wildlife habitat/recreation. The lagoon is stream-fed by Lydiard Brook, the branches of which flow into the lagoon from the south and west and exit via a control structure located at the eastern end of the waterbody.

6.4.9 It is noted that risk arising from a failure of Peatmoor Lagoon is not included in the current EA reservoir flood extent outputs. It is understood this is being undertaken in a current phase of work and therefore the online EA mapping should be reviewed in the absence of this data.

Stanton Park Reservoir

6.4.10 Stanton Park Reservoir is situated in a 36ha parkland owned by SBC near Sevenhampton, approximately 5.6km north-east of Swindon town centre (OS grid reference 417,750m E, 189,950m N)

6.4.11 South Marston Brook flows into the south of the reservoir via a sluice gate before draining out of the reservoir via another sluice gate, north of the reservoir.

Whitehill Flood Storage Area

6.4.12 The EA reservoir flood mapping includes the impacts in the failure of the Whitehill Flood Storage Area; a statutory reservoir operated by Thames Water that was constructed in 1980 in order to alleviate flooding along the Whitehill Stream, a main river tributary of the River Ray that flows north-east through the Eastleaze and Westleaze area and past the Swindon Sewage Treatment Works.

6.4.13 The reservoir is formed by an earth bund, approximately 380m long, running along the upstream side of an old railway embankment. The Whitehill Stream flows through the area and through a culvert in the centre of the embankment, such that in flood conditions the capacity of the 675mm culvert is exceeded, resulting in a throttle that serves to build up temporary storage behind the embankment and therefore limit the discharge to the main River Ray channel.

6.4.14 The height of the bund is approximately 3m (similar to the railway embankment), with a crest level identified at 91.84m AOD – although the maximum level in the reservoir is controlled by the spillway above the culvert, which it approximately 91.48m AOD. It covers a surface area of approximately 61,300m^2.

Wiltshire and Berkshire Canal

6.4.15 The Wiltshire and Berkshire ('Wilts and Berks') Canal was opened in 1810, with 52 mile route linking the Kennet and Avon Canal at Semington with the River Thames at Abingdon. The original canal was established to provide a commercial route for transport.

6.4.16 This was extended with the construction of North Wilts branch, running a further 8 miles to merge and connect the Wilts and Berks Canal with the Thames and Severn Canal at Cricklade in 1821.

6.4.17 In 1914, the Wilts and Berks Canal was abandoned. Subsequently, much of the canal became damaged, unnavigable and in a state of disrepair, with sections of the Canal filled in and built over.

6.4.18 The Wilts and Berks Canal Amenity Group was set up in 1977 with the aim to restore the canal and since, several locks and bridges have been restored and significant stretches of the canal have been rewatered. This strategic objective has been further strengthened by the Wiltshire, Swindon and Oxfordshire Canal Partnership, consisting of over 20 bodies – local councils (including SBC), Thames Water, Natural England, canal trusts and other bodies – with the aim to create a sustainable, accessible and desirable area for people and wildlife.

6.4.19 The original route of the Wilts and Berks Canal ran through the Wichelstowe area. Development throughout Swindon has provided an opportunity to restore and construct stretches of the Canal. Wichelstowe Canal provides an extension of the Wilts and Berks Canal and is located on the southern edge of Swindon. Alongside development, the current stretch of canal at Wichelstowe will be extended to eventually connect with the canal already constructed in East Wichel.

6.4.20 The restoration of the Wilts and Berks Canal provides considerable benefits:

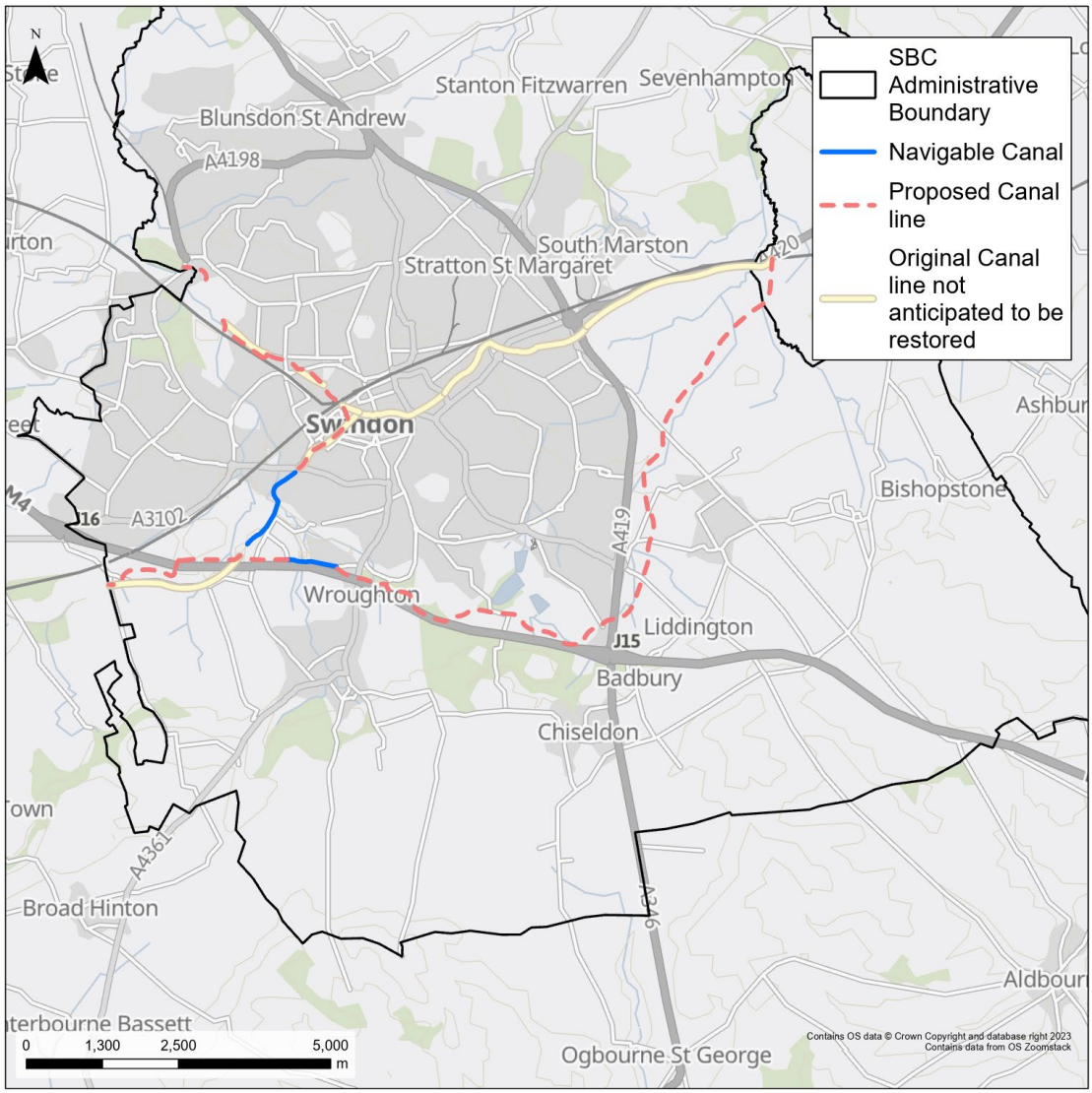
- Excess of £250 million per annum of recurring economic benefits has been identified by the Wilts and Berks Canal Trust, along with £45 million of one time benefits once the entire canal restoration project has been completed.
- There is a positive effect to social, health and wellbeing factors as the restored canal towpaths provide an area for exercise and recreation.
- Environmental benefits include an increase in biodiversity and wildlife, with improvements along canal corridors improving habitats.

- The great length of the Swindon canal, at 25.4km, improves connectivity throughout the Borough. The towpath provides a connection between many residential areas, workplaces, shops, schools and sports facilities.

- In some areas of the Borough, Swindon has been known to have issues with drainage and flooding. The restoration of the canal provides an opportunity to mitigate some of the effects. Flood risk can be reduced at the source, with surface water drainage and excess stream flow taken into the canal system to be safely stored or routed downstream.

6.4.21 Future ambitions for the Canal as proposed by the Wiltshire and Berkshire Canal Trust are to take the mainline of the Canal to the south of Swindon town, to merge with the original canal route west of Shrivenham. The new section of canal constructed in East Wichel has been designed with the intention to bring the Canal back through central Swindon and continue northwards to carry on along the route of the North Wilts Canal.

Figure 6.6: Canal Location within Swindon Borough- information obtained from Wilts and Berks Canal Interactive Map (2021)



6.4.22 As a general point, the canal is typically at existing ground level and as such would not provide a risk of flooding in a potential breach.

6.5 Groundwater Flooding

Appendix C Figure 010 – Susceptibility To Groundwater Flooding Map

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

6.5.2 Groundwater flooding typically occurs in low lying areas that are underlain by permeable rock and aquifers that allow groundwater to rise to the surface via permeable subsoil following long periods of intense wet weather.

6.5.3 The susceptibility of an area to groundwater flooding/emergence is highly dependent on the underlying geology of the area, as discussed in **Section 2.4**, as well as the topography. For instance, low lying areas may be more susceptible to the risk of groundwater flooding, due to the shallower water table depth combined with the groundwater paths which tend to flow from high ground to low ground.

6.5.4 Swindon lies on the boundary of the River Thames river basin to the north and South Downs chalk aquifer catchment to the south. Within the Thames Basin, the Chalk Group forms the most important aquifer, supplying water for drinking water consumption, as well as supporting river flows. The southern areas of the Borough are situated within the South Downs Chalk aquifer, which is typically susceptible to groundwater flooding. However, only a small southern area of Swindon Borough lies within the chalk strata. As a result, the risk from groundwater flooding is typically considered to be low.

6.5.5 Where a potential risk of groundwater is identified, it may be appropriate to manage the risk by suitable waterproof sealing of any low level/basement areas (i.e. water resisting construction in accordance with CIRIA Report 139 Table 2.3), appropriate drainage and/or the raising of entry thresholds to mitigate possible damage. The adopted design will need to ensure that it does not result in any worsening to the risk posed to adjoining properties.

6.5.6 Another consideration with respect to groundwater is the effectiveness (or otherwise) of SuDS. The design of proposed developments should carefully consider the impact that raised groundwater levels may have upon the operation of SuDS during periods of heavy rainfall.

6.6 Sewer Flooding

Appendix C Figure 017 – Thames Water DG5 Sewer Flooding Records

6.6.1 Sewer flooding can occur where sewage is unable to drain away in sewerage pipes and emerges at the surface.

6.6.2 There are generally three types of sewer in a drainage network:

- **Foul sewers** – these are designed to convey wastewater only from connected properties.
- **Surface water sewers** – these are designed to convey rainwater only arising in storm conditions where the rainwater is from roofs, yards and highways which are legitimately connected to the surface water sewers.
- **Combined sewers** – these are normally in the older parts of towns where wastewater and surface water is conveyed in the same pipe.

6.6.3 Sewer flooding occurs when the drainage network becomes overwhelmed and surcharges or cannot manage the volume of water entering the system. This occurs during heavy rainfall or if

the sewer is under capacity. Water then emerges from the sewer causing flooding. Sewer flooding can also occur due to blockages or failure to the system; or when outfalls are surcharged owing to the sea levels.

6.6.4 Sewer flooding can be aggravated by groundwater flooding which gets into the systems as either emerging as surface water that enters through gullies or through infiltration through damaged pipes.

6.6.5 Water companies are required to record all instances of internal flooding of properties. These are categorised on their cause, either hydraulic overloading of the sewers (the sewer pipe is too small or at too shallow a gradient) or other causes (blocked or collapsed sewers, pumping station failure, etc.). In addition, the companies are required to maintain a register of properties which are at risk of internal flooding due to hydraulic overloading, and this is usually known as the ‘DG5 at risk register’.

6.6.6 Thames Water were contacted as part of the SFRA update to obtain their DG5 records across the Swindon area, and these are shown in Figure 017.

7 Flood Defences

7.1.1 Flood defences are measures that help to prevent an area or property/properties from flooding in a severe flood event.

7.1.2 Such defences can be either a 'formal' defence – i.e. specifically constructed for the purpose – or provide a natural function as a de-facto defence due to the characteristics of an area (e.g. a raised embankment or wall).

7.1.3 Flood defences can be either 'hard engineered' defences, such as raised walls, or 'soft engineered' measures which utilise the natural environment to provide mitigation, such as flood attenuation basins or green corridors which provide a conveyance function in time of flood.

7.1.4 The maintenance of flood defences is the responsibility of the riparian owner, but the EA retain permissive powers to carry out flood defence works or maintenance on main river watercourses.

7.1.5 The EA Flood Zone maps indicate the presence of flood defences as a black hatched area ('areas benefitting from flood defences'). The spatial flood defences are located along the majority of the 3 main water bodies, the River Cole, River Ray and the River Thames.

7.1.6 Under Section 21 of the FWMA, a LLFA has to establish and maintain a register of structures which have an effect on flood risk and must keep a record of information about each structure (to include ownership, state of repair etc.). This register allows members of the public to identify significant flood risk assets managed by them as private individuals or partner organisations in their locality.

8 Impacts of Climate Change

8.1 Climate Change Impacts

8.1.1 It is now widely accepted that human activities are leading to climate change of a scale and pace that could significantly impact our lives and those of future generations. Burning of fossil fuels since the 1800s has led to a 40% increase in the level of carbon dioxide in the atmosphere. Evidence has shown that the high levels of carbon dioxide and other greenhouse gases in the atmosphere is a leading cause of increasing global temperatures. The average global temperature is now approximately 1°C higher than the 1850 – 1900 average.

