

Exeter Level 2 Strategic Flood Risk Assessment

December 2024

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This report describes work commissioned by Exeter City Council, by an instruction dated February 2024. The Client's representative for the contract was Jill Day of Exeter City Council. Bethan Griffiths and Ed Hartwell of JBA Consulting carried out this work.

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Abbreviations

AEP	Annual Exceedance Probability
AIMS	Asset Information Management System
BGS	British Geological Survey
CC	Carbon Calculator
CFMP	Catchment Flood Management Plan
DCC	Derbyshire County Council
DEFRA	Department of the Environment, Food and Rural Affairs (formerly MAFF)
DWMP	Drainage and Wastewater Management Plan
EA	Environment Agency
EN	English Nature
FCERM	Flood and Coastal Erosion Risk Management (R&D programme)
FMfP	Flood Map For Planning
FRA	Flood Risk Assessment
FRM	Flood Risk Management
FRMP	Flood Risk Management Plan
GI	Ground Investigations
LFRMS	Local Flood Risk Management Strategy
LLFA	Lead Local Flood Authority
LPA	Local Planning Authority
NPPF	National Planning Policy Framework
PPG	Planning Policy Guidance
RBMP	River Basin Management Plan
SFRA	Strategic Flood Risk Assessment
TUFLOW	Two-dimensional Unsteady FLOW (a hydraulic model)
WFD	Water Framework Directive

Executive Summary

Introduction

This Level 2 Strategic Flood Risk Assessment (SFRA) document was created with the purpose of providing evidence of understanding of flood risk to support the redevelopment and strategic development of Exeter City. Five sites have been progressed to detailed assessment as part of the Level 2 SFRA.

Level 2 SFRA Outputs

The Level 2 assessment includes a detailed assessment of the areas of Exeter which cover the sites being evaluated. This includes:

- An assessment of all sources of flooding including fluvial flooding, surface water flooding and the potential increase in these flood risks due to climate change, plus groundwater flooding.
- Reporting on current conditions of flood defence infrastructure, where applicable.
- An assessment of existing flood warning and emergency planning procedures, including an assessment of safe access and egress during an extreme event.
- Advice and recommendations on the likely applicability of Sustainable Drainage Systems (SuDS) for managing surface water runoff.
- Advice on whether the site is likely to pass the second part of the Exception Test with regard to flood risk and on the requirements for a site-specific Flood Risk Assessment (FRA), ensuring that the development will be able to be made safe throughout its lifetime, without increasing flood risk elsewhere.

Summary of Key Messages

Exeter City Council, working in partnership with the Environment Agency, provided five sites for further assessment (four strategic mixed use brownfield allocations at Water Lane, Red Cow, Exe Bridges Retail Park and East Gate, and one area identified as having potential for regeneration at Marsh Barton). These sites were assessed against flood risk datasets to assess the potential viability and provide flood risk recommendations.

Site summary tables were prepared for each site and set out the flood risk to the sites taking into account the potential benefit and residual risks from flood defences. Maps of extent, depth and velocity of flooding as well as hazard mapping have been produced where modelled outputs were available.

Each table sets out the National Planning Policy Framework (NPPF) requirements for the site, as well as guidance for site-specific FRAs. A broadscale assessment of suitable SuDS options has been provided to give an indication of potential constraints to surface water drainage and where additional information may be required.

All sites, except East Gate, are at moderate to high risk of fluvial flooding, due to their proximity to the River Exe. These sites are also at significant risk of defence breach in the

1% AEP breach scenario. Water Lane, Red Cow and Exe Bridges sites are at risk of flooding during the design fluvial event (1% AEP plus 46% climate change).

Red Cow is also at risk of flooding from the Taddiforde Brook as well as the River Exe with significant flooding during the 0.1% AEP present day event and 1% AEP climate change events.

All five sites are expected to flood in the 3.3% AEP plus 65% climate change and 1% AEP plus 65% climate change surface water events.

The sites are subject to varying risk of groundwater emergence and risk of sewer flooding.

Recommendations

The majority of Exe Bridges, Marsh Barton, Water Lane and Red Cow are situated in Flood Zone 3a. To pass the Exception Test, it must be shown that the development will provide wider sustainability benefits that outweigh the risk and that the development will be safe throughout its lifetime without increasing risk elsewhere. The former is a planning-related consideration and the Level 2 SFRA helps to answer the latter part of the Test.

It is possible for the sites to pass the flood risk element of the Exception Test by:

- Siting development with the highest vulnerability away from the areas of highest flood risk.
- Considering safe access / egress in the event of a flood (from all parts of the site, considering part of the site which may be severed by a flood flow path). In the case of Exe Bridges, Red Cow and Water Lane, safe access from the allocation sites would need to be constructed above the design flood level:
 - East Gate: south along Western Way
 - Exe Bridges: north via Exe Bridge to New Bridge Street
 - Red Cow: southeast via St David's Hill
 - Water Lane: east via Trews Weir Suspension Bridge to Bell Isle Drive
 - Marsh Barton: Any development within this area would require further consideration as part of a site-specific Flood Risk Assessment
- Adequately considering residual risk from defence breaching or overtopping, for example through a flood warning and evacuation plan.
- Designing buildings with habitable floor levels above the design flood event, including an allowance for freeboard and / or providing safe refuge for residents to shelter during an extreme event above the 0.1% AEP flood level including climate change.
- If other solutions are not possible, increasing the elevation of land for whole or parts of the sites could be implemented to prevent flood flows affecting the land up to the design level. Hydraulic modelling will need to be undertaken to ensure that land raising does not impact on flood risk elsewhere and that development layout and design is considered in relation to flow paths across the sites.

In the case of Exe Bridges, Marsh Barton, Red Cow and Water Lane the predominant flood risk is fluvial from the River Exe. Mitigation is likely to require land raising or buildings with less vulnerable, water compatible or essential infrastructure vulnerability uses on the ground floor. This will result in ground floor levels being raised up above the street level which could impact the street scene without proper consideration at an early stage. In both cases, care will need to be taken to ensure that flow paths (from all sources of flooding) during flood events are not obstructed and that flood risk is not increased elsewhere. Careful consideration of building alignment will be important in allowing flow paths to remain un-obstructed and therefore early consideration of site layout and design in relation to flood risk will be required to pass the flood risk element of the Exception Test.

The flood Risk to East Gate is from surface water flooding. The same considerations as above will be required. However, it may be possible to site development away from the surface water flow paths and a sequential approach to placement of development on the site should be taken. There is a combined sewer which crosses the site and therefore South West Water and the Lead Local Flood Authority (Devon County Council) should be approached to discuss options for reducing the flood risk through storage and separation within the site.

The Taddiforde Brook is culverted under the Red Cow site and consideration should be given to daylighting this where possible and also working with the Lead Local Flood Authority (Devon County Council) and Network Rail to identify opportunities to improve the conveyance and condition of this culvert.

1 Introduction

1.1 Purpose of the Strategic Flood Risk Assessment

Paragraph 160 of the National Planning Policy Framework (NPPF, 2023) states that strategic policies should be informed by a Strategic Flood Risk Assessment (SFRA) and should manage flood risk from all sources. They should consider cumulative impacts in, or affecting, local areas susceptible to flooding, and take account of advice from the Environment Agency (EA) and other relevant organisations, such as Lead Local Flood Authorities (LLFAs) and Internal Drainage Boards (IDBs).

The published guidance on '[How to prepare a strategic flood risk assessment](#)' (2022) advocates a tiered approach to risk assessment and identifies the following two levels of SFRA:

- Level 1 SFRA: where flooding is not a major issue and where development pressures are low. The assessment should be sufficiently detailed to allow application of the Sequential Test. Level 1 is completed first to understand whether a Level 2 assessment is required.
- Level 2 SFRA: where land outside Flood Zones 2 and 3 cannot accommodate all the necessary development creating the need to apply the NPPF's Exception Test. In these circumstances the assessment should consider the detailed nature of the flood characteristics within a Flood Zone and assessment of other sources of flooding.

This SFRA report fulfils the requirements for a Level 2 assessment of strategic sites identified for potential allocation within the Exeter City District and has been prepared in accordance with the NPPF (2023) and PPG (2024).

