Cambridgeshire Flood and Water Supplementary Planning Document

Cambridgeshire County Council

Fenland CAMBRIDGESHIRE
Fenland District Council

EAST CAMBRIDGESHIRE DISTRICT COUNCIL

Huntingdonshire DISTRICT COUNCIL

South Cambridgeshire District Council

CAMBRIDGE CITY COUNCIL

Note to the reader

As the emerging Cambridge Local Plan is still at the examination stage, this document will be carried forward for adoption as an SPD at the same time as the Local Plan, as agreed at Development Plan Scrutiny Sub Committee on 6 December 2016. In the interim period, prior to adoption of the SPD, the Cambridgeshire Flood and Water document provides context and guidance as material consideration in the planning process. It does not introduce new policy but rather it elaborates on, and is consistent with Local Plan policies.

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1 Introduction

1.1 Background

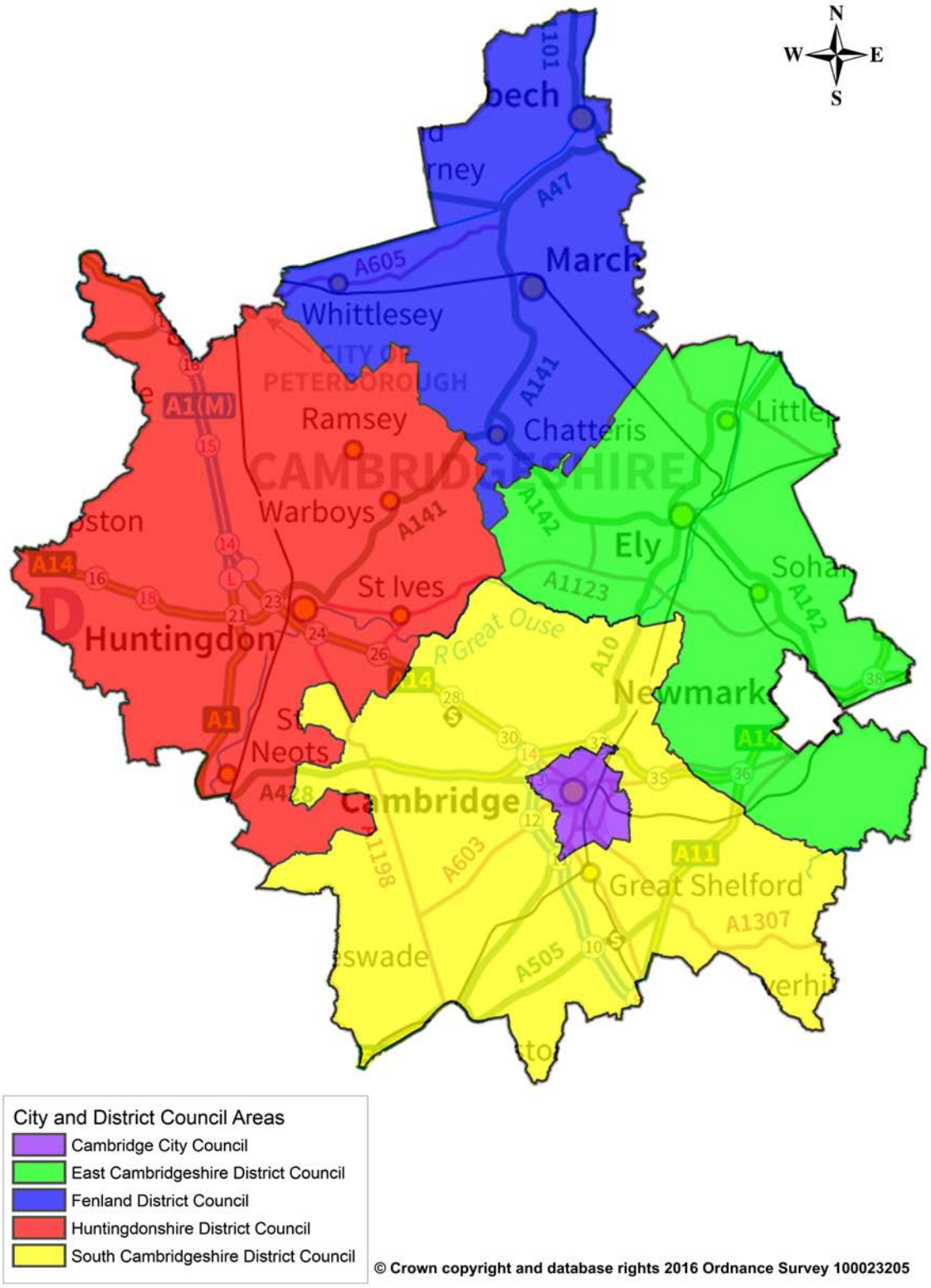
1.1.1 This Supplementary Planning Document (SPD) forms part of each of the Cambridgeshire Local Planning Authority's (LPAs) suite of planning documents. This SPD has been developed by Cambridgeshire County Council (as Lead Local Flood Authority (LLFA)) in conjunction with LPAs within Cambridgeshire, and other relevant stakeholders, to support the implementation of flood risk and water related policies in the Local Plans. It provides guidance on the implementation of flood and water related policies in each authority's respective local plan. Further details on these policies are contained within Appendix A. This section summarises the main issues addressed by the SPD. This SPD supplements policies found in:

- The Cambridgeshire and Peterborough Minerals and Waste Development Plan;
- The Cambridge Local Plan;
- The East Cambridgeshire Local Plan;
- The Fenland Local Plan;
- The Huntingdonshire Core Strategy 2009 and the emerging local plan; and
- The South Cambridgeshire Development Control Policies DPD 2007 and the emerging local plan.

1.1.2 This document is a material consideration when considering planning applications. It does not introduce new policy but rather it is intended to elaborate on, and be consistent with, existing and emerging local plan policies.

1.1.3 As the Lead Local Flood Authority, Cambridgeshire County Council has endorsed the SPD and as part of its role as the statutory consultee for surface water management, will follow the guidance in this SPD.

Map 1.1 : City and District Councils' Areas



1 Introduction

1.2 Why guidance is needed

1.2.1 The aim of this SPD is to provide guidance on the approach that should be taken to manage flood risk and the water environment as part of new development proposals. The SPD will highlight the documents that will be required to accompany planning applications, including:

- Sequential Test, and where appropriate Exception Test, reports
- Site specific Flood Risk Assessments (FRAs) and Drainage Strategies (incorporating the approach to surface water drainage)

1.2.2 A significant amount of new development will occur in Cambridgeshire in the next 20 years and beyond. In order to reduce the impact upon the water environment, development must be appropriately located, well designed, managed and take account of the impacts of climate change.

1.2.3 Each of the chapters contained within the SPD details guidance for applicants on managing flood risk and the water environment in and around new developments within Cambridgeshire. The following paragraphs provide a summary of the details of the guidance contained in each of the chapters:

Chapter 1 Introduction

This chapter provides an introduction into the background of the SPD and how it should be used by applicants, consultants, design teams, development management officers and other interested parties.

Chapter 2 Setting the Scene

This chapter provides an overview of the European and national context on flood risk and water management, as well as providing further details on the local plans and policies associated with Cambridgeshire.

Chapter 3 Working together with Water Management Authorities

Within this chapter details are given as to the key water management authorities that may need to be consulted by the applicant during the planning application, including pre-application and planning application stages.

Chapter 4 Guidance on managing flood risk

The aim of this chapter is to provide specific advice on how to address flood risk issues within the planning process, including the application of the 'sequential approach' to flood risk and producing site specific flood risk assessments.

Chapter 5 Managing and mitigating risk

An integral part of managing and mitigating risk associated with flooding is good site design. This chapter covers ways in which those risks can be appropriately addressed.