8.1.2 The UK Climate Projections (UKCP) provides the most up-to-date assessment of how the climate of the UK may change in the future. UKCP is a climate analysis tool within the government funded Met Office Hadley Centre Climate Programme. The most recent climate projections were released in 2018 (UKCP18), replacing the previous 2009 release (UKCP09).

8.1.3 The UKCP18 observations of current climate show evidence consistent with the expected effects of a warming climate, alongside considerable natural annual to multi-decadal variability. All of the top ten warmest years for the UK, in a series from 1884, have occurred since 2002. The 21st century so far has been warmer than the previous three centuries. Alongside warmer temperatures, winters and summers have also been wetter, although these patterns are potentially within long-term historic natural variability bounds.

8.1.4 The UKCP18 future climate projections indicate warming across all areas of the UK, especially during summer. The temperature and duration of hot spells during summer months will increase. Rainfall patterns will remain variable, but there will be future increases in the intensity of heavy summer rainfall events despite drier summers overall. All future projections also indicate an increase in winter rainfall, although varying between simulation details.

8.1.5 Therefore, it is anticipated that climate change will lead to an increase in the intensity and frequency of extreme weather events, including both summer and winter floods.

8.2 Policy Requirements

8.2.1 The Climate Change Act (2008) as defined in Chapter 3 requires the Local Plan to support the government's 2050 net zero emissions target, to assess the potential impacts of climate change on flood risk, and to identify adaptation and mitigation policies and tools for the new Local Plan.

8.2.2 There are a number of local council policies, strategies and projects that are also working towards meeting the Climate Change Act requirements. This includes Swindon Net Zero Emissions Action Plan 2023, which focuses on the actions required to reduce GHG emissions and enabling actions which once completed, should identify further opportunities to reduce GHG emissions which can either be implemented within existing operations or may be subject to securing new sources of funding. As part of this action plan, Swindon Borough Council strive to support the community on the journey to achieve net zero greenhouse gas emissions by 2050. Progress since July 2021 on projects most relevant to mitigating against flood risk include:

- *"planting around 51,500 new trees across the Borough, including 18 sites in the Great Western Community Forest area."*

8.3 Climate Change Guidance

8.3.1 It is necessary to fully consider the potential impacts of climate change over the lifetime of new development. The EA specify what allowances should be made for climate change in strategic

and site-specific flood risk assessments[2]. The guidance is updated periodically and should be referred to directly when preparing site-specific flood risk assessments. The information presented here was correct at time of writing, referencing the guidance last updated in May 2022, with the guidance for peak river flows and peak rainfall intensity currently based on the UKCP18 climate projections.

8.3.2 The guidance includes allowances for the impacts of climate change on peak river flows, peak rainfall intensity, sea level rise, offshore wind speed and extreme wave height. As Swindon Borough is not affected by tidal flooding, this report considers impacts on peak river flows and peak rainfall intensity only.

8.3.3 In considering flood risk to new development, it is necessary to fully consider the potential impacts of climate change for the lifetime of the development within the mitigation measures. The 'design life' can vary due to the specific nature or requirements of a proposed development (justification for which should be set out in a site-specific FRA), but the generally accepted approach is to assume the following:

- **Residential use – 100 years**
- **Commercial/industrial use – 60 years**

8.3.4 The potential for increased flood probability as the result of possible climate change will need to be taken into account in the consideration of mitigation measures – for example, in terms of the minimum floor levels, impacts on floodplain storage capacity and flow routes, and on the management of surface water runoff.

8.4 Peak River Flow

Appendix C Figure 013 – Modelled Flood Extents (Climate Change)

8.4.1 The peak river flow allowances provide a range of allowances based on percentile (i.e. the degree of certainty of an event occurring, based on the range of climate change scenarios assessed through scientific investigations). The applicable values for a Site are dependent on the 'River Management Catchment' in which the site is located, which can be confirmed via the online mapping tool embedded within the guidance.

8.4.2 The peak river flow allowances provide a range of scenarios based on percentile (i.e., the degree of certainty of an event occurring, based on the range of climate change scenarios assessed through scientific investigations). The provided allowances are subject to the sub-catchments of river basin district (known as management catchments) and the vulnerability classification of the proposed use of the site.

8.4.3 The Central allowance is identified as the design standard for most forms of proposed development in all appropriate Flood Zones (the exception being 'Essential Infrastructure' which requires the 'Higher Central' value). In accordance with the PPG, the peak Central and Higher Central river flow allowances to be considered across Swindon Borough, within the 'Gloucestershire and Vale Management Catchment', as detailed in the following **Table 8.1 and Table 8.2:**

[2] Flood Risk Assessments: Climate Change Allowances Guidance

Table 8.1: Climate Change - Peak River Flow - Central Allowance

River Management Catchment	Central Climate Change Allowance - Epoch		
	2020s	2050s	2080s
Gloucestershire and Vale Management Catchment	+11%	+11%	**+26%**

Table 8.2: Climate Change - Peak River Flow - Higher Central Allowance

River Management Catchment	Higher Central Climate Change Allowance - Epoch		
	2020s	2050s	**2080s**
Gloucestershire and Vale Management Catchment	+17%	+19%	**+41%**

8.4.4 The Upper End allowances for the area are provided in **Table 8.3** for information only. The 'Upper End' allowance is referenced in the PPG as being potentially applicable in Nationally Significant Infrastructure Projects ('NSIPs') – i.e. major infrastructure schemes such as major roads, power stations etc – where a 'credible maximum scenario' should be considered.

Table 8.3: Climate Change - Peak River Flow - Upper End Allowance

River Management Catchment	Upper Climate Change Allowance - Epoch		
	2020s	2050s	**2080s**
Gloucestershire and Vale Management Catchment	+33%	+43%	+84%

8.4.5 These climate change flood extents have been used by SBC when considering flood risk to sites put forward for allocation based on the appropriate criteria – i.e. 'More Vulnerable' proposed residential development in Flood Zone 2 needs to consider the impact of the Central (+26%) and consider the feasibility of such development based on the flood risk constraints. See details of available modelling and modelled scenarios in **Section 3.8.**

8.5 Peak Rainfall

8.5.1 The potential increase in peak rainfall intensity needs to be considered in the surface water drainage strategy for new developments.

8.5.2 The EA climate change allowances guidance was updated in May 2022 to include a GIS based 'peak rainfall allowances' map showing the anticipated changes in rainfall intensity based on river management catchment. The anticipated changes in peak rainfall intensity in small catchments (less than 5km^2), or urbanised drainage catchments are summarised in **Table 8.4** and **Table 8.5**.

Table 8.4: Climate Change – Peak Rainfall Intensity Allowances – 2050s Epoch

Gloucestershire and Vale Management Catchment	**Total potential change anticipated** (2050s epoch – i.e. development lifetime up to 2060)	
	Central	***Upper End***
3.3% (1 in 30-year) rainfall	***20%***	***35%***
1% (1 in 100-year) rainfall	***20%***	***40%***

Table 8.5: Climate Change – Peak Rainfall Intensity Allowances – 2070s Epoch

Gloucestershire and Vale Management Catchment	**Total potential change anticipated** (2070s epoch – i.e. development lifetime 2061 to 2125)	
	Central	***Upper End***
3.3% (1 in 30-year) rainfall	***25%***	***35%***
1% (1 in 100-year) rainfall	***25%***	***40%***

8.6 Impacts of Climate Change on Groundwater Flood Risk

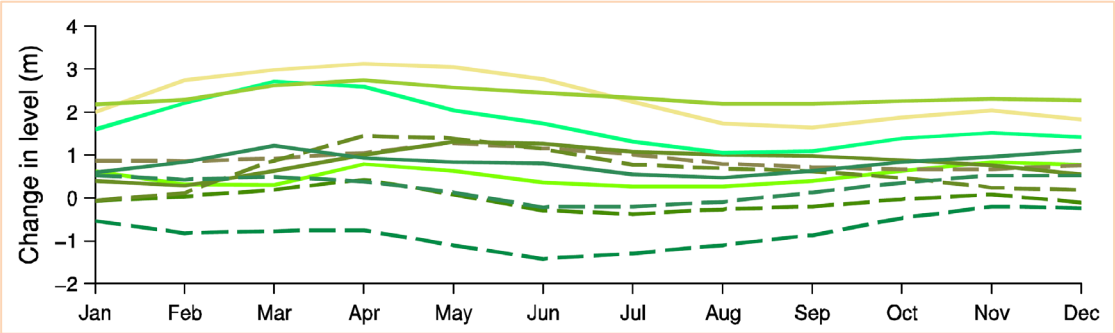
8.6.1 The relationship between climate change and groundwater flood risk is complicated and poorly understood. The Environment Agency do not currently provide guidance on what allowances should be adopted. Much of the research on the impacts of climate change on groundwater levels has focussed on groundwater recharge for water resources purposes, rather than flood risk assessment.

8.6.2 The Future Flows and Groundwater Levels project was carried out in 2010 – 2012, to assess the impact of climate change on water availability, river flows and groundwater levels, based on UKCP09 climate projections. The outputs included an 11-scenario plausible ensemble projection of monthly groundwater levels at 24 borehole locations. Considering all 11 ensemble members (all plausible scenarios) together accounts for some climate change uncertainty.

8.6.3 The simulations indicated that the groundwater recharge season (typically September to April) could be reduced to 3 – 4 months, during which more recharge could occur over a shorter period, leading to flashy responses in groundwater levels. Higher winter river levels could also increase groundwater levels in adjacent river gravel aquifer systems. Although the potential for higher peaks in groundwater level increases under many of the scenarios, results are not uniform and show a wide range of potential outcomes (please see **Figure 8.1**).

8.6.4 **Figure 8.1** shows projections for the Rockley borehole, approximately 5 km to the south of the Swindon administrative boundary, which is the nearest modelled location to Swindon. Each green line represents the change in level between future (2041 – 2070) and control (1961 – 1990) simulated levels at Rockley, for a climate change scenario. Due to this uncertainty, it is not possible to provide absolute climate change allowances for groundwater flood risk at present.

Figure 8.1: Climate Change Impacts on Groundwater Levels



9 Planning & New Development Considerations

9.1 Definition of NPPF Flood Zones

Appendix C Figure 008 – Flood Zone Map

Appendix C Figure 014 – Flood Zone 3b 'Functional Floodplain'

9.1.1 Flood Zones are defined in Table 1 of the NPPF PPG 'Flood Risk and Coastal Change' section and are based on the probability of river and sea flooding.

9.1.2 The online EA Flood Zone map ('Flood Map for Planning (Rivers and Sea)') provides an initial indication of the impacts at a level, and this should be refined where appropriate as part of a site-specific FRA, based on detailed ground level survey and modelled flood levels.

9.1.3 The Flood Zones are defined as follows:

Table 9.1: Definition of Flood Zones

Flood Zone	Map Colour ('Flood Map for Planning')	Definition
Flood Zone 1 'Low Probability'	***Unshaded***	Land having a less than 1 in 1,000 (0.1%) annual probability of river or sea flooding
Flood Zone 2 'Medium Probability'	***Light Blue/Cyan***	Land having between a 1 in 100 and 1 in 1,000 (1% - 0.1%) annual probability of river flooding; or Land having between a 1 in 200 and 1 in 1,000 (0.5% - 0.1%) annual probability of sea flooding
Flood Zone 3a 'High Probability'	***Dark Blue****	Land having a 1 in 100 (1%) or greater annual probability of river flooding; or Land having a 1 in 200 (0.5%) or greater annual probability of sea flooding
Flood Zone 3b 'Functional Floodplain'	***Dark Blue****	Land where water from rivers or the sea has to flow or be stored in times of flood

** - EA Flood Zone map (Flood Map for Planning) does not distinguish between Flood Zone 3a and 3b; rather it shows a Flood Zone 3 area that comprises both Flood Zones 3a and 3b.*

9.1.4 The Flood Zones do not take account of the presence of defences, except when defining the extent of Flood Zone 3b 'Functional Floodplain'. The Flood Zones also do not take the potential impacts of climate change into account.

9.1.5 As the definitions in **Table 9.1** confirm, Flood Zones 1, 2 and 3a are strictly defined by an assessment of probability. The definition of Flood Zone 3b is more subjective; this Zone is identified by Local Authorities, in consultation with the EA, taking account of local circumstances rather than being defined solely on rigid probability parameters.

9.1.6 The starting point for considering and identifying Flood Zone 3b is as follows:

- Land which would naturally flood with an annual probability of 1 in 30 (3.3%) or greater, with any existing flood risk management infrastructure operating effectively (i.e. based on the 'defended scenario' hydraulic modelling); or
- Land which is designed to flood (such as a flood attenuation scheme) even if it would only flood in more extreme events (such as 1 in 1000 (0.1%) annual probability of flooding).

9.1.7 The consideration of Flood Zone 3b should therefore take into account the effects of defences, natural topography and other flood risk management infrastructure which may prevent regular flooding. Areas which are prevented from doing so by existing defences, infrastructure or solid buildings, will not normally be considered as Functional Floodplain.