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

1.2 Local Plan

Exeter City Council as the Local Planning Authority (LPA) are at the publication stage for their Local Plan (the 'Exeter Plan'), which is due to be adopted in November 2026. The Full Draft Exeter Plan was published in October 2023. Once adopted, the Exeter Plan will replace the existing Core Strategy and Local Plan First Review. The Plan establishes a planning framework setting out where development should take place for the next twenty years up to 2041 and provides the policies which will be used in making decisions on planning applications. The Publication Draft Exeter Plan includes strategic mixed use brownfield allocations for Water Lane, Red Cow, Exe Bridges Retail Park and East Gate. An area at Marsh Barton is identified as having potential for regeneration.

1.3 SFRA Objectives

The objectives of this Level 2 SFRA are to:

- Assess the flood risk to potential development sites using the latest available flood risk data and climate change uplifts where available;
- Provide information and mapping to show flood risk from all sources for each site option;
- Provide recommendations for making the site safe from flooding throughout its lifetime without increasing flood risk elsewhere;
- Take into account, as far as practically possible the most recent policy and legislation in the NPPF, PPG and LLFA SuDS guidance; and

1.4 Context of the Level 2 Assessment

Exeter City Council published a Level 1 SFRA in April 2024 which outlines the key sources of flood risk in Exeter, including fluvial, surface water, sewer and groundwater sources. Exeter City Council have proposed five sites to go forward for a Level 2 assessment. To secure allocation within the new Exeter City Local Plan, the council, in accordance with the NPPF, is required to evidence its understanding of flood risk and demonstrate how this might be managed and mitigated via a Level 2 SFRA.

The main objectives of this Level 2 SFRA are stated above in Section 1.3, it will also be used:

- To assess flood risk when making decisions on planning applications;
- By applicants when preparing planning applications;
- To help inform any future proposals undertaken by others.

1.5 Consultation

SFRAs should be prepared in consultation with other Risk Management Authorities (RMAs). The following parties (external to Exeter City Council) were consulted as part of the Level 2 SFRA:

- Devon County Council as LLFA;
- The Environment Agency;
- SWW (through the DWMP)

1.6 L2 SFRA Study Area

Exeter City Council (ECC) is a district council covering the city of Exeter in Devon, south-west England. Exeter contains 13 wards covering an area of 47km² and the 2021 census identifies a population of 130,000.

The River Exe flows in a southerly direction through the city to reach the Exe Estuary on the south coast of Devon. The Alphin Brook flows in a southeasterly direction to join the River Exe and the River Clyst flows along the southwest boundary of the district for 3.5km, to

eventually enter the Exe Estuary at Bowling Green Marsh. The Exeter Ship Canal flows alongside the River Exe for approximately 8km, from Exeter Quay to Turf Lock.

South West Water is the water company that provides water supply and sewerage services to Exeter.

Five sites have been identified for a Level 2 assessment, based on the risk of flooding from different sources, both now and in the future. The five sites that have been listed for further consideration are shown in Figure 1-1 and the main watercourses in the Exeter City Council boundary are shown in Figure 1-2.