Chapter 6 Surface water and Sustainable Drainage Systems

This chapter specifically looks at a number of different design methods and how they can be incorporated into SuDS that form part of a proposed development. In addition, further guidance is given on the adoption and maintenance of SuDS.

Chapter 7 Water Environment

Under the Water Framework Directive (WFD) water environments must also be protected and improved with regards to water quality, water habitats, geomorphology and biodiversity. This chapter discusses the water environment in more detail.

1.3 How to use this Supplementary Planning Document

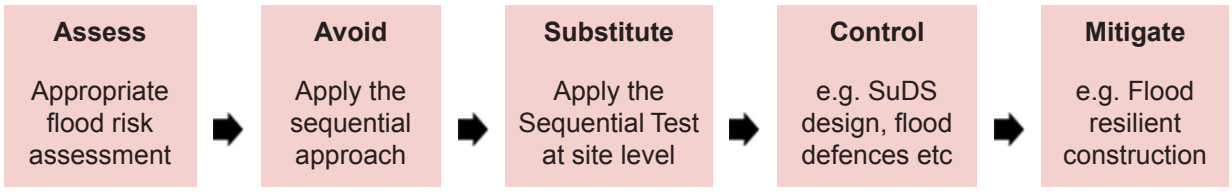
1.3.1 To ensure that Cambridgeshire has a consistent, locally appropriate approach to flood risk and water management, this SPD should be used by:

- Applicants when considering new sites for development
- Applicants when preparing the brief for their design team to ensure drainage and water management schemes are sustainably designed
- Consultants when carrying out site specific flood risk assessments
- Design teams preparing masterplans, landscape and surface water drainage schemes
- Development management officers and their specialist consultees when determining delegated planning applications, selecting appropriate planning conditions, making recommendations to committees and drawing up S106 obligations that include contributions for SuDS
- Other interested parties (e.g. Local Members) who wish to better understand the interaction between development, flooding and drainage issues

1.3.2 A checklist of information which may need to be considered in support of an application, demonstrating how it has met all the requirements set out in Chapters 2 – 7, can be found in Appendix B.

1.3.3 This SPD is set within the context of a water and flood risk management hierarchy to help developers and decision makers understand flood and water management and to embed it in decision making at all levels of the planning process.

Figure 1.1 : The Flood Risk Management Hierarchy



1.3.4 The SPD addresses all the flood and water issues associated with developments within the Cambridgeshire context. It should however be considered that the design of water features and drainage systems is dependent on a number of constraints such as existing site contamination levels, for example. This SPD does not provide detailed information on land and groundwater contamination remediation measures.

1.3.5 The SPD does not provide a comprehensive guide on all other development related issues. There is a wide range of other guidance available as part of national planning policy and from various sources for other matters.

2 Setting the scene

The aim of this chapter is to provide an overview of the European (e.g. The Water Framework Directive and The Floods Directive) and national context (e.g. Flood and Water Management Act 2010, National Planning Policy Framework, National Planning Practice Guidance and DEFRA Non-statutory Technical Standards for SuDS) on flood risk and water management, as well as providing further details on the local plans and policies associated with Cambridgeshire.

2.1 Legislation, policy and guidance

2.1.1 Flood and water management in Cambridgeshire is influenced by European and national legislation, national and local policy, technical studies and local knowledge. These themes are considered further within this chapter.

2.2 European context

The Water Framework Directive

2.2.1 The Water Framework Directive – 2000/60/EC (WFD) came into force in England in 2003 via The Water Environment (Water Framework Directive) (England and Wales) Regulations. There are four main aims of the WFD:

- To improve and protect inland and coastal waters
- To promote sustainable use of water as a natural resource
- To create better habitats for wildlife that lives in and around water
- To create a better quality of life for everyone

2.2.2 To achieve the purpose of the WFD of protecting all water bodies, environmental objectives have been set. These are reported for each water body in the River Basin Management Plan (RBMP). Progress towards delivery of the objectives is reported on by the relevant authorities at the end of each six-year river basin planning cycle. Objectives vary according to the type of water body; across Cambridgeshire and the Fens there is a significant network of heavily modified and artificial watercourses.