9.1.8 Flood Zone 3b is based on the 1 in 30 annual probability flood extent (where available) – both fluvial and from surface water flood mapping – as follows:

- **Where detailed river modelling is available**: Flood Zone 3b should be based on the 1 in 30 annual probability flood event (if available); if unavailable then the 1 in 20 annual probability floodplain should be used as a proxy;
- **Where no detailed river modelling is available:** Flood Zone 3b should be based on the extent of Flood Zone 3, until such time that detailed modelling of the 1 in 30 annual probability flood event is available.
- **The 1 in 30 annual probability surface water flood extent** from the Risk of Flooding from Surface Water dataset.
- The extent of any **flood alleviation schemes or reservoirs** within the Borough.

9.1.9 For any proposed development potentially impacted, it is incumbent on the developer to assess the potential impact of the 1 in 30 annual probability floodplain across the site, via either a remodelling exercise or incorporation of an appropriate allowance above the modelled 1 in 20 annual probability flood level.

9.1.10 Final consideration of whether a site is Flood Zone 3b should be made by the Council on a site-specific basis and according to local circumstances.

9.2 Residual Risk of Flooding

9.2.1 It is essential that the risk of flooding is minimised over the lifetime of the development in all instances. It is important to recognise however that flood risk can never be fully mitigated, and there will always be a residual risk of flooding. This residual risk is associated with a number of potential risk factors including (but not limited to):

- A flooding event that exceeds that for which the local drainage system has been designed;
- The residual danger posed to property and life as a result of flood defence failure; and,
- General uncertainties inherent in the prediction of flooding.

9.2.2 The modelling of flood flows and flood levels is not an exact science; therefore, there are inherent uncertainties in the prediction of flood levels used in the assessment of flood risk. The adopted Flood Zones are largely based upon detailed river modelling within the Borough. Whilst these provide a robust depiction of flood risk from a strategic perspective, all detailed modelling requires the making of core assumptions and the use of empirical estimations. The broad-scale nature of the models means that small scale features that may impact on overland flow pathways are not necessarily represented.

9.2.3 The recommended flood risk management measures set out in **Section 11** incorporate measures, such as ground floor level freeboard recommendations, to allow for this inherent residual risk within new development.

9.3 Site Specific FRA Requirements

9.3.1 The SFRA is a strategic-level document that provides an overview of flood risk throughout the area. It is imperative that a site-specific Flood Risk Assessment (FRA) is prepared by the developer for all proposed developments within Flood Zones 2 and 3 and for all developments greater than 1 hectare in Flood Zone 1, and this should be submitted as an integral part of the planning application.

9.3.2 The FRA should be commensurate with the risk of flooding to the proposed development. For example, where – following site-specific investigations – the risk of flooding to the site is considered to be negligible (e.g. Zone 1 Low Probability), there is little benefit to be gained in a detailed analysis of the potential risk to life and/or property as a result of flooding. Rather, emphasis should be placed on ensuring that surface water runoff from the site does not exacerbate flooding lower in the catchment.

9.3.3 Government guidance and EA standing advice for developers, setting out where a FRA is needed, and the scope and requirements for any FRA, are available via the following link:

https://www.gov.uk/guidance/flood-risk-assessment-for-planning-applications

9.3.4 The NPPF PPG also includes a 'site-specific FRA checklist' setting out the typical scope and requirements for a FRA via the following link:

https://www.gov.uk/guidance/flood-risk-and-coastal-change#para80

9.3.5 The required FRA content in the aforementioned link can be summarised under the following headings:

- ***Development site and location***
- ***Development proposals***
- ***Sequential Test***
- ***Climate Change***
- ***Site specific flood risk***
- ***Surface water management***
- ***Occupants and users of the development***
- ***Exception Test***
- ***Residual Risk***
- ***Flood risk assessment credentials***

9.3.6 A summary of potential requirements in relation to flood risk, and the associated online Government guidance, is outlined in **Table 9.2.**

Table 9.2: Developer Flood Risk Requirements

Context	Requirements	Government Guidance on Scope for Submission
Flood Zone 1	FRA required IF site application area exceeds 1ha or if site lies in a 'critical drainage area'	https://www.gov.uk/guidance/flood-risk-assessment-in-flood-zone-1-and-critical-drainage-areas
Flood Zone 2 or 3	FRA Required	https://www.gov.uk/guidance/flood-risk-assessment-in-flood-zones-2-and-3 https://www.gov.uk/guidance/flood-risk-assessment-standing-advice
At risk from other sources of flooding	Where development or change of use is proposed to a more vulnerable development class in a flood risk area	
On, or within 8m of bank of, main river	Flood Risk Activity Permit (FRAP) required	https://www.gov.uk/guidance/flood-risk-activities-environmental-permits

9.4 EA Engagement

9.4.1 The EA is a key source of information to inform the development of the detailed FRA. The appropriate regional team should be contacted as early as possible to source information relating to (for example) historical flooding, hydraulic modelling and topography (LiDAR). For the SBC area, this is covered by the EA Thames Area 'Environment Planning and Engagement' team at enquiries_THM@environment-agency.gov.uk .

9.4.2 The information provided within the SFRA is the best available at the time of writing. More up-to-date information may be available, and contact should always be made with the EA at an early stage to ensure that the detailed site-based FRA is using current datasets (as noted in **Section 3.8**).

9.4.3 When consulted with details of a proposed development, the EA can typically provide a 'preliminary opinion', which will outline the EA's position and highlight any environmental issues they may be concerned about in their role as a statutory consultee; however, this would not involve any technical review of reports or documents.

9.4.4 The EA can also provide free-of-charge advice in relation to which of the new climate change allowances is appropriate for consideration of new development, in line with the guidance issued in February 2016 and updated in May 2022, as discussed in **Section 4.10**. If the applicant requires more detailed technical advice from the EA ahead of submitting a planning application, they also offer a voluntary cost recovery service with a dedicated project manager acting as a single point of contact to coordinate any problems or review technical documents such as the FRA.

9.4.5 There are also particular EA policy issues that may require consideration and potential further liaison with the EA when developing new proposals over a site as follows:

Buffer Zone

9.4.6 For developments in the vicinity of a main river watercourse, the EA seek to include a 'buffer zone' between the top of the riverbank and the built development over the site (including footpaths, landscaping, lighting and fencing etc.)

9.4.7 SBC will work with developers to improve the functioning of ordinary watercourses where possible. While no formal buffer requirement is identified, a 5m offset should be considered as a basis for master planning on any greenfield areas.

9.4.8 This buffer also serves an intention on biodiversity, to try and protect the integrity of the river corridor and prevent encroachment on the river. Undisturbed buffer strips are considered essential in reducing disturbance impacts to the ecology, allow some lateral movement of river without having to resort to hard bank protection, and form a vital wildlife corridor allowing movement of species through the landscape. In terms of planning, the buffer will vary depending on the sensitivity of the watercourse, and existing conditions of the site.

Deculverting of Watercourses

9.4.9 The EA encourage developers to open up and naturalise any culverted sections of watercourse where feasible, in line with the aims of the Water Framework Directive.

9.4.10 For the purposes of this policy, the EA define a culvert as an enclosed artificial channel or pipe that is used to continue a watercourse beneath the ground or a structure. Culverting can exacerbate the risks of flooding and increase maintenance requirements and costs. It also destroys wildlife habitats, damages an attractive natural amenity and interrupts the continuity of the linear corridor of a watercourse. Detrimental effects are likely to include:

- increased likelihood of flooding due to obstruction of flow and risk of blockages, and loss of floodwater storage leading to increased impact of flooding;
- loss of and adverse effects on natural morphology, fisheries and wildlife habitat including substrate;
- the creation of barriers to fish passage through increased water velocities, shallow depths and eroded culvert entrances;
- increased riverbank and bed erosion downstream of culverted sections;
- greater difficulties in providing for drainage connections;
- increased liabilities and costs due to the need to maintain, repair and replace culverts;
- increased health and safety hazards, notably for workers clearing blockages and for children in urban areas;
- locally reduced groundwater recharge;
- increased difficulty in detecting the origins of pollution and in monitoring water quality.

9.4.11 The EA promote this policy to planners and developers and use it to inform their responses to applications involving culvert watercourses. They will encourage and promote the removal of culverts where possible to restore a more natural river environment in both urban and rural settings.

9.4.12 Conversely, any culverting of a main river watercourse, or the alteration of an existing culvert on a main river, require an Environmental Permit from the EA under the terms of the Environmental Permitting Regulations published in 2016 and updated in 2021.

10 Flood Risk Management – Planning

10.1 Sequential Approach to Locating Development

10.1.1 The risk of flooding is most effectively addressed through *avoidance*, which in very simple terms equates to guiding future development away from areas at risk. Development that is sustainable for future generations is imperative, but it is widely recognised that the risk of flooding cannot be considered in isolation - there are many tests and measures of *'sustainability'* that must be weighed in the balance when locating and designing future development.

10.1.2 The NPPF follows a sequential risk-based approach in determining the suitability of land for development in flood risk areas, with the intention of steering new development to the lowest flood risk areas in preference to those at higher risk of flooding, where possible.

10.1.3 This approach is formalised in the 'Sequential Test', the application of which is detailed below.

10.2 Flood Risk Vulnerability and Compatibility

10.2.1 Where there are no reasonably available sites in Flood Zone 1 and at low risk of flooding from other sources, or where it is necessary to locate a particular form of development in a location/Flood Zone at higher probability of flooding, then it is necessary to consider the 'Flood Risk Vulnerability' classification of the proposed development, which is set out in **NPPF Annex 3** and reproduced in **Table 10.1**.

10.2.2 It should be noted that **Table 10.1** is a summary of the main definitions of development and the original table in the NPPF PPG should be consulted for the full list. This list is not exhaustive, and a pragmatic approach combined with liaison with the Local Authority may be required if a proposed use is not clearly defined from the Table.

Table 10.1: Summary of Flood Risk Vulnerability Classification

Classification	Forms of Development
Essential Infrastructure	**Essential transport infrastructure** (including mass evacuation routes) which has to cross the area at risk. **Essential utility infrastructure** which has to be located in a flood risk area for operational reasons, and water treatment works that need to remain operational in times of flood. **Wind turbines**. **Solar farms.**
Highly Vulnerable	**Police and ambulance stations**; fire stations and command centres; telecommunications installations. **Emergency dispersal points** **Basement dwellings**. **Caravans, mobile homes and park homes** intended for permanent residential use. **Installations requiring hazardous substances consent.**
More Vulnerable	**Hospitals**, **Residential institutions** such as residential care homes, children's homes, social services homes, prisons and hostels. **Buildings used for dwelling houses**, student halls of residence, drinking establishments, nightclubs and hotels. **Non–residential uses for health services, nurseries and educational establishments**. **Landfill and sites used for waste management facilities for hazardous waste.** **Sites used for holiday or short-let caravans and camping**, subject to a specific warning and evacuation plan.
Less Vulnerable	**Police, ambulance and fire stations** which are not required to be operational during flooding. **Buildings used for shops; financial, professional and other services**; restaurants, cafes and hot food takeaways; offices; general industry, storage and distribution; non-residential institutions not included in the 'More Vulnerable' class; and assembly and leisure. **Land and Buildings used for agriculture and forestry.** **Waste treatment** (except landfill and hazardous waste facilities). **Minerals working and processing** (except for sand and gravel working) **Water treatment works** which do not need to remain operational during times of flood, **sewage treatment works**, if adequate measures to control pollution and manage sewage during flooding events are in place. **Car parks**
Water Compatible	**Flood control infrastructure**. **Water transmission infrastructure and pumping stations.** **Sewage transmission infrastructure and pumping stations.** **Sand and gravel working.** **Docks, marinas and wharves**, **navigation facilities**. Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location. **Water-based recreation** (excluding sleeping accommodation). **Lifeguard and coastguard stations** **Amenity open space, nature conservation and biodiversity**, outdoor sports and recreation and essential facilities such as changing rooms. **Essential ancillary sleeping or residential accommodation** for staff required by uses in this category, subject to a specific warning and evacuation plan.

10.2.3 Once the flood risk vulnerability of the proposed development has been established, it is necessary to consult **NPPF PPG Table 2** (reproduced in **Table 10.2**) to confirm that the proposed use is appropriate (or not) within the Flood Zone it is located, and if the Exception Test is required.