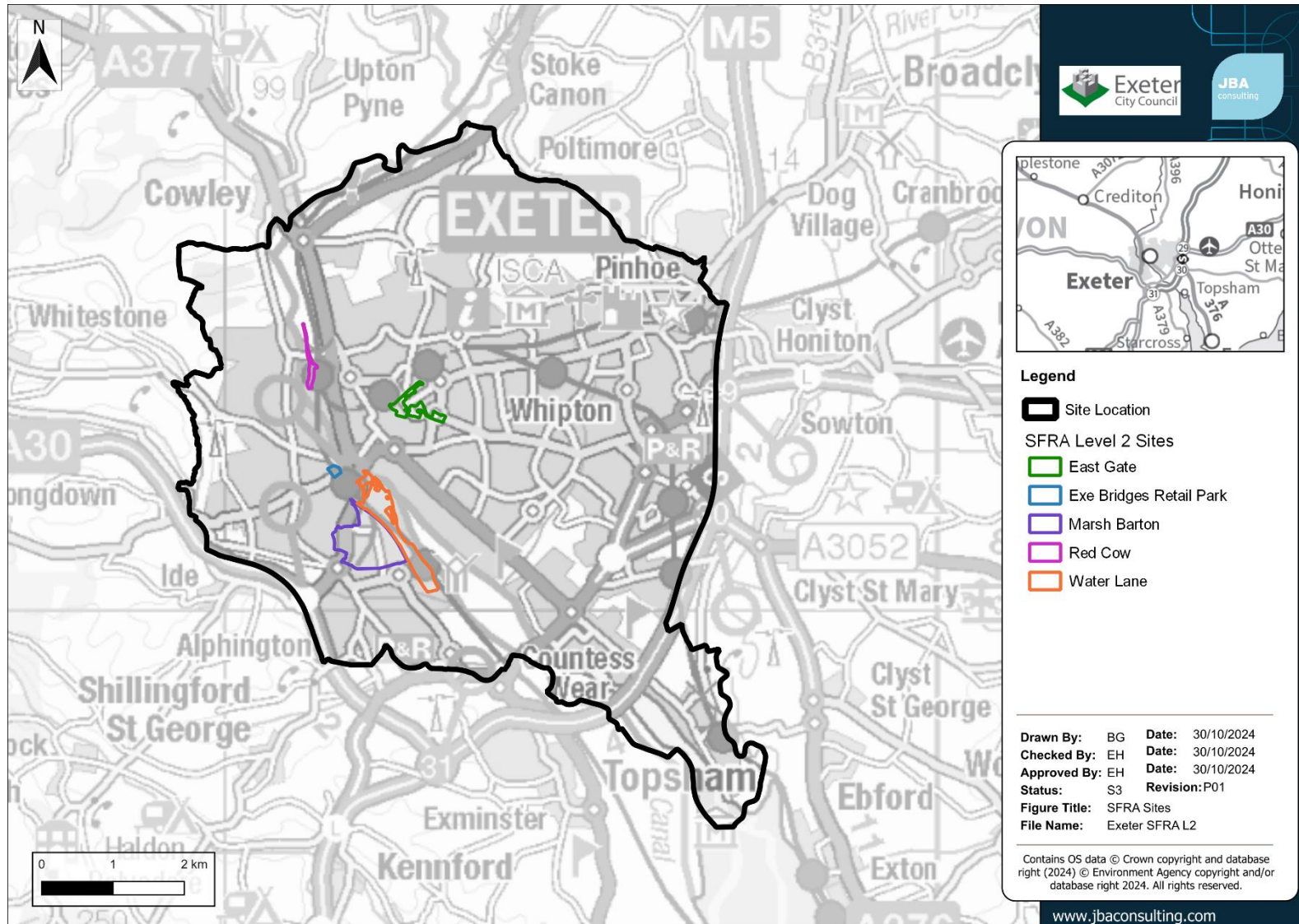


Figure 1-1 Overview map of study area

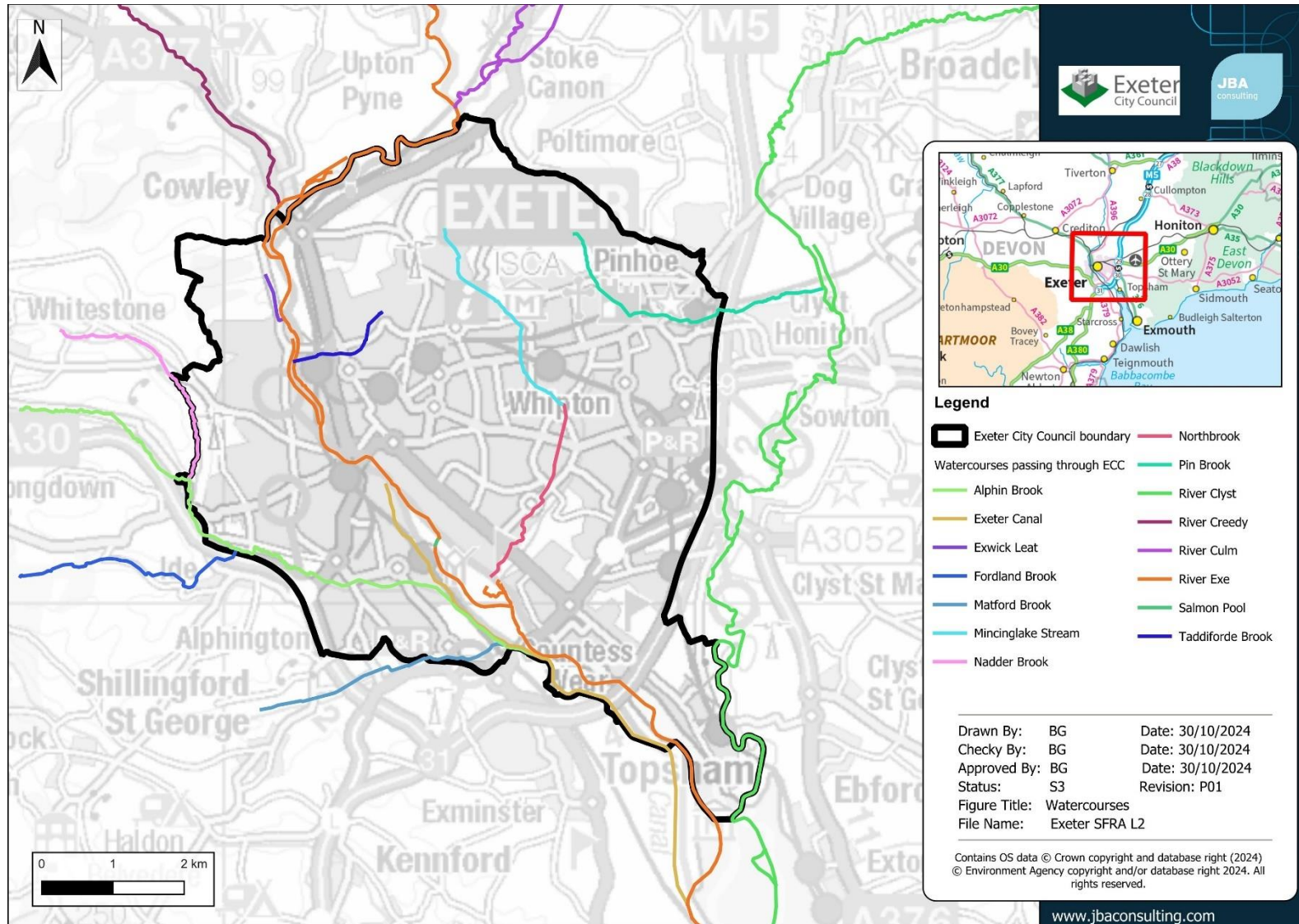


Figure 1-2 Watercourses in the Exeter District

2 Flood Risk policy

This section sets out the Flood Risk Management (FRM) roles and responsibilities for different organisations and relevant legislation, policy, and strategy.

2.1 Roles and responsibilities for Flood Risk Management in Exeter

There are different organisations in and around Exeter City that have responsibilities for FRM, known as RMAs. These are listed in Table 2-1, with a summary of their responsibilities. Further information on the roles and responsibilities can be found in Annex A of the [National Flood and Coastal Erosion Risk Management Strategy \(FCERM\) for England](#).

It is important to note that land and property owners are responsible for the maintenance of watercourses either on or next to their properties, this is known as Riparian Ownership. Riparian Owners are also responsible for the protection of their properties from flooding as well as other management activities, for example by maintaining riverbeds/ banks, controlling invasive species, and allowing the flow of water to pass without obstruction. More information can be found on the Government website in the EA publication '[Owning a watercourse](#)' (2018).

When it comes to undertaking works to reduce flood risk, the EA, and Devon County Council as the LLFA do have jurisdiction, but limited resources must be prioritised and targeted to where they can have the greatest effect. Permissive powers mean that RMAs are permitted to undertake works on watercourses but are not obliged.

Table 2-1 Roles and responsibilities for RMAs

Risk Management Authority	Strategic Level	Operational Level	Planning Role
EA	Strategic overview for all sources of flooding, National Strategy, reporting, and general supervision	Main River (e.g., the River Exe) and reservoirs (consenting, enforcement, and works)	Statutory consultee for certain development in Flood Zones 2 and 3 and all works within 20 metres of a main river. Advice on when to consult the EA is available on the Government website here .

Risk Management Authority	Strategic Level	Operational Level	Planning Role
Devon County Council as LLFA	LFRMS	Surface water, groundwater, and ordinary watercourses (consenting, enforcement, and works)	Statutory consultee for major developments
Exeter City Council as LPA	The development plan for the area	Determination of Planning Applications	Determination of Planning Applications
South West Water	Asset Management Plans, supported by Periodic Reviews (business cases), develop drainage and wastewater management plans	Public sewers	Non-statutory consultee
National Highways (for motorways and trunk roads) and Exeter Highways and Traffic Orders Committee	Highway drainage policy and planning	Highway drainage	Statutory consultee regarding highways design standards and adoptions

2.2 Relevant legislation

The following legislation is relevant to development and flood risk in Exeter. Hyperlinks are provided to external documents:

- [Town and Country Planning Act \(1990\)](#), [Planning and Compulsory Purchase Act \(2004, as amended\)](#), [Localism Act \(2011\)](#), [Water Industry Act \(1991\)](#), [Land Drainage Act \(1991\)](#), [Environment Act \(2021\)](#), which set out the regulations for development on land in England and Wales.
- Neighbourhood Plans - these form part of the local statutory development plan which forms the basis for determining planning applications in that area. To date, a neighbourhood plan only exists for [Exeter St James](#).
- [Flood and Water Management Act \(2010\)](#) – as amended and implemented via secondary legislation. These set out the roles and responsibilities for organisations that have a role in FRM.
- The [Land Drainage Act \(1991, as amended\)](#) and [Environmental Permitting Regulations \(2018\)](#) also set out where developers will need to apply for additional permission (as well as planning permission) to undertake works to an Ordinary Watercourse or Main River.
- [Flood Risk Activity Permits \(FRAPs\)](#) - these must be used if development is planned on or near a main river, on or near a flood defence structure, in a floodplain or on or near a sea defence.
- The [Water Environment Regulations \(2017\)](#) – these transpose the European Water Framework Directive (WFD) (2000) into law and require the EA to produce River Basin Management Plans (RBMPs). These aim to support the improvement/maintenance of the water quality of aquatic ecosystems, riparian ecosystems, and wetlands so that they reach 'good' status.
- Other environmental legislation such as the [Habitats Directive \(1992\)](#), [Environmental Impact Assessment Directive \(2014\)](#) and [Strategic Environmental Assessment Directive \(2001\)](#) also apply as appropriate to strategic and site-specific developments to guard against environmental damage.

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

The FCERM Strategy for England provides the overarching framework for future action by all RMAs to tackle flooding and coastal erosion in England. The EA brought together a wide range of stakeholders to develop the strategy collaboratively. The Strategy looks ahead to 2100 and the actions needed to address the challenge of climate change.

The Strategy has been split into three high level ambitions:

- Climate resilient places
- Today's growth and infrastructure resilient in tomorrow's climate
- A nation ready to respond and adapt to flooding and coastal change.

2.3 Key national, regional and local policy documents

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

- provide useful and specific local information to inform FRAs within the local area.
- set the strategic policy and direction for FRM and drainage – they may contain policies and action plans that set out what future flood mitigation and climate change adaptation plans may affect a development site. A developer should seek to contribute in all instances to the strategic vision for FRM and drainage in Exeter City District.
- provide guidance and/or standards that inform how a developer should assess flood risk and/or design flood mitigation and SuDS.

The following sections provide further details on some of these documents and strategies.