2.2.3 Further details on the WFD can be found under Chapter 7.

The Floods Directive

2.2.4 The aim of the EU Floods Directive - 2007/60/EC is to reduce and manage the risks that floods pose to human health, the environment, cultural heritage and economic activity. The Directive came into force in the UK through the Flood Risk Regulations 2009 which in turn sets the requirement for Preliminary Flood Risk Assessments (PFRA) to be produced by all unitary and county councils. The PFRA process is aimed at providing a high level overview of flood risk from local flood sources, including surface runoff, groundwater and ordinary watercourses. It is not concerned with flooding from main rivers or the sea. The Cambridgeshire PFRA report 2011 concludes (based on the evidence collected) that there are no 'Flood Risk Areas' of 'national significance' within Cambridgeshire.

2 Setting the scene

2.3 National context

Flood and Water Management Act 2010

2.3.1 The Flood and Water Management Act 2010 (FWMA) places the responsibility for co-ordinating 'local flood risk' management on the relevant county or unitary authority, making them a Lead Local Flood Authority (LLFA). In this context, the Act uses the term 'local flood risk' to mean flood risk from:

- Surface runoff
- Groundwater and
- Ordinary watercourses

2.3.2 Cambridgeshire County Council (CCC) is the LLFA for Cambridgeshire. The FWMA contains a range of different duties for LLFAs, including the need to prepare a Local Flood Risk Management Strategy (LFRMS) and to maintain a register of significant flood prevention assets.

2.3.3 The FWMA also seeks to encourage the uptake of Sustainable Drainage Systems (SuDS) by agreeing new approaches to the management of drainage systems.

National Planning Policy Framework and Practice Guidance

2.3.4 Section 10 of the National Planning Policy Framework (NPPF) sets out the government's aim that spatial planning should proactively help the mitigation of, and adaption to, climate change including management of water and flood risk.

2.3.5 The NPPF states that both Local Plans and planning application decisions should ensure that flood risk is not increased and where possible is reduced. Development should only be considered appropriate in flood risk areas where it can be demonstrated that:

- A site specific flood risk assessment has been undertaken which follows the Sequential Test, and if required, the Exception Test;
- Within the site, the most vulnerable uses are located in areas of lowest flood risk unless there are overriding reasons to prefer a different location;
- Development is appropriately flood resilient and resistant, including safe access and escape routes where required (Please see DEFRA/ EA publication 'Flood Risks to People' for further information on what is considered 'safe');
- That any residual risk can be safely managed, including by emergency planning; and
- The site gives priority to the use of sustainable drainage systems (SuDS).

2.3.6 The Government has also produced the national Planning Practice Guidance (PPG) to support the NPPF. Relevant sections of the NPPG advise on how spatial planning can ensure water quality and the delivery of adequate water and wastewater infrastructure can take account of the risks associated with flooding and coastal change in plan-making and the planning application process.

Sustainable Drainage Systems: Written Ministerial Statement

2.3.7 On 18 December 2014, a ministerial statement was made by the Secretary of State for Communities and Local Government (Mr Eric Pickles). The statement has placed an expectation on local planning policies and decisions on planning applications relating to major development to ensure that SuDS are put in place for the management of run-off, unless demonstrated to be inappropriate. The statement made reference to revised planning guidance to support local authorities in implementing the changes and on 23 March 2015, the Department for Environment, Food and Rural Affairs (Defra) published the 'Non-Statutory Technical Standards for Sustainable Drainage Systems'. Further detail on how SuDS can be delivered in the Cambridgeshire context can be found in Chapter 6.