Table 10.2: Flood Risk Vulnerability and Flood Zone 'Incompatibility'

Flood Zone	Flood Risk Vulnerability Classification				
	Essential infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	Exception Test Required	✓	✓	✓
Zone 3a	Exception Test Required	✗	Exception Test Required	✓	✓
Zone 3b	Exception Test Required	✗	✗	✗	✓*

✓ - Development is appropriate

✗ - Development should not be permitted

** - In Flood Zone 3b (functional floodplain) essential infrastructure that has passed the Exception Test, and water-compatible uses, should be designed and constructed to:*

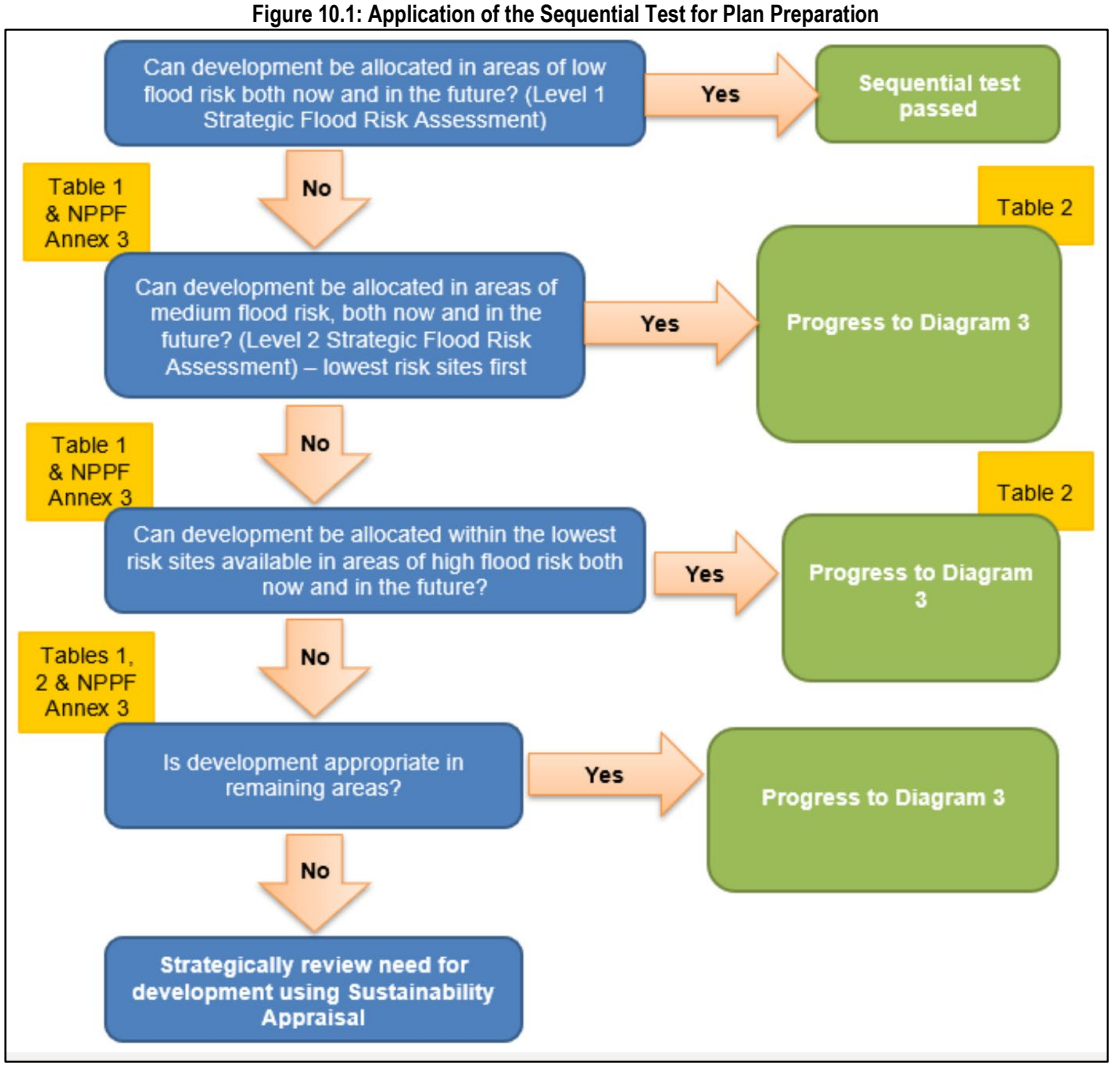
- *remain operational and safe for users in times of flood;*
- *result in no net loss of floodplain storage;*
- *not impede water flows and not increase flood risk elsewhere.*

10.3 Application of the Sequential Test

10.3.1 The requirements for the Sequential Test are set out in the NPPF, as detailed in **Section 4.1.**

10.3.2 **Figure 10.1** is an extract from the NPPF PPG to illustrate how the Sequential Test should be applied by Local Authorities in the preparation of a Local Plan, when considering the allocation of submitted sites for development. The Sequential Test needs to be applied to the whole local planning authority area to increase the possibilities of accommodating development that is not exposed to flood risk both now and in the future.

Figure 10.1: Application of the Sequential Test for Plan Preparation



10.3.3 For windfall sites it is therefore the responsibility of the developer to undertake and submit a Sequential Test to accompany – or ideally in advance of – a planning application. A typical approach to undertaking the Sequential Test for a windfall site would be:

1) **Site Identification**: Identify the alternative sites to be tested, based on discussions with the Local Authority and local agents;

2) **Establish Flood Zone:** Assess the Flood Zone classification of the alternative sites, based on the mapping contained within the SFRA and checked against the latest EA Flood Zones (in case the modelling on which the SFRA data is based has been superseded);

3) **Establish risk from other sources:** Assess the flood risk to the alternative sites from other sources based on information contained within the SFRA and/or current online EA mapping (i.e. surface water, reservoir breach, groundwater, sewer flooding), noting the caveats on the suitability of relevant information where relevant.

4) **Assess Availability of Alternative Sites**: A desk-based assessment based on publicly available information, of whether the alternative sites identified are 'reasonably available'. This could consider issues such as:

   - When is the site available for development?

- Is the site currently occupied/in use?
- Can the owner be identified or are there multiple ownerships?
- Has there been any planning activity (a review of the planning history)?
- Is the site being pursued by other third parties?
- Are there any known development constraints?

10.3.4 Guidance on where a Sequential Test is needed is also provided in the .GOV.UK guidance for local planning authorities – **https://www.gov.uk/guidance/flood-risk-assessment-local-planning-authorities#the-sequential-and-exception-tests** – which states the following:

A sequential test is required for major and non-major development if any proposed building, access and escape route, land-raising or other vulnerable element will be:

- **in flood zone 2 or 3**
- **in flood zone 1 and your SFRA shows it will be at increased risk of flooding during its lifetime**
- **subject to sources of flooding other than rivers or sea**

A development is not exempt from the sequential test just because a flood risk assessment shows the development can be made safe throughout its lifetime without increasing risk elsewhere.

10.3.5 It is for SBC, as the 'decision maker', to consider and approve any submitted Sequential Test. SBC must notify the EA – as statutory consultee on flood risk matters – that they consider the Test to be passed so that the EA can undertake a review of the technical flood risk matters during the planning application consultation period.

10.3.6 **Table 10.2** sets out where, in certain circumstances, the Exception Test is also required to accompany the Sequential Test. The requirements for this Test are detailed in **paragraph 4.1.5.**

10.4 Site Screening

Appendix D Figure 019 – Site Screening Locations

10.4.1 The site screening identifies the risk of flooding from all sources to the sites that have been submitted.

10.4.2 Swindon Borough Council, as the Local Planning Authority, are required to demonstrate that the site allocation process considers a range of possible sites by considering the flood risk and vulnerability information included in this SFRA.

10.4.3 The location of the allocated sites has been assessed against a variety of sources of flooding, including datasets from the Environment Agency, Thames Water and the British Geological Survey (BGS).

10.4.4 The following information has been used to assess the flood risk to the sites:

- Risk of Flooding from Rivers - see **Figure 008, 013, 014**:
  - **Flood Zone 2:** Land having between a 1 in 100 and 1 in 1,000 (1% - 0.1%) annual probability of river flooding.

- **Flood Zone 3:** Land having a 1 in 100 (1%) or greater annual probability of river flooding.
- Defended 1 in 30 annual probability (or 1 in 20 annual probability where 1 in 30 is not available) fluvial extents from the detailed hydraulic models covering the Swindon Borough - see **Figure 012**.
- 1 in 100 annual probability plus allowance for climate change fluvial extents from the detailed hydraulic models covering the Swindon Borough- see **Figure 013**.

- Risk of Flooding from Surface Water - see **Figure 009**:
  - **Low Risk:** Equivalent to a 1 in 1000 (0.1%) annual probability rainfall event;
  - **Medium Risk:** Equivalent to a 1 in 100 (1%) annual probability rainfall event;
  - **High Risk:** Equivalent to a 1 in 30 (3.3%) annual probability rainfall event.
- Historic Flood Map - see **Figure 015** and **016**.
- Susceptibility to Groundwater Flooding – see **Figure 010**:
  - **Low:** Limited potential for groundwater flooding to occur.
  - **Medium:** Potential for groundwater flooding of property situated below ground level.
  - **High:** Potential for groundwater flooding to occur at surface.
- Where a watercourse has not been modelled, a 20m buffer has been applied – see **Figure 014**.
- Sewer Flooding record – total number of flooding incidents over the past ten-year period for a particular postcode prefix area (DG5 records)- see **Figure 017**.

10.4.5 To identify where the above datasets overlap with the proposed site boundaries, a GIS spatial analysis has been completed. The results of the assessment have been presented in the Site Screening Assessment, which can be found in **Appendix D**.

10.4.6 This gives a high-level indication of the source and level of flood risk that can be encountered at each site and is intended to support the screening of sites for allocation or further site specific assessments.

11 Flood Risk Management – Design

11.1 Reducing Flood Risk through Design

11.1.1 If, following application of the Sequential Test (and potentially the Exception Test), it is considered appropriate to locate new development in an area of Flood Zone 2 or 3 (or at risk from other sources), then the proposed development must be appropriately designed to ensure (i) the occupants/users are safe from flooding, and (ii) the development does not increase flood risk to third parties.

11.1.2 The following Section provides guidance on the general principles of flood mitigation – in terms of the siting of new development, freeboard and safe access requirements, building design, floodplain management – which should form an integral element of any new development within a flood risk area.

11.2 Sequential Approach

11.2.1 The first stage of addressing flood risk when considering new development on a site is through applying the 'sequential approach' during the master planning stage at a site-specific level; i.e. locating the more vulnerable elements of the proposed development on the areas at lowest probability of flooding.

11.2.2 Where development is considered necessary in an area susceptible to flooding, the mitigation measures set out in the following sections should be incorporated into the development where applicable.

11.3 Ground Floor Levels

11.3.1 Standard requirements for ground floor levels of new development are set out in the British Standards document BS8533:2011 'Assessing and Managing Flood Risk in New Development – Code of Practice'.

11.3.2 The applicable allowance for climate change is dependent on the EA climate change allowances guidance discussed in **Section 4.10** and **Section 8.** For most forms of development, the 'Central' allowance of +26% is applied (assuming 100-year design life).

11.3.3 In accordance with Section 5.5.2 of the BS, it is recommended that floor levels of new development are set a minimum of **300mm above the modelled 1 in 100 annual probability plus appropriate allowance for climate change fluvial flood level**.

11.3.4 Where relevant, building floor levels should also be an appropriate freeboard above (i) the predicted 1 in 100 (1%) annual probability surface water flood level, (ii) surrounding ground levels, to mitigate the flood risk in an extreme rainfall event, and (iii) the maximum anticipated groundwater flood level.

11.4 Building Design

11.4.1 Where floor levels cannot be elevated to the recommended level due to access or planning constraints, and where it is considered acceptable in terms of the flood risk vulnerability classification, then the building fabric should incorporate appropriate flood resistant measures ('dry proofing') and/or flood resilient measures ('wet proofing').

- **Flood Resistance Measures** – Flood resistant measures aim to keep flood water out of the building by providing barriers and incorporating low permeability measures in the wall and floors.

Such measures include demountable defences, water resistant wall rendering, the sealing of ground level vents and anti-flood valves fitted to all drainage runs exiting the building. Typically, flood resistance measures are effective up to a maximum flood depth of approximately 500mm, with suitable measures incorporated up to the flood level. When flood depths exceed 500mm, it is typically considered more effective to incorporate flood resilience measures.

- **Flood Resilience Measures** – Flood resilient measures are incorporated where it is accepted that, in severe flood events, water may enter the building so it is necessary to ensure the building will remain useable after the floodwater has receded and the area has been cleaned. Therefore, the key issue is to incorporate materials that retain their structural integrity and have good drying and cleaning properties. It is also recommended that services are secured and sockets etc. are located a suitable freeboard above floor level. It is recommended that such measures are only utilised for 'non-habitable' elements of residential development, such as garages, utility rooms etc.

  If floor levels are proposed that would potentially be subject to greater than 500mm depths of flooding, then flood resilience measures are likely to be more appropriate than flood resistance measures.

11.4.2 Resistance and resilience measures are unlikely to be suitable as the only mitigation measure to manage flood risk, but they may be suitable in some circumstances, such as:

- Water-compatible and less vulnerable uses where temporary disruption is acceptable and an appropriate flood warning is provided; or,

- In some instances where the use of an existing building is to be changed and it can be demonstrated that no other measure is practicable (see **Section 11.9**).

11.4.3 Further guidance on the available measures and their application in new development is detailed in the guidance document *'Improving the Flood Performance of New Buildings – Flood Resilient Construction'* (published in 2007, updated in 2021) jointly produced by the Department for Communities and Local Government, the EA and DEFRA.

11.4.4 Flood resistance and flood resilience measures may also be appropriate in the design of buildings located behind flood defences, where a residual flood risk exists.

11.4.5 Basement dwellings are considered as 'highly vulnerable' development and, as such, not appropriate in Flood Zone 3 (and only acceptable in Flood Zone 2 if the Exception Test has been passed). However, basement areas used for parking/storage may be appropriate within Zones 2 or 3a, provided (i) they incorporate water resisting construction in accordance with CIRIA Report 139 Table 2.3 and (ii) the thresholds of any such areas are set (ideally 300mm) above the modelled 1 in 100 annual probability plus appropriate allowance for climate change fluvial flood level.

11.4.6 Appropriate internal emergency escape routes from basement areas should also be incorporated into the design to ensure that there is a safe route from the basement to a higher part of the development in accordance with health and safety requirements (potentially with the inclusion of a Flood Management/Evacuation Plan, if appropriate).

11.5 Floodplain Storage Capacity

11.5.1 Any new development located in the vicinity of a watercourse should be constructed such that it does not reduce the available floodplain storage capacity over a site, which could potentially cause an increase in flood levels on-site or elsewhere.