Table 2-2: Relevant national, regional and local policy

Policy level	Document, lead author and date	Contextual information	Policy and measures	Development design requirements	Next update due
National	Flood and Coastal Management Strategy (EA) 2020	Yes	Yes	No	
National	NPPF updated in December 2023	Yes	Yes	Yes	-
National	PPG updated in February 2024	Yes	Yes	Yes	-
National	How to prepare a SFRA	Yes	No	No	-
National	Building Regulations Part H (MHCLG) 2010	Yes	No	Yes	-
Regional	Exe CFMP (EA) 2012	Yes	Yes	No	-
Regional	South West RBD RBMP (EA) 2022	Yes	Yes	No	-
Regional	South West RBD FRMP (EA) 2023	Yes	Yes	No	
Regional	South West Water DWMP 2023	Yes	No	No	-

Policy level	Document, lead author and date	Contextual information	Policy and measures	Development design requirements	Next update due
Regional	Climate change guidance for development and flood risk (EA) last updated May 2022	Yes	No	Yes	-
Local	Devon LFRMS 2021	Yes	Yes	No	-
Local	Sustainable Drainage System - Guidance for Devon 2023	Yes	No	Yes	-

2.4 Local Policy

2.4.1 Sustainable Drainage System: Guidance for Devon (2023)

The Sustainable Drainage System - Guidance for Devon document (2023) outlines the process for designing and implementing SuDS within Devon and sets out the drainage approval process and SuDS requirements.

The guidance highlights the importance for a multidisciplinary approach to SuDS, to ensure flood risk benefits are provided alongside maximum benefits for wildlife and the environment.

2.4.2 Devon County Council Local Flood Risk Management Strategy (2021)

Devon County Council as the Lead Local Flood Authority are required to develop, maintain, apply and monitor a strategy for local flood risk management in the area. The most recent iteration of the LFRMS covers the period 2021-2027. The LFRMS aims to set out how flood risk will be reduced and managed in the county.

3 Planning policy for flood risk management

3.1 National Planning Policy Framework and Guidance

The [Revised National Planning Policy Framework](#) (NPPF) was published in July 2021 (and last updated in December 2023). The NPPF sets out Government's planning policies for England and how these are expected to be applied. The Framework is based on core principles of sustainability and forms the national policy framework in England, also accompanied by a number of Planning Practice Guidance (PPG) notes. It must be taken into account in the preparation of local plans and is a material consideration in planning decisions.

“Strategic policies should be informed by a strategic flood risk assessment and should manage flood risk from all sources. They should consider cumulative impacts in, or affecting, local areas susceptible to flooding, and take account of advice from the Environment Agency and other relevant flood risk management authorities, such as lead local flood authorities and internal drainage boards” (para.166).

The [PPG \(2024\) on flood risk and coastal change](#) was published in 2014 and sets out how the policy should be implemented. Diagram 1 in the PPG (2024) sets out how flood risk should be considered in the preparation of Local Plans. It was last updated in February 2024.

3.2 Risk-based approach

This approach is designed to ensure areas with little or no risk of flooding (from any source) are developed in preference to areas at higher risk, with the aim of keeping development outside of medium and high flood risk areas, where possible. In the long term this will strategically reduce the reliance on flood risk management measures and avoid commitment to the long-term investment required to maintain measures and appropriate standards of safety under climate change conditions.

When drawing up a development plan document such as a Local Plan, it is often the case that it is not possible for all new development to be allocated on land that is not at risk from flooding. In these circumstances the Flood Zone maps, which show the extent of fluvial inundation without the presence of defences, are too simplistic. Thus, a greater understanding of the scale and nature of the actual flood risks is required as the Flood Zones do not take account of the effect of flood risk management measures or flood risk from other sources such as surface water or groundwater.

The NPPF (2023) takes a risk-based approach to development in flood risk areas. Since July 2021 the approach has adjusted the requirement for the Sequential Test (as defined in Para 167 of the NPPF) so that all sources of flood risk are included in the consideration.

3.2.1 The Flood Zone definitions

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

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

The Flood Zones are:

- Flood Zone 1: Low probability: less than a 0.1% chance of river and sea flooding in any given year.
- Flood Zone 2: Medium probability: between a 1% and 0.1% chance of river flooding in any given year.
- Flood Zone 3a: High probability: between a 3.3% and 1% chance of river flooding in any given year.
- Flood Zone 3b: Functional Floodplain: land where water has to flow or be stored in times of flood (greater than 3.3% Annual Exceedance Probability (AEP)). SFRAs identify this Flood Zone in discussion with the LPA and the EA. The identification of functional floodplain takes account of local circumstances. Only water compatible and essential infrastructure are permitted in this zone and should be designed to remain operational in times of flood, resulting in no loss of floodplain or blocking of water flow routes. Information on flood risk vulnerability classification is available online in Annex 3 of the NPPF (2023), [here](#). It may be required to consider climate change on the functional floodplain; this would need hydraulic modelling to confirm extents and therefore it is recommended that this is considered in site specific FRAs and a suitable approach is agreed with the EA. Within this study, Flood Zone 3b has been based on the River Exe model's 3.3% AEP defended extent. In line with EA guidance, this represents a minimum definition and may vary based on local defence characteristics and conditions. Developers should consult the EA and LPA early to confirm the appropriate definition in the context of their site.

3.2.2 The Sequential Test

The Sequential Test aims to ensure that areas at lower risk of flooding are prioritised for development over areas at a higher risk of flooding. This means areas at a medium or high risk of flooding from any source, now or in the future, should be avoided for development where possible. The revision to the Sequential Test ceases to be based on the use of the Zones describing river and sea flood risk, and instead is based on whether development can be located in the lowest risk areas (high-medium-low) of flood risk both now and in the future. The test now applies to all sources of flood risk – whereas previously the test was only performed for present day flood risk for the “Flood Zones” i.e., river and sea flood risk.

Exeter City Council's Level 1 SFRA (2024) provides guidance on the application of the Sequential Test in Exeter.

3.2.3 The Exception Test

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

The Exception Test should only be applied following the application of the Sequential Test. It applies in the following instances, where it is not possible for development to be located in areas with a lower risk of flooding:

- More vulnerable development in Flood Zone 3a;
- Essential infrastructure in Flood Zone 3a or 3b;
- Highly vulnerable development in Flood Zone 2 (this is NOT permitted in Flood Zone 3a or 3b); and/or
- Locations where surface, groundwater, sewer or reservoir flood risk materially affect the safety of proposed development or where development proposals potentially affect existing land or property.

For information on what types of development constitute more vulnerable, essential infrastructure and highly vulnerable refer to [Annex 3 of the NPPF](#).

The information included in this Level 2 SFRA will provide sufficient information to inform the application of the Exception Test.

To meet the flood risk component of the Exception Test development will need to remain safe or its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall. For Water Lane, Marsh Barton, Exe Bridges and Red Cow this will mean raising ground floor levels above the flood level, in many locations by up to 2m. Furthermore, development will need to be designed to provide space between buildings for water to flow, these flood routes may need to be as wide as 20m to allow water to flow through without increasing flood risk elsewhere. As a result flood mitigation design needs to be considered early on in the planning process and at a strategic allocation site level to ensure that there is no off site detriment.

3.2.4 Making a site safe from flood risk over its lifetime

ECC will need to consider the actual and residual risk of flooding and how this will be managed over the lifetime of the development. Table 3-1 provides details of the actual and residual risk to each site assessed within the Level 2 SFRA:

- Actual risk is the risk to the site considering existing flood mitigation measures.
- The PPG (2024) refers to the 'design flood' against which the suitability of a proposed development should be assessed and mitigation measures, if any, are designed.

- The 'design flood' is defined as the 1% AEP fluvial event or 1% AEP surface water event, plus an appropriate allowance for climate change. Guidance on appropriate allowances for climate change can be found [on the EA website here](#) and within Section 4 of this report.
- Safe access and egress should be available during the design flood event. Firstly, the design of the development should seek to avoid areas of a site at flood risk. If that is not possible then access routes should be located above the design flood event levels. Where that is not possible, access through shallow and slow flowing water that poses a low flood hazard may be acceptable.
- Residual risk is the risk that remains after the effects of flood defences have been taken into account and/ or from a more severe flood event than the design event. The residual risk can be:
 - The effects of an extreme 0.1% annual probability flood event. This could lead to the overtopping of flood defences, which may lead to erosion and/or failure, and/ or
 - Structural failure of any flood defences, such as breaches in embankments or walls.
- Flood resistance and resilience measures should be considered to manage any residual flood risk by keeping water out of properties and seeking to reduce the damage caused, should water enter a property. Emergency plans should also account for residual risk, e.g., through the provision of flood warnings and a flood evacuation plans where appropriate.
- In line with the NPPF (2023), the impacts of climate change over the lifetime of the development should be taken into account when considering actual and residual flood risk.