2.4 Local context

Catchment Flood Management Plans and Flood Risk Management Plans

2.4.1 The Environment Agency (EA) has prepared catchment based guidance to ensure that main rivers and their respective flood risk have been considered as part of the wider river system in which they function. Catchment Flood Management Plans (CFMPs) discuss the management of flood risk for up to 100 years in the future by taking into account factors such as climate change, future development and changes in land management. As well as informing Councils' planning policy and local flood management practises, the CFMPs will be part of the mechanism for reporting into the EU Floods Directive. The relevant CFMPs that impact on Cambridgeshire are the 'Great Ouse' and the 'Nene', these can all be accessed on 'gov.uk' - Catchment Flood Management Plan.

2.4.2 In addition under the Flood Directive, the EA is responsible for preparing Flood Risk Management Plans (FRMPs) to highlight the hazards and risks of flooding from rivers, the sea, and reservoirs and set out how Risk Management Authorities (RMAs) work together with communities to manage flood risk. The Anglian FRMP is a river basin district level plan which will draw on the relevant CFMPs covering Cambridgeshire. The plan highlights flood risk across the district and identifies the types of measures which need to be undertaken. The Anglian FRMP will enable effective co-ordination across catchments and will inform investment in flood risk management.

River Basin Management Plans

2.4.3 In addition, the EA has developed an Anglian District River Basin Management Plan (ARBMP) that identifies the state of, and pressures on, the water environment.

2.4.4 The CFMPs, FRMPs and the RBMPs together, highlight the direction of considerable investment in Cambridgeshire and how to deliver significant benefits to society and the environment.

Cambridgeshire Local Flood Risk Management Strategy

2.4.5 The LFRMS has been developed with members of the Cambridgeshire Flood Risk Management Partnership (CFRMP), for the years 2015 – 2020. The partnership is made up of representatives from the county, city and district councils, the EA, Anglian Water Services Ltd, Cambridgeshire's Internal Drainage Boards (IDBs) and Cambridgeshire Constabulary. The strategy aims to coordinate, minimise and manage the impact of flood risk within Cambridgeshire by addressing the five key objectives:

- Understanding flood risk in Cambridgeshire
- Managing the likelihood and impact of flooding
- Helping Cambridgeshire's citizens to understand and manage their own risk
- Ensuring appropriate development in Cambridgeshire
- Improving flood prediction, warning and post flood recovery

Cambridgeshire Strategic Flood Risk Assessments

2.4.6 A Strategic Flood Risk Assessment (SFRA) provides essential information on flood risk, allowing local planning authorities (LPAs) to understand the risk across the authority area. This allows for the Sequential Test (see Chapter 4) to be properly applied. Level 1 SFRAs have been undertaken for all LPAs in Cambridgeshire. Level 2 SFRAs are sometimes also required in order to facilitate the application of the Sequential and Exception Tests in areas that are at medium or high risk of flooding and where there are no suitable areas for development after applying the Sequential Test. Level 2 SFRAs provide breach and hazard mapping information that may be useful to developers in undertaking site specific flood risk assessments (FRAs). To date, a Level 2 SFRA has been undertaken for Wisbech, in Fenland.

2 Setting the scene

Cambridgeshire Surface Water Management Plans

2.4.7 The Surface Water Management Plan (SWMP) outline the preferred strategy for the management of surface water in a given location. The SWMP aims to establish a long term action plan and to influence future strategy development for maintenance, investment, planning and engagement.

Local Plans

2.4.8 Each LPA within Cambridgeshire has, or is working towards, adopted its own local plan. Local plans set out a vision for their administrative area and the planning policies necessary to deliver the vision, with relevant policies on water and flood risk issues. The relevant LPAs and their adopted and draft Local Plans are identified in Appendix A.

Landscape and flood characteristics in Cambridgeshire

2.4.9 Landscape and flood risk characteristics vary across Cambridgeshire. Notably the area known as the Fen area to the north and east varies from the rest of Cambridgeshire due to its flat and low lying landscape (close to or below sea level) with extensive parts within the fluvial and/or tidal flood zone, although many settlements are predominantly located on 'islands' of higher ground e.g. Ely. As the drainage of developments on higher ground can impact on lower areas, flood risk is an important issue that needs to be considered at a local as well as strategic level. From Cambridgeshire the watercourses eventually flow to the River Nene and River Great Ouse and subsequently discharge to The Wash and the North Sea. Changes in flood regimes in Cambridgeshire can therefore have consequences downstream within the Nene and Ouse Washes catchment, beyond Cambridgeshire.