11.5.2 Where a development site encroaches within the modelled 1 in 100 (1%) annual probability plus allowance for climate change floodplain, a floodplain storage analysis should be undertaken as

part of any site-specific FRA to compare the floodplain capacity pre- and post- development, demonstrating no detrimental impact and ideally an improvement over the existing situation.

11.5.3 This is normally undertaken on a 'level-for-level' basis considering the impacts in (typically) 100mm to 200mm depth level bands, to ensure the characteristics of the floodplain are mimicked at all stages of the hydrograph, up to the reference modelled 1 in 100 (1%) annual probability plus allowance for climate change flood level. However, there may be some site-specific considerations where a more flexible approach is considered acceptable – i.e. if conventional level-for-level gains cannot be fully met it may still be acceptable if there is a significant over-provision of overall floodplain storage capacity (i.e. total volume).

11.5.4 In some more complex circumstances, such as larger scale development that have significant interaction with watercourses, it may be acceptable instead to demonstrate the impacts of a scheme through hydraulic modelling to demonstrate no detriment, and ideally a betterment as a result of the proposals.

11.5.5 Floodplain 'compensation' for any new development should ideally be provided through ground lowering across the site and removal of non-floodable building footprints/structures.

11.5.6 Where it is not possible to provide floodplain compensation through the above measures, then it may be acceptable to mitigate the loss of floodplain storage through incorporation of floodable elements at ground level of new development– i.e.

- **Open floodable areas**, such as ground level/undercroft parking provision (potentially with the main development on an upper level); and/or,

- **Floodable voids** below the proposed buildings, with the underside of the ground floor slab set a minimum elevation of the reference 1 in 100 (1%) annual probability plus allowance for climate change flood level and with regular openings – a minimum of 1m opening in every 5m length of wall – on all sides to allow free flow of floodwater in and out of the void area (security bars can be incorporated into the perimeter wall openings to control access to the void area).

11.5.7 Incorporation of such measures should be discussed with the EA and – if considered acceptable – may require a planning condition to be imposed to ensure (i) the voids remain open in perpetuity, (ii) the capacity of the void space is not compromised and (iii) a maintenance plan is submitted to demonstrate the void will remain functional for the lifetime of the development.

11.5.8 In certain circumstances an applicant may propose new development on a site, with the provision of compensatory floodplain storage at a different location. Under such circumstances, the land would need to meet particular requirements as follows:

- The land proposed for ground lowering would need to be in the control of the developer;

- The land would need to be in an area 'hydraulically relevant' to the subject site (i.e. within the same reach of the watercourse, and not separated by hydraulic control structures), such that the compensation volume can be considered to be of direct benefit to the area impacted by any loss of flood storage;

- The ground levels would need to be at a suitable elevation to ensure the volume gained is within the equivalent level bands as the volumes lost on the subject site (i.e. level-for-level);

- The alternative site would need to be in 'hydraulic connectivity' with the fluvial floodplain for the area (i.e. either land within the floodplain or located along the outer boundary of the floodplain) to ensure floodwater would be able to flow into the area where ground lowering is to take place.

11.6 Conservation of Flow Routes

11.6.1 Any new development located in the vicinity of a watercourse should be constructed such that it does not detrimentally impact on flow routes over a site, which could potentially cause an increase in flood levels elsewhere through backing up or diversion of flood flows. This can apply to fluvial flow routes or surface water flow routes.

11.6.2 While flood compensation measures would typically address any potential impacts of development on floodplain volume within the site, this does not necessarily consider the impacts on flood risk if a flow route exists through the site. This may be in the form of a fluvial watercourse but could also be a surface water flood flow route in an area otherwise designated as Flood Zone 1 'Low Probability'.

11.6.3 Blockage or constriction of such a flow route by development could potentially have a more significant cumulative effect that impacts on floodplain storage capacity. As such, development should carefully consider the presence of any flood routing through the site and demonstrate (potentially through detailed pluvial modelling) such routes – and their capacity – are allowed for to ensure no detrimental impact to third parties either upstream or downstream of the site.

11.7 Safe Access Arrangements

11.7.1 It is necessary to consider safe access arrangements as part of the mitigation for any new development, to ensure the occupants/users of development are safe in times of flooding and can achieve access/egress to or from the wider area safely for the lifetime of the development.

11.7.2 Proposed 'more vulnerable' uses are particularly sensitive as such development may incorporate sleeping accommodation; therefore, introducing the risk of a site being impacted by flooding while occupants are asleep and unaware of the potential impacts to their mobility and access to services.

11.7.3 Safe access should be considered for the lifetime of the development, and therefore the impacts should be assessed for the 1 in 100 annual probability flood event, plus appropriate allowance for climate change (see **Section 8**).

11.7.4 The starting point, and preference when considering a proposed development, should be the provision of a fully dry access route which remains unaffected in a major flood event. Should a fully 'dry' route not be achievable then it may be possible to demonstrate a 'very low hazard' based on the flood hazard ratings along the route (as discussed below).

11.7.5 Another option, where a safe access route at the peak of the flood event is not feasible, is to consider the suitability of 'safe refuge' measures. This is where the proposed development is designed to ensure it remains safe and operational even if flooding impacts the surrounding area (and cuts off wider safe access to land outside the floodplain). The anticipated duration of any flooding – during which any safe access route may be cut off – is a key factor in determining the suitability of such an approach. If considered appropriate, it is recommended that a Flood Management Plan is provided for the development, setting out details of measures to take before, during and after a flood event, so the occupants are aware of the potential impacts of flooding.

11.7.6 Proposed development may be located on an area of high ground that becomes a 'dry island' surrounded by potentially significant depths of floodwater in a major flood event. While the development may be outside the floodplain, it is important to fully consider the impact on safe access routes from the site to the wider land outside the floodplain. This should include consideration of the duration that the access route is impacted in addition to the depths along the route. It is essential that any future development within these areas considers carefully the emergency response in times of flood.

11.7.7 For 'less vulnerable' uses, where sleeping accommodation is not provided within the development, safe access is still a significant concern but can potentially be addressed more effectively through the incorporation of management systems including, in the event of widespread flooding, closure of the site in advance of flooding affecting the area and re-opening after the flooding has receded.

Flood Hazard

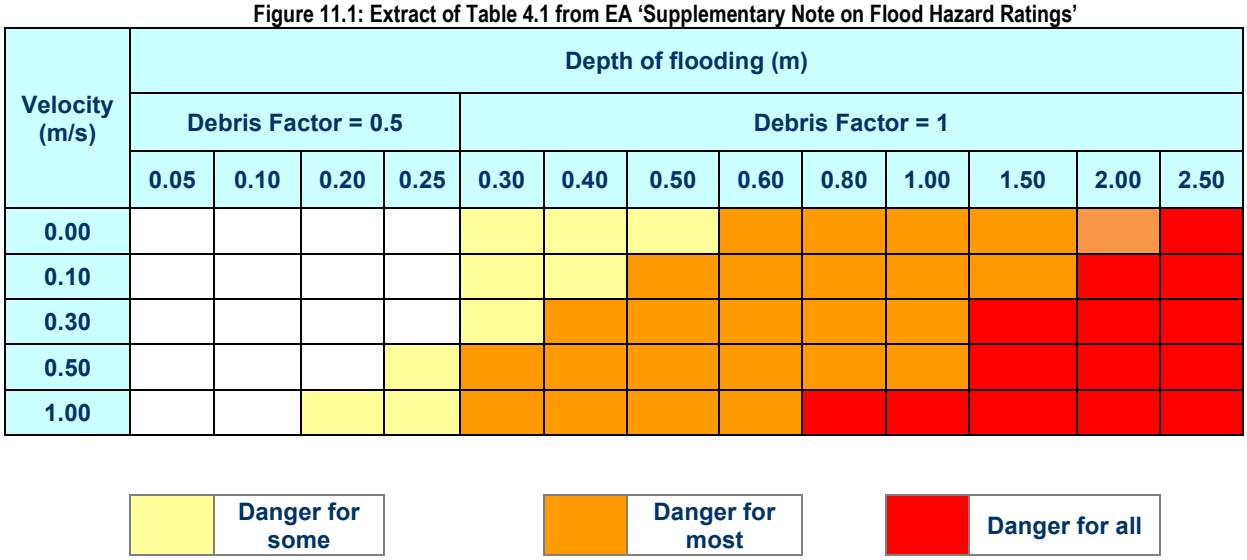
11.7.8 The Environment Agency use a calculation of flood hazard to determine safety in relation to flood risk. The calculation is a function of the flood depth and flow velocity at a particular point in the floodplain, along with a debris factor, which accounts for the hazard posed by any material entrained by the flood water.

11.7.9 Consideration of the safety of any pedestrian route has been based on the guidance in the EA document '*Supplementary Note on Flood Hazard Ratings and Thresholds for Development Planning and Control Purpose – Clarification of the Table 13.1 of FD2320/TR2 and Figure 3.2 of FD2321/TR1*'. Table 4.1 from this Supplementary Note is set out in **Table 11.1** and **Figure 11.1**.

Table 11.1: The Hazard to People (based on EA guidance Table FD2320/TR2)

Flood Hazard	Flood Hazard Rating (FHR)	Description
Low	Less than 0.75	Very low hazard- Caution
Moderate	Between 0.75 - 1.25	Danger for some- includes children, the elderly and the infirm
Significant	Between 1.25 – 2.0	Danger for most- includes the general public
Extreme	Greater than 2.0	Danger for all- includes the emergency services

Figure 11.1: Extract of Table 4.1 from EA 'Supplementary Note on Flood Hazard Ratings'



11.7.10 FD2320 states that '*The outputs of the Flood Risk to People project indicate that flood depths below 0.25m and velocities below 0.5m/s are generally considered low hazard. When designing safe access and exit routes, the combinations of depth and velocity on the routes should*

correspond to the white boxes in the above diagram. As flood depth and/or velocity increase the hazard to people increases. Combinations of depths and velocities in the white boxes (below the 'danger for some' class) are 'very low hazard', but a hazard does remain.'

11.7.11 Reference to **Figure 11.1** confirms that in standing (or slow velocity) floodwater, it is generally considered a 'very low hazard' at depths of up to 250mm and therefore considered 'safe' for the purposes of development control. For depths exceeding 250mm the hazard becomes a minimum of 'Danger for some', based on an assumed debris factor of 1.

Flood Warning and Management

11.7.12 As detailed in **Section 3.10** the EA operate a 'Flood Information Service', covering the key watercourses of the River Thames, River Ray and River Cole in the Swindon area. This service for the Swindon area can be found online at the following address:

https://check-for-flooding.service.gov.uk/location?location=Swindon

11.7.13 The Flood Information Service provides an array of flood data for the area, including:

- An overview of the national flooding situation, identifying total number and location of flood alerts, flood warnings and severe flood warnings;
- A five-day flood risk overview;
- A feed of the local river level information (updated hourly).

11.7.14 The River Thames, River Ray and River Cole drain considerable catchment areas and flooding is typically a result of long duration, regional rainfall events and due to the relatively long catchment response times, substantial forewarning of a pending flood event can generally be provided. This enables the Council, emergency services, residents and businesses to prepare in an endeavour to minimise property damage and risk to life.

11.8 Building Extensions

11.8.1 Floor levels of proposed building extensions should also address flood risk in accordance with the guidance in **Section 11.3**. However, it is accepted that these may be constrained by existing building thresholds. If the guidance above is not achievable then ground floor levels should be set a minimum of the existing floor level and consideration given to flood resistant/resilient measures (see **Section 11.4**).

11.8.2 There is a concern that the cumulative impact of extensions and outbuildings is progressively eroding fluvial floodplain storage capacity, and such development is often allowable under permitted development rights. While there is no clear solution to this problem, at a local level the detrimental impact can be minimised by seeking the provision of compensatory floodplain storage, particularly for larger scale extensions, and through the retrofitting of flood resistant/resilient measures within the existing property as part of any application.

11.9 Changes of Use and Minor Development

11.9.1 Paragraph 174 of the NPPF states that: *"Applications for some minor development and changes of use should not be subject to the sequential or exception tests but should still meet the requirements for site-specific flood risk assessments".*

11.9.2 A proposed change of use may result in a change in the flood risk vulnerability classification of a site (e.g. a change of use from commercial to residential results in a change from 'less vulnerable' to 'more vulnerable' development), and therefore a potential increase in the flood risk to a site.

11.9.3 Where a site is proposed to undergo a change of use to a caravan, camping or chalet development, the sequential and exception tests should be applied as appropriate.

11.9.4 Minor development consists of any of the following:

- Minor non-residential extensions: industrial/commercial/leisure extensions with a footprint less than 250 square metres;
- Alterations: development that does not increase the size of buildings (e.g. alterations to external appearance);
- Householder development: For example; sheds, garages, games rooms etc. within the curtilage of the existing dwelling, in addition to physical extensions to the existing dwelling itself. This definition excludes any proposed development that would create a separate dwelling within the curtilage of the existing dwelling (e.g. subdivision of houses into flats).

11.9.5 Under such circumstances it will be necessary for the developer to ensure the proposed use is compatible with the Flood Zone in which it is located and demonstrate that the future users of the development remain safe from flooding for the lifetime of the development. As such, additional mitigation may be necessary within the fabric of the building to enhance its safety for the proposed use (which would be detailed in the submitted FRA).

12 Surface Water Management

12.1 What are SuDS?

12.1.1 The NPPF recognises that flood risk and other environmental damage can be managed by minimising changes in the volume and rate of surface runoff from development sites. It recommends that priority is given to the use of Sustainable Drainage Systems (SuDS) in new development, this being complementary to the control of development within the floodplain.