Table 3-1 Summary of actual and residual flood risk at each assessed Level 2 site

Site	Actual risk	Residual risk	Safe access and egress
Water Lane	High risk of fluvial flooding, as 84% of the site situated in the fluvial design event 1% AEP plus 46% CC	The 1% AEP event of Breach Scenario 5 demonstrates moderate flooding as a result of lack of closure of the flood gate at Haven's Wall.	East via Trews Weir Suspension Bridge to Bell Isle Drive, safe access from the allocation site to this point would need to be constructed above the design flood level.

Site	Actual risk	Residual risk	Safe access and egress
Marsh Barton	High risk of fluvial flooding, as 96% of the site situated in the fluvial design event 1% AEP plus 46% CC	The 1% AEP event of Breach Scenario 5 demonstrates sporadic, moderate flooding as a result of lack of closure of the flood gate at Haven's Wall.	Any development within this area would require further consideration as part of site-specific Flood Risk Assessment
Exe Bridges	High risk of fluvial flooding, as 99.5% of the site situated in the fluvial design event 1% AEP plus 46% CC	The 1% AEP event of Breach Scenario 4 demonstrates significant flooding as a result of lack of closure of the flood gate at Royal Oak along Flowerpots Floodwall.	North via Exe Bridge to New Bridge Street, safe access from the allocation site to this point would need to be constructed above the design flood level.
Red Cow	High risk of fluvial flooding, as 96% of the site situated in the River Exe fluvial design event 1% AEP plus 46% CC and 34% of the site situated in the Taddiforde Brook fluvial design event	The 1.3% AEP event of Breach Scenario 1 demonstrates widespread flooding in the absence of the demountable railway defence at Cowley Bridge.	Southeast via St David's Hill, safe access from the allocation site to this point would need to be constructed above the design flood level.
East Gate	Low risk of fluvial flooding as the site is not situated in the fluvial design event 1% AEP plus 46% CC 7% of the site is situated in the 1% plus 65% CC surface water design event.	N/A	South along Western Way

4 Climate Change Guidance

4.1 Relevant allowances for Exeter

4.1.1 Fluvial

Exeter falls within the East Devon Management Catchment. Table 4-1 shows the peak river flow allowances that apply to Exeter for fluvial risk. For large catchments (more than 5km²) with rural land use, these allowances should be used. The central allowance should be used for all developments except essential infrastructure, for which the higher central allowance should be used. The epoch considered will be dependent on the anticipated lifetime of the development. Residential development can be assumed to have a lifetime of at least 100 years, unless there is specific justification for considering a different period. For example, the time in which flood risk or coastal change is anticipated to affect it, where a development is controlled by a time-limited planning condition. The lifetime of a non-residential development depends on the characteristics of that development but a period of at least 75 years is likely to form a starting point for assessment.

Table 4-1 Peak river flow allowances for the East Devon Management Catchment

Management Catchment	Allowance Category	Total potential change anticipated for '2020s' (2015 to 2039)	Total potential change anticipated for '2050s' (2040 to 2069)	Total potential change anticipated for '2080s' (2070 to 2115)
East Devon	Central	16%	24%	46%
	Higher Central	22%	33%	61%
	Upper End	34%	55%	96%

4.1.2 Surface Water

Table 4-2 shows the peak rainfall intensity allowances that apply when considering surface water flood risk. These should be used for site-scale applications (for example, drainage design), and for surface water flood mapping in small catchments (less than 5km²) and urbanised drainage catchments. For development with:

- A lifetime beyond 2100: the Upper End allowances for the 2070s epoch should be considered for both the 3.3% and 1% AEPs.
- A lifetime of between 2061 and 2100: the Central allowance for the 2070s epoch should be considered for both the 3.3% and 1% AEPs.
- A lifetime of up to 2060: the Central allowance for the 2050s epoch should be considered for both the 3.3% and 1% AEPs.

The uplifts are provided for the East Devon Management Catchment, which covers Exeter. Surface water modelling with a 65% uplift allowance for climate change was already

available and therefore this has been used as a conservative estimate of climate change impacts on surface water in Exeter.

Table 4-2 Peak rainfall intensity allowances for the East Devon Management Catchment

Management Catchment	Allowance Category	Annual Exceedance Rainfall event	Total potential change anticipated for '2050's (up to 2060)	Total potential change anticipated for '2070's (2061 to 2125)
East Devon	Central	3.3%	20%	25%
	Upper End	3.3%	35%	40%
	Central	1%	25%	30%
	Upper End	1%	40%	45%

4.1.3 Tidal

Tidal flood risk has not been considered as part of this Level 2 SFRA as it does not affect the assessed sites. Developers are required to liaise with the EA at the earliest opportunity to determine the extent of tidal flood risk to other sites.

5 Level 2 Strategic Flood Risk Assessment

5.1 Summary of sources of information

As part of a site-specific FRA, developers may need to undertake more detailed hydrological and hydraulic assessments of the unmodelled watercourse (or modelled watercourses where additional information can be added) to verify flood depth, hazard and velocity based on the relevant 1% AEP plus climate change event, using the relevant climate change allowances based on the type of development and its associated vulnerability classification (see Section 4).

Table 5-1 highlights all the datasets used in the Level 2 SFRA to assess the Local Plan sites against flood risk.

Table 5-1 Datasets used in the Level 2 SFRA

Source of flood risk	Data used to inform the assessment	Data supplied by
Historic (all sources)	Historic Flood Map and Recorded Flood Outlines	Environment Agency
	Historic flood investigations	Devon County Council
Flood Map for Planning	Flood Zones 2 and 3 datasets	Environment Agency
	Flood Zone 3b - fluvial 3.3% AEP defended extents from the Environment Agency 2024 River Exe Scheme Modelling	Environment Agency
Fluvial (depths, velocities, hazard where detailed modelling is available - present day and climate change)	Present day - 2024 River Exe Scheme Modelling and 2024 Taddiforde Brook modelling	Environment Agency (2024 River Exe Scheme Modelling), JBA Consulting (2024 Taddiforde Brook modelling)
	Climate change - 2024 River Exe Scheme Modelling and 2024 Taddiforde Brook modelling	Environment Agency (2024 River Exe Scheme Modelling), JBA Consulting (2024 Taddiforde Brook modelling)
Surface Water mapping (depths, velocities, hazard - present day and climate change)	Present day	Environment Agency
	Climate change	JBA Consulting

Source of flood risk	Data used to inform the assessment	Data supplied by
Groundwater	Bedrock geology / superficial deposits dataset, EA groundwater flood warning areas	Environment Agency
	JBA's Groundwater Flood Risk Map	JBA Consulting
Reservoir	Reservoir Flood Extents dataset	Environment Agency
Sewer	Drainage and Wastewater Management Plan	South West Water
Flood Alert and Warnings	Flood Alert and Warnings dataset	Environment Agency
Geology	Bedrock geology and superficial deposits datasets	British Geological Survey (BGS)
AIMS dataset	Spatial flood defences type, design standard of protection and condition	Environment Agency

5.1.1 Data used to inform depth, velocity and hazard to people

The Level 2 assessment seeks to map the probable depth and velocity of flooding as well as the hazard to people during the defended fluvial and surface water events. The following events have been assessed:

Fluvial:

- 3.3% AEP, 1% AEP and 0.1% AEP depth hazard and velocity data.
- 1% AEP plus 46% climate change and 1% AEP plus 61% climate change depth, hazard and velocity data.

Surface water:

- 3.3% AEP, 1% AEP and 0.1% AEP depth hazard and velocity data.
- 3.3% AEP plus 65% climate change, 1% AEP plus 65% climate change and 0.1% AEP plus 65% climate change depth, hazard and velocity data.

Hazard to people has been calculated using the formula as suggested in [Defra's FD2321/TR2 "Flood Risk to People"](#). The different hazard categories are shown in Table 5-2. Developers should also test the impact of climate change depths, hazard and velocities on the site at the Flood Risk Assessment (FRA) stage.

Table 5-2 DEFRA's flood hazard categories

Flood hazard rating d x (v+0.5)	Degree of flood hazard	Description
<0.75	Low	Caution - "Flood zone with shallow flowing water or deep standing water"
0.75 - 1.25	Moderate	Danger for some - "Danger: Flood zone with deep or fast flowing water"
1.25 - 2.00	Significant	Danger for most - "Danger: Flood zone with deep fast flowing water"
>2.00	Extreme	Danger for all - "Extreme danger: Flood zone with deep fast flowing water"

5.1.2 Duration and onset of flooding

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

- The position of the site within a river / surface water catchment, with those at the top of a catchment likely to flood sooner than those lower down. The duration of flooding tends to be longer for areas in the lower catchments.
- Tributaries with small catchment areas will respond faster and result in flashier storm hydrographs than those of a larger Main River. However, manmade incidental flood attenuation features in the floodplain will hold water back, such as road embankments. These will affect the speed of water travelling downstream by slowing it down.
- The principal source of flooding: where this is surface water, depending on the intensity and the location of the rainfall, flooding could be experienced within 30 minutes of the heavy rainfall event e.g. a thunderstorm. Typically, the duration of flooding for areas at risk of surface water flooding or from flash flooding from small watercourses is short (hours rather than days).
- The preceding weather conditions prior to the flooding: wet weather lasting several weeks will lead to saturated ground. Rivers respond much quicker to rainfall in these conditions.
- Whether a site is defended, noting that if the defences were to fail, a site could be affected by very fast flowing and hazardous water within 15 minutes of a breach developing (depending on the size of the breach and the location of the site in relation to the breach), causing danger to life.
- Catchment geology, for example chalk catchments take longer to respond than typical clay catchments.

The information in this document should be used as a guide only, therefore it is recommended that a site-specific FRA refines this information, based on more detailed modelling work where necessary.

The River Exe hydraulic modelling indicates that flood levels could remain above the top of bank / defence levels for durations in excess of 24 hours which in turn is likely to lead to significant flood durations lasting days within the Water Lane, Marsh Barton, Exe Bridges and Red Cow sites as the water drains away. Furthermore, the speed of onset between flood levels exceeding the banks / defences of the River Exe and flooding occurring on the sites is expected to be less than two hours for all sites and therefore robust warning and emergency plans will be required to keep residents safe.

5.2 Historic Flooding

Historic flooding was assessed using the EA's Recorded Flood Outlines dataset, as well as using incidents picked up in the Devon County Council's Section 19 flood records.

5.3 Fluvial Flood Risk

Flood Zones are based on the undefended scenario (where flood extents are not reduced as a result of the presence of defences) with the exception of Flood Zone 3b, which includes the presence of defences on the basis that land behind existing defences is not functional floodplain.

The EA's Flood Map for Planning (FMfP) flood zones were used to consider Flood Zone 2 and Flood Zone 3a flood risk across the Level 2 sites. For Flood Zone 3b, the EA's Exe Scheme Modelling (3.3% AEP defended extent) was used.

5.3.1 The River Exe Post-Scheme Model (2024 Update)

An update to the hydraulic model for the River Exe, in Exeter, was undertaken to include the recently constructed Exeter Flood Defence Scheme (FDS). The raised defences in the model update reflect the actual levels of defences instead of design levels. The Flood Modeller-TUFLOW model also incorporates a number of changes in the topographic survey of hydraulic structures.

The River Exe flows in a southerly direction through the Exeter City District. Four of the five sites assessed are situated adjacent, or close to the River Exe.

5.3.2 Assessment of fluvial risk

All five sites other than East Gate are affected by present day fluvial flooding. Red Cow and Water Lane are impacted by flooding in the 1% AEP and 0.1% AEP present day scenarios, whilst Exe Bridges and Marsh Barton are impacted by flooding in the 0.1% AEP present day scenario only. The extent of flooding in the fluvial event is not as severe as the extent outlined in the flood zone data, this is due to fluvial modelling taking into account the recently constructed Exeter Flood Defence Scheme (FDS).

5.4 Surface water flood risk

5.4.1 Data used to inform surface water flood risk

Present day surface water flood extents, depths, hazard and velocities were downloaded from Defra data services for the following scenarios: 3.3% 1% and 0.1%. Climate change surface water data was produced by JBA for the following scenarios: 3.3% plus 65% climate change, 1% AEP plus 65% climate change and 0.1% AEP plus 65% climate change. The 65% allowance for climate change was used as a proxy for the Upper End rainfall intensity allowance of 45% for the East Devon management catchment, as set out in Section 4.1.

5.4.2 Assessment of surface water flood risk

In Exeter, there is a risk of surface water flooding along watercourses, roads and topographic low points across the region, where ponding and significant flows occur. All five sites are situated within the design surface water flood event (1% AEP plus 65% climate change).

5.5 Groundwater

5.5.1 Data used to inform groundwater flood risk

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

Mapping of groundwater has been based on the JBA Groundwater Emergence mapping dataset. The dataset is a strategic scale map showing groundwater flood areas on a 5m grid and illustrates where groundwater may emerge. The modelling for JBA's mapping involves simulating groundwater levels for a range of return periods (including 75, 100 and 200 years). Groundwater levels are then compared to ground surface levels to determine the head difference in metres. The JBA Groundwater Emergence mapping categorises the head difference (m) into five feature classes based on the 1% AEP model outputs which are outlined in Table 5-3.

Table 5-3 JBA Groundwater Flood Risk Map categories

Category	Flood depth range during a 1% AEP flood event	Groundwater flood risk
4	Groundwater levels are either at or very near (within 0.025m of) the ground surface	Within this zone there is a risk of groundwater flooding to both surface and subsurface assets. Groundwater may emerge at significant rates and has the capacity to flow overland and/or pond within any topographic low spots.
3	Groundwater levels are between 0.025m and 0.5m below the ground surface	Within this zone there is a risk of groundwater flooding to both surface and subsurface assets. There is the possibility of groundwater emerging at the surface locally.
2	Groundwater levels are between 0.5m and 5m below the ground surface	There is a risk of flooding to subsurface assets but surface manifestation of groundwater is unlikely.
1	Groundwater levels are at least 5m below the ground surface	Flooding from groundwater is not likely.
-	Low risk	This zone is deemed as having a negligible risk from groundwater flooding due to the nature of the local geological conditions.

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

It should be noted that the JBA Groundwater Emergence map is suitable for general broad-scale assessment of the groundwater flood hazard in an area, but it is not explicitly designed for the assessment of flood hazard at the scale of a single property. In high-risk areas, a site-specific risk assessment for groundwater flooding is recommended to fully inform the likelihood of flooding.

5.5.2 Assessment of groundwater risk

The JBA Groundwater Emergence mapping shows that the sites to the southwest of the River Exe are at the greatest risk of groundwater emergence. The majority of the Red Cow site is not subject to groundwater emergence risk. East Gate is at medium risk of groundwater emergence with areas in categories 1, 2 and 3. Exe Bridges is situated entirely within category 3. Water Lane is located in categories 2 and 3 in the central area and

category 4 in the south of the site. The north of the site is identified to be at low risk of groundwater emergence. The south of Marsh Barton is situated in category 4, whereas the north is situated in a low risk area.

5.6 Reservoirs

5.6.1 Data used to inform reservoir risk

The latest available EA Risk of Flood from Reservoirs mapping now shows “wet day” and “dry day” reservoir inundation extents. The “wet day” being a reservoir breach at the same time as a 0.1% AEP (1 in 1000-year) river flood (as this is a likely time when a reservoir might fail) and the dry day shows the failure just from the water retained by the dam.

5.6.2 Assessment of reservoir risk

Four sites are at risk from reservoir breach in both the dry day and wet day scenarios: Red Cow, Exe Bridges, Water Lane and Marsh Barton. These sites are situated adjacent to, or close to, the River Exe. East Gate is not impacted by reservoir flooding in either scenario.

5.7 Sewer Flooding

5.7.1 Data used to inform sewer flooding

Sewer incident data was not provided for the purpose of this Level 2 SFRA report. South West Water's [Drainage and Wastewater Management Plan \(DWMP\)](#) was used to identify the risk of sewer flooding across the River Exe management catchment, with particular focus on the Countess Wear WwTW that serves most of Exeter.