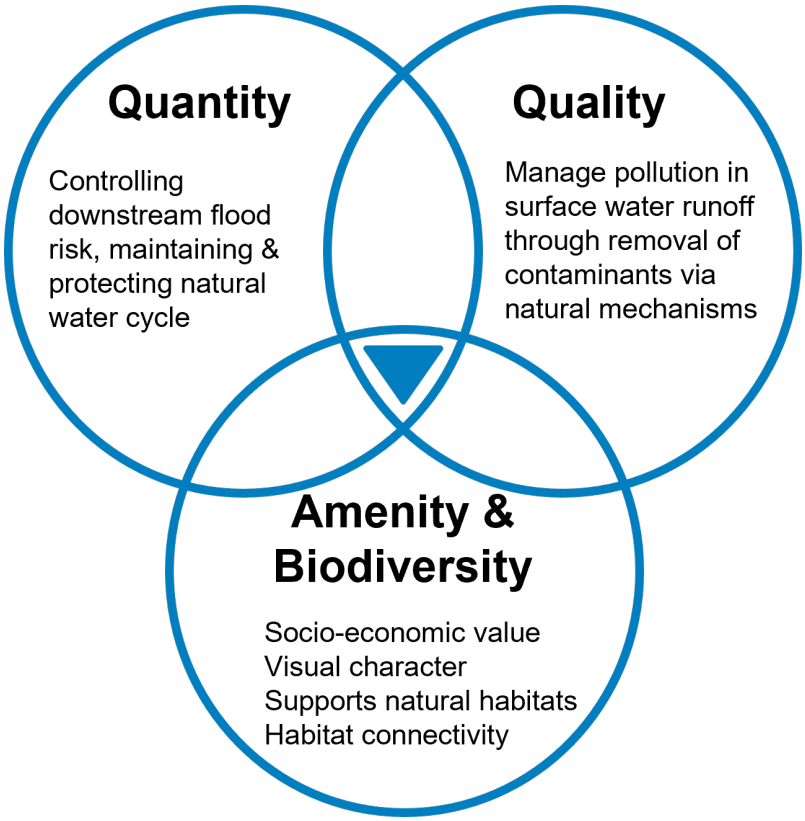
12.1.2 SuDS manage surface water run-off from a development in ways that aim to replicate the benefits of natural drainage systems – i.e. the natural site prior to development; they collect, store, slow and treat the quality of surface water in order to mitigate the impacts of development on run-off rates, volumes and quality.

12.1.3 SuDS generally replace traditional underground, piped drainage systems with overground open channel systems (e.g. swales) and surface storage ponds. They can be integrated into all developments, including heavily urbanised environments. They offer opportunities to improve and connect habitat in existing urbanised environments and will play an important role in delivering and reinforcing wider green infrastructure ambitions for Swindon.

12.2 What are the Benefits of SuDS?

12.2.1 The CIRIA SuDS Manual identifies benefits of SuDS for water quantity, water quality, amenity and biodiversity (known as the 'Four Pillars of SuDS') and these are shown in **Figure 12.1**. Proposed developments can incorporate a range of linked and multifunctional SuDS features to provide the range of benefits for surface water runoff management, ecological enhancement and amenity provision.

Figure 12.1: Objectives & Benefits of Sustainable Drainage



12.3 Role of SBC as the Lead Local Flood Authority

12.3.1 SBC is a statutory consultee for surface water drainage on 'major developments' as part of their role as the LLFA for the Borough. Major development consists of any of the following:

- The provision of dwelling houses where residential development of 10 or more units; or where the development is to be carried out on a site having an area of 0.5 hectares or more and the number of units is not known;
- The provision of a building or buildings where the floor space to be created by the development is 1,000 square metres or more; or,
- Development carried out on a site having an area of 1 hectare or more.

12.3.2 The following sections provide an overview of the Defra Technical Standards and items which applicants should include when preparing a SuDS Surface Water Drainage Strategy as part of a planning application submission to SBC.

12.4 Policy and Guidance on SuDS in New Developments

12.4.1 There are several overarching policies, guidance documents and other sources of information relating to surface water management that set out the key requirements, approach and design criteria for the management of surface water.

12.4.2 These should be consulted at an early stage to ensure any new development meets current requirements in this regard:

- **'The SuDS Manual'** (CIRIA document reference C753F, dated December 2015);
- **'Sustainable Drainage Systems – Non-statutory technical standards for sustainable drainage systems'** (Defra, March 2015) and accompanying Practice Guidance (Local Authority SuDS Officer Organisation (LASOO), 2016);
- '**Flood Risk Assessments: Climate Change Allowances'** – see **Section 8.3**);
- **CIRIA sustainable drainage website http://www.susdrain.org/**;
- **SBC Local Flood Risk Management Strategy** (CH2MHILL, July 2014).

12.4.3 In accordance with the SBC Local Plan 2026 Policy EN6: Flood Risk part (e), all developments will be required to provide a drainage strategy and should seek to enhance water quality and biodiversity in line with the WFD in accordance with part (f).

12.4.4 NPPF paragraph 182 states that:

182. Applications which could affect drainage on or around the site should incorporate sustainable drainage systems to control flow rates and reduce volumes of runoff, and which are proportionate to the nature and scale of the proposal. These should provide multifunctional benefits wherever possible, through facilitating improvements in water quality and biodiversity, as well as benefits for amenity. Sustainable drainage systems provided as part of proposals for major development should:

a) take account of advice from the Lead Local Flood Authority;

b) have appropriate proposed minimum operational standards; and

c) have maintenance arrangements in place to ensure an acceptable standard of operation for the lifetime of the development..

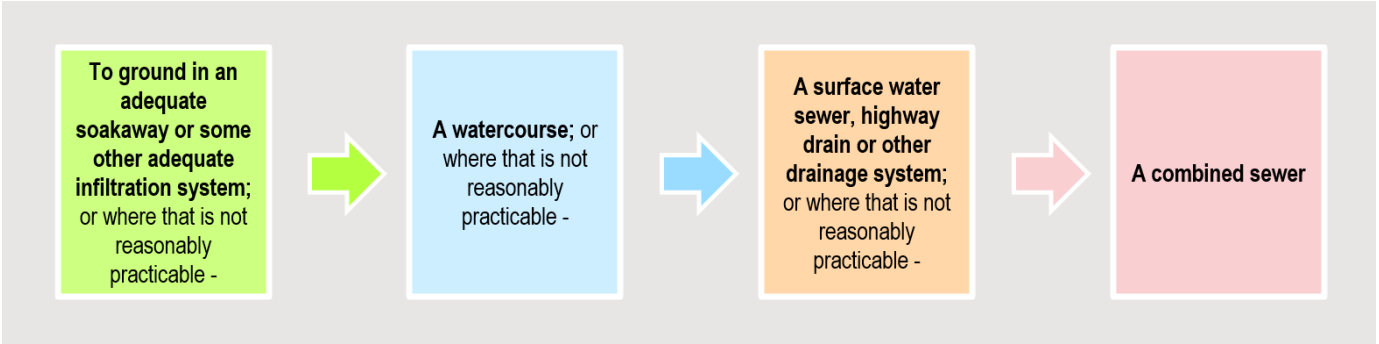
12.4.5 A supplementary planning document (SPD) setting out SBC's 'SuDS Vision for New Eastern Villages (NEV)' was released in 2017 and sets out the Council's aspirations in relation to surface water management for development for urban extensions in the eastern part of Swindon. The document promotes the use of open features for the stages of the drainage system, including piped connections from domestic units.

12.4.6 It should be noted that the document is guidance and not policy, and that a pragmatic approach should be taken when assessing the use of different SuDS features within a proposed development against other constraints and environmental factors.

12.5 SuDS Hierarchy and the Suitability of SuDS Measures

12.5.1 The NPPF, PPG, Non-Statutory Standards for Sustainable Drainage, Buildings Regulations, and adopted and emerging Local Planning policies require SuDS to be applied as the first choice for surface water management for new development in preference to traditional sewer systems and to allow surface water to be discharged according to the Hierarchy of Drainage (see **Figure 12.2**).

Figure 12.2: Hierarchy of Drainage based on Part H of the Building Regulations 2010



12.5.2 The feasibility of infiltration should be the initial consideration for disposal of surface water, which is dependent on the ground conditions underlying the site. The online British Geological Survey (BGS) portal provides information on bedrock and superficial deposit mapping, historical borehole logs and the 'Infiltration SuDS Suitability' (ISS) maps - https://www.bgs.ac.uk/information-hub/bgs-maps-portal/ . The ISS maps show that the geology within Swindon Borough has a variable permeability and infiltration SuDS suitability, and this may be different across large sites. The suitability for infiltration SuDS drainage should be identified by developers early in the planning stage and where feasible to do, should be confirmed by intrusive ground investigations at the concept planning stage to confirm ground conditions, groundwater levels and infiltration rates.

12.5.3 The depth of the groundwater table will also influence the suitability of infiltration SuDS drainage. The EA typically require a minimum of a 1 metre unsaturated zone (depth between the base of

any infiltration structure and the highest recorded groundwater level at a site). Where the groundwater table is relatively shallow (i.e. less than 2 metres below ground level) and infiltration rates are high enough to facilitate infiltration drainage, the use of shallow SuDS features such as permeable pavements and swales should be considered.

12.5.4 The surface water 'management train' is a concept stated in the "Cost estimation for SuDS - summary of evidence" published in March 2013 and used in the development of drainage systems whereby different techniques are used in series to change the flow and characteristics of run-off in stages that attempt to mimic natural drainage.

12.5.5 The hierarchy of techniques that should be considered in developing the management train are as follows:

1. **Prevention** – Good site design, good housekeeping measures (sweeping to remove dust and detritus from carparks) and reusing/harvesting rainwater are beneficial techniques used to prevent runoff and pollution. Prevention policies should typically be included within the site management plan.

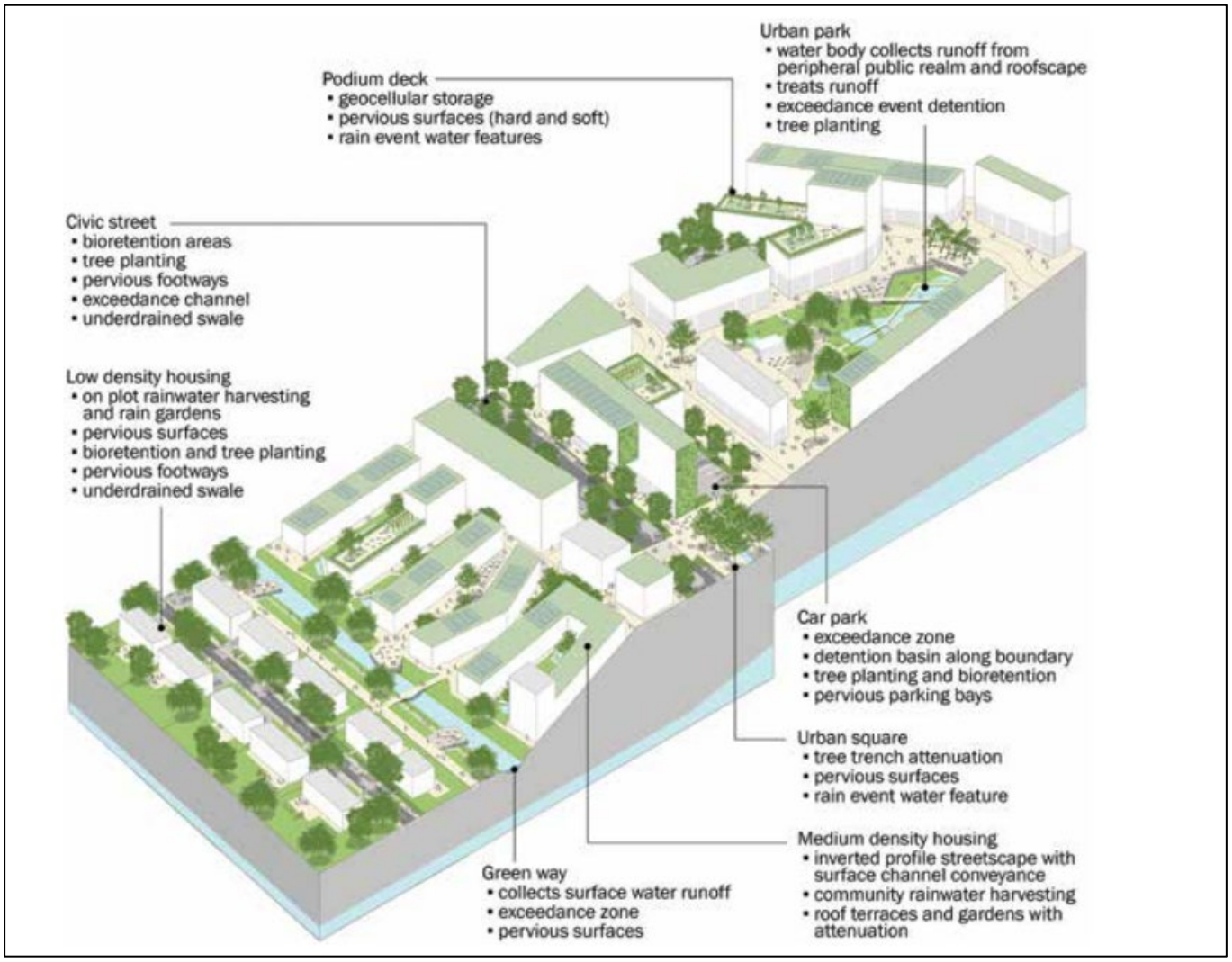
2. **Source controls** – Control runoff at or near its source (infiltration methods, i.e. soakaways, green roofs, pervious pavements etc).