The DWMP indicates immediate, moderate risk of sewer flooding in the 10% AEP and 50% AEP events. Internal sewer flooding has been deemed not to be a significant risk in the catchment.

Section 19 Flood Investigations carried out by Devon County Council indicate that increased surface water runoff has led to the overwhelming of drainage systems across the city.

5.8 Canals

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

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

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

The Exeter Ship Canal runs adjacent to the Water Lane development site. However, it is not embanked along this section and therefore this has not been considered within this Level 2 SFRA.

6 Summary of Level 2 Assessment and Recommendations

Notwithstanding the recommendations of this Level 2 SFRA, site-specific assessments will need to be undertaken in accordance with the latest policy guidance and flood risk, defence information and information in the SFRA.

A summary of the risk at each of the five sites is outline in Table 6-1 to Table 6-4.

6.1 Summary of the key messages

Table 6-1 Water Lane flood risk summary

Site code	Water Lane
Current land use	Mixed use, including industrial, commercial and residential
Proposed land use	Mixed use, including new homes, leisure, retail, employment and public open space.
Site area and location	36ha, Water Lane EX2 8BD
General level of flood risk	Flood Zones: 1.5% in Flood Zone 1; 1.5% in Flood Zone 2, 97% in Flood Zone 3a. Fluvial: The site is situated 3.5% in the 1% AEP event and 87% in the 0.1% AEP event. 84% of the site is situated in the design event (1% AEP plus 46% climate change). Surface water: 0.3% of the site is situated in the 3.3% AEP surface water event, increasing to 2% in the 3.3% AEP plus 65% climate change surface water event. 1.4% of the site is situated in the 1% AEP event, increasing to 5.8% in the 1% AEP plus 65% climate change event. The southern and east parts of the site have been shown to be a high risk of groundwater flooding. However this should be confirmed through infiltration testing and groundwater monitoring.
Risk of breach	The Exeter Flood Defence Scheme (FDS) saw the construction of Trews flood relief channel and Haven Banks wall, alongside embankments and flood gates in the vicinity of Water Lane. Fluvial breach modelling (based on the failure to close the play park gates on Haven Road) shows more significant flooding, encroaching the site in the north initially, travelling in a southerly direction across the site.

Site code	Water Lane
Access and egress issues	A raised route (elevated above the design flood level) via Trews Weir has been identified to be the preferred option. This route would start at the embankment adjacent to the eastern side of the railway line, south of Tan Lane. From here the route would head east via an elevated cycle path, a bridge would provide a crossing over Water Lane, leading to the dry ground within the Old Gas Works site. A path would lead around the southern edge of the Old Gas Works site where it would join a bridge of the Exeter Ship Canal, before linking to further bridges (connected by elevated cycle paths) over the Flood Relief Channel and River Exe. Finally an elevated cycle path would connect the River Exe bridge to dry ground on Bell Isle Drive.

Table 6-2 Exe Bridges flood risk summary

Site code	Exe Bridges
Current land use	Retail park
Proposed land use	Mixed use, including residential and retail
Site area and location	1.8ha, Exe Bridges EX4 1AH
General level of flood risk	Flood Zones: 100% of the site is in Flood Zone 3a Fluvial: The site is situated entirely within the 0.1% AEP flood extent. 99.5% of the site is situated in the design flood event (1% AEP plus 46% climate change) Surface water: 13% of the site is situated in the 3.3% AEP plus 65% climate change event and 28% of the site is situated in the 1% AEP plus 65% climate change event. The site has been shown to be a high risk of groundwater flooding. However this should be confirmed through infiltration testing and groundwater monitoring.
Risk of breach	The site is protected by Flowerpots floodwall, situated 70m north of the site. The breach scenario (based on failure of the flood wall of the Royal Oak pub) shows the majority of the site is impacted by flooding in this event.
Access and egress issues	A raised safe access and egress route (elevated above the design flood level) north via Exe Bridge to New Bridge Street is the preferred option.

Table 6-3 Red Cow flood risk summary

Site code	Red Cow
Current land use	Mixed use, including rail infrastructure and associated car parking
Proposed land use	Mixed use including residential
Site area and location	3.79ha, Bonhay Road EX4 4NT
General level of flood risk	Flood Zones: 1.5% of the site is situated in Flood Zone 1 and 98.5% of the site is situated in Flood Zone 3a. Fluvial: 28% of the site is situated in the 1% AEP event and 97% is situated in the 0.1% AEP event of the River Exe model. 96% of the site is situated in the design flood event (1% AEP plus 46% climate change) of the River Exe model. 4% of the site is situated in the 1% AEP event and 36% of the site is situated in the 0.1% AEP event. 34% of the site is situated in the design flood event of the Taddiforde Brook (1% AEP plus 46% climate change) Surface water: 33% of the site is in the 3.3% AEP plus 65% climate change event and 48% of the site is in the 1% AEP plus 65% climate change event. This site is shown to be at low risk of groundwater flooding. However this should be confirmed through infiltration testing and groundwater monitoring.
Risk of breach	There is a risk of breach from the demountable railway defences at Cowley Bridge, which run alongside the railway track in the region of the site. The breach modelling of these defences indicates widespread flooding across the site, initially encroaching from the north. Along the bank of the River Exe there are additional defences, including a sheet piled wall, the Station Road flood gate, a combi wall, Old View Road embankment and St David's flood wall. Modelling of this breach scenario (based on failure to close the Network Rail flood gates at Cowley Bridge) generates minimal flood extent, primarily in the north of the site, with additional flooding is observed on the right bank of the River Exe, the opposite side of the river to Red Cow. This latter breach scenario has not been assessed as part of this SFRA.

Site code	Red Cow
Access and egress issues	A raised safe access and egress route (elevated above the design flood level) is proposed to connect the site to St David's Hill. Access and egress remains available via St David's Hill in the design fluvial event (1% AEP plus 46% CC) and the design surface water event (1% plus 65% CC). Further consideration is required to ensure that safe access and egress can be achieved for all site users, taking into account all potential flood risk and the site's topography.

Table 6-4 East Gate flood risk summary

Site code	East Gate
Current land use	Brownfield
Proposed land use	Mixed Use, including residential
Site area and location	6.14ha, Paris Street EX1 1JN
General level of flood risk	Flood Zones: The site is situated entirely within Flood Zone 1. Fluvial: The site is not identified to be at fluvial risk in the present day or under future climate change scenarios. Surface water: 2% of the site is situated in the 3.3% AEP event, 4% in the 1% AEP event and 8% in the 0.1% AEP event. Increasing to 5% in the in the 3.3% AEP plus 65% climate change surface water flood event, 7% in the 1% AEP plus 65% climate change surface water event and 16% in the 0.1% AEP plus 65% climate change event. Significant, high risk surface water is situated just east of the site, on Russel Road, posing potential risk to the site and all development which may back onto Russell Road. The majority of the site (in the south and east) has been shown to be a high risk of groundwater flooding. However this should be confirmed through infiltration testing and groundwater monitoring.
Risk of breach	The site is not at residual risk of flooding.
Access and egress issues	Access and egress is likely to be available along Paris Street and Western Way in the 1% AEP plus 65% climate change surface water flood event.

Table 6-5 Marsh Barton flood risk summary

Site code	Marsh Barton
Current land use	Mixed use, including commercial, industrial, leisure and retail use.
Proposed land use	No allocation, but identified as having potential for regeneration
Site area and location	53.6ha
General level of flood risk	Flood Zones: 3% of the site is in Flood Zone 2 and 97% is in Flood Zone 3a. Fluvial: 96% of the site is situated within the design flood (1% AEP plus 46% CC) Surface Water: 7% of the site is situated in the 3.3% AEP plus 65% climate change RoFSW event. 20% of the site is situated within the 1% AEP plus 65% climate change RoFSW event. The southern half of the site has been shown to be a high risk of groundwater flooding. However this should be confirmed through infiltration testing and groundwater monitoring.
Risk of breach	The EA AIMS dataset identifies flood defences along the River Exe, in the vicinity of the site. The 1% AEP breach scenario (based on the failure to close the play park gates on Haven Road) shows an increased fluvial impact on the site.
Access and egress issues	Consideration is required to ensure that safe access and egress can be achieved during the design flood events ((1% AEP plus 46% CC fluvial and 1% AEP plus 45% surface water events) taking into account all potential flood risk and the site's topography.

6.2 Recommendations

To pass the Exception Test, it must be shown that a development will provide wider sustainability benefits that outweigh the risk and that the development will be safe throughout its lifetime without increasing risk elsewhere. The former is a planning-related consideration and the Level 2 SFRA helps to answer the latter part of the Test.

6.2.1 Water Lane

To pass the Exception Test, it is required that the following actions are addressed:

- A raised safe access and egress route should be established as part of an Emergency Response Plan. For Water Lane, raised safe access and egress route (elevated above the design flood level) is proposed via Trews Weir Suspension Bridge, to Bell Isle Drive. However, safe access to this route will need to be provided by individual developers.
- Finished Floor levels should be raised to at least 300mm above the design flood levels (1% AEP plus 46% CC). For Water Lane the design flood level is between 6.34mAOD and 8.75mAOD depending on location within the site. Levels will need to be confirmed through a site-specific flood risk assessment using the latest available hydraulic modelling data which can be requested from the Environment Agency.
- An Emergency Response Plan should be prepared which aligns with ADEPT guidance. As part of the Emergency Response Plan, the residual risk posed by the defences should be assessed further and suitable mitigation adopted.
- Where possible, highest risk development should be sited in areas at lowest risk, for Water Lane this includes the land at the Former Gasworks.
- Site-specific Flood Risk Assessments should be undertaken to assess the risk of fluvial, surface water and groundwater flooding in relation to the proposed development, and the access and egress arrangements, as outlined above. The impact on flood risk elsewhere will also need to be considered.
- Infiltration rates should be assessed on site as part of a drainage strategy. The drainage strategy should identify opportunities for SuDS to manage the surface water flood risk at the site. Given the flood risk to the site, consideration should be given to source control of impermeable runoff, through the construction of green roofs and grey water recycling, reducing the amount of runoff that would need to be stored on site.

6.2.2 Exe Bridges

To pass the Exception Test, it is required that the following actions are addressed:

- A safe access and egress route should be established as part of an Emergency Response Plan. For Exe Bridges a raised safe access and egress route (elevated above the design flood level) is proposed to the north, via Exe Bridges to New Bridge Street.
- Finished Floor levels should be raised to at least 300mm above the design flood levels (1% AEP plus 46% CC). For Exe Bridges the design flood level is between 8.98mAOD and 9.74mAOD depending on location within the site. Levels will need to be confirmed through a site-specific flood risk assessment using the latest available hydraulic modelling data which can be requested from the Environment Agency.
- An Emergency Response Plan should be prepared which aligns with ADEPT guidance. As part of the Emergency Response Plan, the residual risk posed by the defences should be assessed further and suitable mitigation adopted.

- Infiltration rates should be assessed on site as part of a drainage strategy. The drainage. Given the flood risk to the site, consideration should be given to source control of impermeable runoff, through the construction of green roofs and grey water recycling, reducing the amount of runoff that would need to be stored on site.
- Site-specific Flood Risk Assessments will need to be undertaken to assess the risk of fluvial, surface water and groundwater flooding in relation to any proposed development. The impact on flood risk elsewhere will also need to be considered.

6.2.3 Red Cow

To pass the Exception Test, it is required that the following actions are addressed:

- Site-specific hydraulic modelling should be undertaken to assess the significance of fluvial flooding from the Taddiforde Brook on the Red Cow Site.
- A safe access and egress route should be established as part of an Emergency Response Plan. For Red Cow, a raised safe access and egress route (elevated above the design flood level) is proposed to connect the site to St David's Hill. However, safe access to this route will need to be provided by individual developers.
- Finished Floor levels should be raised to at least 300mm above the design flood levels (1% AEP plus 46% CC). For Red Cow the design flood level is between 13.14mAOD and 14.44mAOD depending on location within the site. Levels will need to be confirmed through a site-specific flood risk assessment using the latest available hydraulic modelling data which can be requested from the Environment Agency.
- An Emergency Response Plan should be prepared which aligns with ADEPT guidance. As part of the Emergency Response Plan, the residual risk posed by the defences should be assessed further and suitable mitigation adopted.
- Where possible, highest risk development should be sited in areas at lowest risk, for Red Cow, this is the land at the current St David's car park, east of the station ticket office.
- Infiltration rates should be assessed on site as part of a drainage strategy. The drainage strategy should identify opportunities for SuDS to improve the existing flood conveyance routes through the site for both fluvial and surface water events. Given the flood risk to the site, consideration should be given to source control of impermeable runoff, through the construction of green roofs and grey water recycling, reducing the amount of runoff that would need to be stored on site.
- Site-specific Flood Risk Assessments will need to be undertaken to assess the risk of fluvial (from the River Exe and Taddiforde Brook) and surface water flooding in relation to any proposed development. The impact on flood risk elsewhere will also need to be considered.

- Developers should work with Devon County Council (LLFA) and Network Rail to identify opportunities to daylight the Taddiforde Brook culvert which runs through the site and improve the conveyance and condition of this culvert.

6.2.4 East Gate

To pass the Exception Test, it is required that the following actions are addressed:

- The location of the culverted watercourse at the site should be identified and hydraulic modelling be carried out to determine the extent of flood risk this poses to the site.
- Highest risk development should be sited in areas at lowest risk, for East Gate, this is the west of the site in the areas surrounding Paris Street.
- A safe access and egress route should be established and an Emergency Response Plan may be required. For East Gate, this study has identified that safe access and egress may be possible to the south via Western Way. However, access to this road may be restricted due to flooding on Heavitree Road.
- Finished Floor levels should be raised to at least 300mm above the design flood levels (1% AEP plus 46% CC) or 600mm above the adjacent road level to the building, whichever is the higher. As flood risk to East Gate is from surface water the design flood level varies significantly across the site and therefore levels should be confirmed through a site-specific flood risk assessment.
- Infiltration rates should be assessed on site as part of a drainage strategy. The drainage strategy should identify opportunities for SuDS to improve the existing flood conveyance routes through the site for surface water events. Given the flood risk to the site, consideration should be given to source control of impermeable runoff, through the construction of green roofs and grey water recycling, reducing the amount of runoff that would need to be stored on site.
- Site-specific Flood Risk Assessments will need to be undertaken to assess the risk of surface water and groundwater flooding in relation to any proposed development. The impact on flood risk elsewhere will also need to be considered.

6.2.5 Marsh Barton

To pass the Exception Test, it is required that the following actions are addressed:

- A safe access and egress route should be established as part of an Emergency Response Plan. Developers will need to engage at the earliest opportunity with the EA and LPA to determine a suitable route of access and egress. If other solutions are not possible, increasing the elevation of land for whole or parts of the sites could be implemented to prevent flood flows affecting the land up to the design level. However, in this instance, hydraulic modelling would be required to show that flood risk will not increase elsewhere.

- An Emergency Response Plan should be prepared in line with ADEPT guidance. As part of the Emergency Response Plan, the residual risk posed by the defences should be assessed further and suitable mitigation adopted.
- Finished Floor levels should be raised to at least 300mm above the design flood levels (1% AEP plus 46% CC). For Marsh Barton the design flood level is between 7.32mAOD and 8.66mAOD depending on location within the site. Levels will need to be confirmed through a site-specific flood risk assessment using the latest available hydraulic modelling data which can be requested from the Environment Agency.
- Infiltration rates should be assessed on site as part of a drainage strategy. The drainage strategy should identify opportunities for SuDS to improve the existing flood conveyance routes through the site for both fluvial and surface water events. Given the flood risk to the site, consideration should be given to source control of impermeable runoff, through the construction of green roofs and grey water recycling, reducing the amount of runoff that would need to be stored on site.
- Site-specific Flood Risk Assessments will need to be undertaken to assess the risk of fluvial, surface water and groundwater flooding in relation to any proposed development. The impact on flood risk elsewhere will also need to be considered.

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