3. **Site controls** – Management of water (routing water from building roofs, carparks etc to soakaways or infiltration of detention basins).

4. **Regional controls** – Management of runoff from a site, typically to a balancing pond or wetland.

12.5.6 The SuDS Manual should be consulted during the evolution of a surface water drainage strategy for a new development, as this provides extensive guidance on the range of SuDS measures appropriate for all situations. **Figure 12.3** shows an extract from the SuDS Manual illustrating the range of measures commonly used in different development types.

Figure 12.3: SuDS Techniques for Different Development Types (SuDS Manual Fig. 1.6)



12.6 SuDS Design Requirements for New Development in Swindon

12.6.1 Surface water drainage systems for new development should be designed in accordance with the principles of the NPPF, i.e. the occupants/users of the new development are safe from flooding, and the development does not increase (and ideally decreases) flood risk elsewhere.

12.6.2 To avoid compromising the functionality and capacity of SuDS attenuation features such as detention basins or ponds, these should be located outside the fluvial 1 in 100 (1.0%) annual probability plus allowance for climate change floodplain.

12.6.3 The updated EA climate change allowances for fluvial flooding could cause implications on where they are located, and careful consideration is required when locating such measures over a development site and in ensuring there is sufficient space over the site if fluvial flood risk is also a key design constraint.

12.6.4 The key design criteria for aspects of the surface water drainage system are detailed in the DEFRA '*Non-statutory technical standards for sustainable drainage systems'*, published in March 2015 and summarised in **Table 12.1**.

Table 12.1: Drainage Design Criteria from DEFRA Non-statutory Technical Standards

Design Aspect	Site Conditions	
	Greenfield site	***Previously developed site***
Peak Flow Control	**[S2]** Peak runoff rate for the 1 in 1 year rainfall event and the 1 in 100 year rainfall event should never exceed the peak greenfield runoff rate for the same event.	**[S3]** Peak runoff rate for the 1 in 1 year rainfall event and the 1 in 100 year rainfall event must be as close as reasonably practicable to the greenfield runoff rate for the same rainfall event, but should never exceed the rate of discharge from the development prior to redevelopment
Volume Control*	**[S4]** Where reasonably practicable, the runoff volume from the development to any highway drain, sewer or surface water body in the 1 in 100 year, 6 hour rainfall event should never exceed the greenfield runoff volume for the same event.	**[S5]** Where reasonably practicable, the runoff volume from the development in the 1 in 100 year, 6 hour rainfall event must be constrained to a value as close as is reasonably practicable to the greenfield runoff volume for the same event, but should never exceed the runoff volume from the development site prior to redevelopment for that event.
Design Criteria	**[S7]** The drainage system must be designed so that, unless an area is designated to hold and/or convey water as part of the design, flooding does not occur on any part of the site for a 1 in 30 year rainfall event.	
	[S8] The drainage system must be designed so that, unless an area is designated to hold and/or convey water as part of the design, flooding does not occur during a 1 in 100 year rainfall event in any part of: a building (including a basement); or in any utility plant susceptible to water (e.g. pumping station or electricity substation) within the development.	
	[S9] The design of the site must ensure that, so far as is reasonably practicable, flows resulting from rainfall in excess of a 1 in 100 year rainfall event are managed in exceedance routes that minimise the risks to people and property.	

** **[S6]** Where it is not reasonably practicable to constrain the volume of runoff to any drain, sewer or surface water body in accordance with **S4** or **S5** above, the runoff volume must be discharged at a rate that does not adversely affect flood risk.*

12.6.5 All surface water drainage strategies should be designed in accordance with the above DEFRA standards, the latest climate change allowances guidance (see **Section 8.3**) and the CIRIA SuDS Manual. SBC require the following information for Surface Water Management Strategies as part of a planning application submission (see **Figure 12.4**).

Figure 12.4: SBC LLFA Requirements for Surface Water Drainage Submissions

- *Detailed topographical survey that clearly identifies the existing drainage features on the site as well as level contours to show how the site falls;*
- *Existing flood flow routes through the site have been maintained or where they will be affected, adequate measures to intercept and safely control flows through the site have been provided to ensure flood risk is not increased elsewhere;*
- *The strategy mimics the existing drainage characteristics of the site and retaining and utilising any existing drainage features;*
- *Existing Greenfield Runoff Rates for the site;*
- *If infiltration is proposed, soakage tests have been carried out in accordance with Soakaway Design DG365 (BRE, 2016) to demonstrate infiltration is feasible, and that it is implemented in a manner that does not create off-site impact, particularly if there are reports of groundwater flooding in the area;*
- *Calculations to demonstrate the attenuation requirements for the 1 in 100 year plus climate change event to support the proposed strategy, and demonstration that surface water can be safely managed up to and including this event;*
- *Proposed flows will discharge at or below greenfield runoff rates, or as close as practical for any areas that have been previously developed;*
- *The impact upon the existing drainage systems is mitigated by discharging the flow throughout the management train rather than relying upon a single point of discharge;*
- *Detailed plan showing existing drainage features on the site and how the proposed drainage strategy will be implemented;*
- *SuDS Source Control measures to manage the water quantity and maintain water quality have been implemented wherever possible and throughout the management train so the development is not reliant upon large attenuation features close to the points of discharge;*
- *The applicant should use green, shallow/above ground SuDS measures wherever feasible;*
- *Proposed SuDS have been selected to provide a wide range of benefits including amenity, biodiversity and maintaining water quality;*
- *Consent for any outfalls from the proposed drainage systems into a public sewer or other drainage system not owned by the applicant;*
- *If any existing drainage features such as existing watercourses (including ditches) are proposed to be removed or culverted, the applicant has agreed this with the LLFA by obtaining Land Drainage Consent or the Environment Agency (EA) for any main rivers;*
- *All proposed drainage features are outside of flood zones 2 and 3 and where they are adjacent to an ordinary watercourse, they are not located within the EA surface water flood map extents. Where drainage features are located adjacent to flood zones 2 and 3, they must be above the 1 in 100 year plus climate change flood level;*
- *Details of how the proposed and existing drainage features on the site will be maintained and managed after completion with confirmation from the relevant authority that they will adopt any systems that are being offered for adoption;*
- *During construction, adequate measures are proposed to control pollution to existing watercourses and groundwater.*"

12.6.6 These requirements may be subject to change and should be checked against the most up to date requirements on the SBC LLFA website. Applicants are encouraged to discuss their proposals with SBC LLFA at the pre-application stage.

12.6.7 To ensure that in an exceedance event any flooding does not affect properties or discharge from the development, flows up to the 1 in 100 (1%) annual probability plus allowance for climate change rainfall event should be managed on site. This may be achieved by ensuring that site levels are designed to direct flows away from the buildings and towards areas such as car parking or formal landscaping where temporarily shallow flooding can occur, or through the provision of additional storage within the drainage system.

12.7 Adoption and Maintenance Considerations

12.7.1 Long term management of surface water drainage assets, including any SuDS components, is essential to ensure they continue to function to their design standard. As such, there should be consideration of the management and maintenance requirements to ensure any systems continue to work effectively.

12.7.2 Advisory information on the typical operation and maintenance requirements for specific forms of SuDS drainage are set out in the SuDS Manual, which confirms there are broadly three types of maintenance activities associated with surface water drainage systems, defined as:

- **Regular Maintenance** – 'basic tasks undertaken on a frequent and predictable schedule' including vegetation management, litter and debris removal, and inspections.'
- **Occasional Maintenance** – 'tasks that are likely to be required periodically, but on a much less frequent and predictable basis than the routine tasks (sediment removal is an example.'
- **Remedial Maintenance** – 'intermittent tasks that may be required to rectify faults associated with the system, although the likelihood of faults can be minimised by good design. Where remedial work is found to be necessary, it is likely to be due to site-specific characteristics or unforeseen events, and as such timings are difficult to predict.'

12.7.3 SBC should be satisfied that the proposed minimum standards of operation are appropriate and that there are clear arrangements in place for ongoing maintenance.

12.7.4 The final strategy for adoption of SuDS and the SuDS maintenance plan, including a maintenance schedule and details of easements and outfalls for the drainage system, should be provided at the detailed design stage, once details of the SuDS features to be incorporated into a new development have been finalised.

12.7.5 The costs of maintaining SuDS will depend on the following factors:

- Labour and materials costs of contractor undertaking the maintenance;
- Type and frequency of maintenance required (e.g. landscaping, jetting, litter removal);
- The body responsible for the maintenance (local authority, highways authorities, residents, management company).

12.7.6 Typical annual maintenance costs are outlined in the DEFRA and EA publication '*Cost Estimation for SuDS – Summary of Evidence*' (2015) and summarised below for a range of SuDS features. The document provides an indication of the unit costs of the different SuDS features based on actual costs from several developments within the UK and from wider industry literature. It should be noted that this document was prepared in 2015 and, as such, any budgeting exercise should allow for inflation to present day. The unit costs per annum (p.a.) for each SuDS feature have been extracted from the document and are presented in **Table 12.2** overleaf.

Table 12.2: Annual SuDS Maintenance Costs (DEFRA/EA 2015)

SuDS Feature	Unit Cost (£) Per Annum (p.a.)		
	Per m^2 Area	Per m^3 Storage Volume	Per Property
Green Roof: • Sedum Mat (sedum plants): • Biodiverse Roof (includes a wider variety of plants):	-	-	£2,500 (first 2 years), then £600 after £1,250 (first 2 years) then £150
Simple Rainwater Harvesting (water butts)	Negligible		-
Permeable Pavements (permeable bricks or surface which allows run-off through the surface/gaps in bricks to aggregate or cellular sub-base beneath).	-	£0.5-£1	-
Filter Drain (shallow gravel trench with perforated pipe)	£0.1 - £1	-	-
Swale (shallow, trapezoidal channels. Can be wet or dry (with underdrain).	£0.1	-	-
Infiltration Basin (man-made depression with geotextile lined sides/base)	£0.1 - £0.3	£0.25 - £1	-
Soakaways (ring manhole or geo-cellular crates lined with geotextile)	£0.1 (treated area)	-	-
Infiltration Trench (shallow gravel trench with geotextile lined base)	£0.2 - £1 (filter surface area)	-	-
Retention (Wet) Pond (manmade depression with geomembrane lined sides/base with permanent water depth below attenuation depth).	£0.5 - £1.5	£0.1 - £2	-
Detention Basin (manmade depression with geomembrane lined sides/base and designed to be dry following storms)	£0.1 - £0.3	£0.25 - £1	-
Constructed Wetland (larger manmade depression designed to be permanently/seasonally wet)	£0.1 per m^2 (wetland surface area) Annual Maintenance of £200-£250 p.a. for first 5 years, declining to £80-£100 p.a. after 3 years)		

12.8 SuDS Capital Costs

12.8.1 Identifying whole life costs associated with the incorporation of SuDS into development involves the consideration of several factors, including capital construction costs, operation/maintenance costs and procurement/design costs.

12.8.2 The indicative costs will also vary depending on site factors which include but are not limited to scale and size of development, hydraulic design criteria, inlet/out infrastructure design, soil types, amenity/safety requirements, density of planting and materials availability.

12.8.3 Information on the anticipated costs of SuDS is provided within the DEFRA and EA publication '*Cost Estimation for SuDS – Summary of Evidence*' and summarised in **Table 12.3**. An allowance should be made in any cost estimates for the effect of inflation over the intervening period.

Table 12.3: SuDS Capital Costs (DEFRA/EA 2015)

SuDS Feature	Per m^2 Area	Per m^3 Storage Volume	Per Property
Green Roof: • Sedum Mat: • Biodiverse Roof	£90 £80	-	-
Simple Rainwater Harvesting (water butts)	-	-	£100-243
Advanced Rainwater Harvesting (Tanks)	-	-	£2,500-£,6000 (residential) £6,300-£21,000 (commercial)
Greywater Re-use	-	-	£3,000
Permeable Pavements (permeable bricks or surface which allows run-off through the surface/gaps in bricks to aggregate or cellular sub-base beneath.	£54	-	-
Filter Drain (gravel trench with perforated pipe) **Filter Strip** (shallow, narrow gravel trench)	£120 £2-£4 (filter strip area)	-	-
Swale (shallow, trapezoidal channels. Can be wet or dry (with underdrain).	£12.5	-	-
Infiltration Basin (man-made depression with geotextile lined sides/base)	-	-	£10-£15

SuDS Feature	Per m^2 Area	Per m^3 Storage Volume	Per Property
Soakaways (ring manhole or geo-cellular crates lined with geotextile)	-	>£100	-
Infiltration Trench (shallow gravel trench with geotextile lined base)	£60	-	-
Retention (Wet) Pond (manmade depression with geomembrane lined sides/base with permanent water depth below attenuation depth).	-	£15-£25	-
Detention Basin (manmade depression with geomembrane lined sides/base and designed to be dry following storms)	-	£15-£20	-
Constructed Wetland (larger manmade depression designed to be permanently/seasonally wet)	-	£25-£30	-
On-site Attenuation Storage (Reinforced Concrete Tank)	-	£449-£518	-

13 Local Flood Risk Management

13.1 Development of SBC Local Flood Risk Management Strategy

13.1.1 The SBC Local Flood Risk Management Strategy (LFRMS), as outlined in **Section 5.3** aims to; increase awareness of local flood risk issues; provide an overview of the on-going flood risk mitigation work underway across Swindon; and set out the long term strategy for flood risk management.

13.1.2 The strategy identifies the broad nature and extent of flood risk across the Borough, responses to manage flood risk, and identifies how SBC will work together with other Risk Management Authorities, stakeholders, and local communities to manage local flood risk.

13.1.3 A range of sources of information, including EA river flood maps, surface water flood maps and groundwater flood maps to identify areas at risk of significant flooding.

13.1.4 One of the principal purposes of the LFRMS is to reduce local flood risk. The Swindon LFRMS identifies and develops a variety of means to reduce flood risk, including maintenance and improvements to existing flood risk management infrastructure. Other measures to mitigate and reduce flood risk are detailed in Section 6 'Managing Local Flood Risk in Swindon' of the Swindon LFRMS.

13.2 Emergency Planning

13.2.1 The Council is designated as a Category 1 Responder under the Civil Contingencies Act 2004. As such, the Council has defined responsibilities to assess risk, and respond appropriately in case of an emergency, including (for example) a major flooding event. The Council's primary responsibilities are[34]:

- From time to time assess the risk of an emergency occurring.
- From time to time assess the risk of an emergency making it necessary or expedient for the person or body to perform any of his or its functions.
- Maintain plans for the purpose of ensuring that, so far as is reasonably practicable, if an emergency occurs the person or body is able to continue to perform his or its functions.
- Maintain plans for the purpose of ensuring that if an emergency occurs or is likely to occur the person or body is able to perform his or its functions so far as necessary or desirable for the purpose of:
  - preventing the emergency;
  - reducing, controlling or mitigating its effects; or
  - taking other action in connection with it.

13.2.2 The FWMA also puts responsibility on LLFAs to take a lead in response to flooding events with an emphasis on co-operation with adjoining authorities, emergency services, utility providers and the EA.

[4] Civil Contingencies Act 2004

13.2.3 The SFRA provides a concise summary of the possible sources of flooding within the Borough and may be used to inform the assessment of flood risk in response to the requirements of the Act.

13.2.4 In the Swindon area, the EA monitors river levels within the River Thames, Cole, Ray and the Dorcan Stream. Based upon weather predictions provided by The Met Office, the Agency makes an assessment of the anticipated maximum water level that is likely to be reached within the proceeding hours (and/or days). Where these predicted water levels are expected to result in the inundation of populated areas, the EA will issue a series of flood warnings within defined flood warning areas, encouraging residents that are signed up to the service to take action to avoid damage to property in the first instance.

13.2.5 The EA advises that people and key infrastructure may be vulnerable at different stages of flooding:

- **Before** – lack of preparedness – ensure people are aware (sign up to Flood Warnings Direct) infrastructure is protected or resilient.
- **During** - property and infrastructure is flood-resistant, escape and access is appropriate, refuge areas are provided.
- **After** – recovery is maximised - ensure emergency services can reach those most at risk/affected, no basement-only properties in areas if most flood risk, ensuring properties are properly flood-resilient.

13.2.6 As water levels rise and begin to pose a risk to life and/or livelihood, it is the responsibility of the emergency services to coordinate the evacuation of residents. This evacuation will be supported by the Council. It is essential that a robust plan is in place that clearly sets out (as a minimum):

- Roles and responsibilities.
- Paths of communication.
- Evacuation routes.
- Community centres to house evacuated residents.
- Contingency plans in case of loss of power and/or communication.

13.2.7 Co-ordination with the emergency services and the EA is imperative to ensure the safety of residents in time of flood. A significant proportion of the Borough is at risk from fluvial flooding. Flooding of this nature will typically occur following relatively long duration rainfall events, and consequently forewarning will generally be provided to encourage preparation in an effort to minimise property damage and risk to life. It is worth highlighting however that the benefits of flood warning systems are often compromised to a large degree by the lack of *'take up'* within the local community. This emphasises the extreme importance of raising local awareness with respect to the potential risks of flooding.

13.2.8 Areas suffering from localised flooding issues will tend to be at greater risk. These areas are susceptible to *'flash'* flooding, associated with storm cells that pass over the Borough resulting in high intensity, often relatively localised, rainfall. It is anticipated that events of this nature will occur more often as a result of possible climate change over the coming decades (see **Section 4.10**). Events of this nature are difficult to predict accurately, and the rapid runoff that follows will often result in flooding that cannot be sensibly forewarned. All urbanised areas are potentially at some degree risk of localised flooding due to heavy rainfall. The blockage of gullies and culverts as a result of litter and/or leaves is commonplace, and this will inevitably lead to localised problems that can only realistically be addressed by reactive maintenance.

13.2.9 To support the emergency planning process, **Map 017** in **Appendix C** indicates the locations of key infrastructure, vulnerable sites and emergency services. The emergency planning team (and prospective developers) should use this information in combination with the outputs of surface water flood modelling to identify routes that may be susceptible to flooding.

13.2.10 Floodplain management and emergency response activities must have a focus on key infrastructure such as the underground network and other properties that are below sea level. Emergency planning would include refuge areas in vulnerable areas and aim to increase the number of people who sign up to Flood Warnings Direct.

13.2.11 It is important to reiterate that flood risk can be lessened by reducing both the probability and the consequences of flooding. If the probability is uncertain, the consequences can still be reduced by increasing flood awareness and flood preparedness, assisting members of the community to help themselves in case of flooding by providing forewarning of a flood event. Those at flood risk should be encouraged to sign up to the EA's Flood Warnings Direct.

14 Conclusion and Recommendations

14.1.1 This Strategic Flood Risk Assessment (SFRA) has been prepared in accordance with the requirements of the National Planning Policy Framework (NPPF) and developed in consultation with Swindon Borough Council (SBC) and the Environment Agency (EA).

14.1.2 A number of properties within the Borough of Swindon are at risk of flooding from a range of sources, including river flooding, localised runoff and sewer flooding.

- ***It is recommended that SBC utilise the data in the SFRA and other documents to refine the assessment of flood risk through the Borough and address local flooding concerns through any associated Action Plans.***

14.1.3 The Borough has been broken down into zones of 'High', 'Medium' and 'Low' probability of flooding from different sources of flood risk in accordance with the requirements of the NPPF, providing the basis for the application of the NPPF Sequential Test. A Site Screening Assessment has been undertaken to provide an overview of the flood risk to the sites submitted for consideration.

- ***SBC are to use the Screening Assessment to inform sequential testing for the emerging Local Plan. Key strategic areas of development, or significant zones of flood risk, should be considered as part of a Level 2 SFRA to further assess the suitability of sites at a detailed level.***

14.1.4 It is necessary to ensure proposals incorporate mitigation designed for the lifetime of the development. Modelling of the climate change allowances based on the current EA guidance has been undertaken as part of the SFRA to provide an overview of the impacts across the Swindon area. Developers should liaise with the EA at the earliest opportunity to ensure the appropriate climate change allowances are applied based on the latest guidance.

- ***It is recommended that SBC liaise with the EA to ensure any updated modelled flood data associated with the new EA climate change allowance requirements becomes available in order to inform development within the Borough – noting the EA have advised that the River Cole is in the process of being updated;***

14.1.5 A planning solution to flood risk management should be sought wherever possible, steering vulnerable development away from areas affected by flooding in accordance with the Sequential Test.

14.1.6 Where other planning considerations must guide the allocation of sites and the Sequential Test has been applied, specific recommendations in relation to mitigation measures have been provided to assist the Council and the developer to meet the Exception Test.

14.1.7 Council policy is essential to ensure that the recommended development control conditions can be imposed consistently at the planning application stage. This is essential to achieve future sustainability within the Borough with respect to flood risk management.

- ***It is recommended that emerging Council policy incorporates, where appropriate, recommendations presented in the Swindon Borough SFRA.***

14.1.8 Emergency planning is imperative to minimise the risk to life posed by flooding within the Borough. It is recommended that the Council advises the local Resilience Forum of the risks raised in light of the SFRA, ensuring that the planning for future emergency response can be reviewed accordingly.

15 SFRA Review and Update

15.1.1 The SFRA has been developed building heavily upon existing knowledge with respect to flood risk within the Borough. However, knowledge of flood risk is continuously evolving and flood mapping is regularly being updated. This, in addition to observed flooding that may occur throughout a year, will improve the current knowledge of flood risk within the Borough and may marginally alter predicted flood extents within the study area.

15.1.2 Given that this is the case, a periodic review of the Swindon SFRA is imperative. It is recommended that the SFRA is reviewed on a regular basis, and a number of key questions to be addressed as part of the SFRA review process (i.e. triggering whether or not a comprehensive review is required) are provided below.

Question 1: Has any flooding been observed within the Borough since the previous review?

15.1.3 If so, the following information should be captured as an addendum to the SFRA:

- What was the mapped extent of the flooding?
- On what date did the flooding occur?
- What was the perceived cause of the flooding?
- If possible, what was the indicative statistical probability of the observed flooding event? (i.e. how often, on average, would an event of that magnitude be observed within the Borough?)
- If fluvial flooding occurred, are the observed flood extents situated outside of the current Flood Zone 3a? If it is estimated that the severity of flooding does not exceed the 1 in 100 (1%) annual probability event then the flooded areas should be incorporated into Zone 3a to inform future planning decision making.

Question 2: Have any amendments to the NPPF or associated PPG been implemented?

15.1.4 If so, the following key questions should be tested:

- Does the revision to the policy guidance alter the definition of the NPPF Flood Zones presented within the SFRA?
- Does the revision to the policy guidance alter the decision making process required to satisfy the Sequential Test?
- Does the revision to the policy guidance alter the application of the Exception Test?
- Does the revision to the policy guidance alter the categorisation of land use vulnerability, presented within Annex 3 of the NPPF?

15.1.5 If the answer to any of these core questions is *'yes'* then a review of the SFRA recommendations in light of the identified policy change should be carried out.

Question 3: Has the EA issued any amendments to their flood risk mapping and/or standing guidance since the previous policy review?

15.1.6 If so:

- Has any further detailed fluvial flood risk mapping been completed within the Borough, resulting in a change to the 1 in 30, 1 in 100 or 1 in 1000 annual probability flood outlines? If yes, then the Flood Zone extents should be reviewed and updated accordingly.

- Has the assessment of the impacts that climate change may have upon rainfall and/or river flows over time altered? If yes, then a review of the impacts that climate change may have upon the Borough is required.

- Do the flood risk management recommendations provided in **Section 11** of the SFRA in any way contradict emerging advice with respect to (for example) the provision of emergency access, the setting of floor levels and the integration of sustainable drainage techniques? If yes, then a discussion with the EA is required to ensure an agreed suite of development management requirements are in place.

15.1.7 The EA typically review the Flood Zone Map on a quarterly basis. If this has been revised within the Borough, the updated Flood Zones will be automatically forwarded to the Council for their reference. *It is recommended that only those areas that have been amended by the EA since the previous SFRA review are reflected in Zone 3 and Zone 2 of the SFRA flood maps.* This ensures that the more rigorous analyses carried out as part of the SFRA process are not inadvertently lost by a simple global replacement of the SFRA flood maps with the Flood Zone Maps.

Appendix A SFRA Maps – Setting

- Map 001 - Study Area and Administrative Boundaries
- Map 002 - Study Area and Administrative Boundaries (Aerial)
- Map 003 - Topography (LiDAR)
- Map 004 - River Catchment and Management Areas
    - Map 004A River Thames - Catchment and Management Areas
    - Map 004B River Ray - Catchment and Management Areas
    - Map 004C River Cole - Catchment and Management Areas
    - Map 004D River Kennet - Catchment and Management Areas

Appendix B SFRA Maps – Geology

- Map 005 - Bedrock Geology
- Map 006 - Superficial Geology
- Map 007 - Groundwater Source Protection Zones

Appendix C SFRA Maps – Flood Risk

- Map 008 - Flood Zone Map
    - Map 008A – 008D - Flood Zone Map (*Detailed*)
- Map 009 - Risk of Flooding from Surface Water (RoFSW)
    - Map 009A – 009D - Risk of Flooding from Surface Water (RoFSW) (*Detailed*)
- Map 010 - Susceptibility to Groundwater Flooding
    - Map 010A – 010D - Susceptibility to Groundwater Flooding (Detailed)
- Map 011 - Reservoir Flood Map
    - Map 011A - Reservoir Flood Map – Coate Water
    - Map 011A - Reservoir Flood Map – Stanton Park Reservoir
    - Map 011A - Reservoir Flood Map – Whitehill Flood Storage Area and Peatmoor Lagoon
- Map 012 - Modelled Flood Extents – Present Day
    - Map 012A – 012D - Modelled Flood Extents – Present Day (*Detailed*)
- Map 013 - Modelled Flood Extents – Climate Change
    - Map 013A – 013D - Modelled Flood Extents – Climate Change (*Detailed*)
- Map 014 - Functional Floodplain
    - Map 014A – 014D – Functional Floodplain (*Detailed*)
- Map 015 - EA Historic Flood Map
- Map 016 - EA Historic Flood Map (By Year)
- Map 017 - Key infrastructure overlaid onto Flood Zones
- Map 018 - Thames Water DG5 Sewer Flooding Records

Appendix D Site Screening Assessment

- Map 019 - Site Screening Locations
- Site Screening Assessment Spreadsheet (xls)

Appendix E Climate Change Modelling

- TN001 – Swindon SFRA – Hydraulic Modelling – Peak River Flow – Climate Change Updates