2.4.10 The Fen area has an extensive network of artificial drainage channels which are mostly pump-drained and are predominantly under the control and management of IDBs. The area is therefore reliant on flood defence infrastructure to minimise flood risk to existing development and agricultural land. Due to the historical drainage of the area, the majority of land lies below embanked higher level drainage channels representing a residual risk of defences being breached or overtopped.

2.4.11 The southern part of the county includes some significant topographical variation. Undulating hills define much of the land to the northeast of the River Cam, while the topography to the southwest of the river is more varied. Other main rivers, which flow through Cambridgeshire, include the Nene, Kym and Great Ouse. The Great Ouse flows through market towns across Huntingdonshire and East Cambridgeshire and its floodplains are prominent features in the landscape.

3 Working together with Water Management Authorities

This chapter provides specific details in relation to the key water management authorities that may need to be consulted during the pre-application and planning application stages, when considering water management and flood risk matters that may be associated with a proposal.

3.1 Water Management Authorities

3.1.1 This chapter highlights the key Water Management Authorities (WMAs) that may need to be consulted during the planning application process. Applicants are advised to seek advice at the earliest opportunity (e.g. pre-application stage) in order to ensure all relevant flood and water requirements are appropriately addressed and met.

3.1.2 The national Planning Practice Guidance (PPG) lists the statutory consultees to the planning process. Within Cambridgeshire, although the local water and sewerage companies (Anglian Water and Cambridge Water) and the IDBs are not statutory consultees, they are consulted by LPAs as part of the planning application process. Table 3.1 lists all the key WMAs across Cambridgeshire (some of which are statutory consultees) and it is important that those proposing new developments actively engage with the relevant WMAs at the earliest possible stage.

3.1.3 Some of the WMAs listed in Table 3.1, are defined as Risk Management Authorities (RMAs) under the Flood and Water Management Act (FWMA). Details of the RMAs in Cambridgeshire are shown in Table 3.2. RMAs have responsibilities and powers that they can use in order to manage flood risk (refer to Section 3.2.16 for further information).

3.2 Pre-application advice

3.2.1 Many of Cambridgeshire's LPAs and WMAs provide a pre-application advice service. There may be a charge for this service. Further advice can be found on each LPA's or WMA's website.

3.2.2 The LPAs encourage all applicants to seek pre-application advice to help make sure that the proposed development is of a high quality. LPAs can provide useful guidance and advice to help ensure that applications that are submitted contain the correct information and comply with the relevant planning policies. All proposed development, regardless of size, can benefit from pre-application advice. In the case of larger development proposals, Planning Performance Agreements (PPAs) may be appropriate. The relevant LPA should be consulted for further information.

3.2.3 It is recommended that alongside contacting LPAs, developers directly contact relevant WMAs to receive in depth comments and feedback, to strengthen their final application. The more detailed the information provided to the authority about the site, its location and the proposed discharge points and drainage system, the better its advice can be. Some of these authorities have a specific form that needs to be completed as part of this process. It is the responsibility of developers to ensure that they engage with the appropriate WMAs at the earliest stages of the planning process in advance of an application being made to the LPA.

Table 3.1 : Key Water Management Authorities

Key Authorities	When to consult (not exhaustive)	Applicable to relevant district area/countywide					
		CCC	CCiC	ECDC	FDC	HDC	SCDC
Environment Agency (EA)	The EA should be consulted on development, other than minor or as defined in the EA's Flood Risk Standing Advice document within Flood Zone 2 or 3, or in Flood Zone 1 where critical drainage problems have been notified to the LPA. Consultation will also be required for any development projects within 20m of a Main River or flood defence, and other water management matters.	✓	✓	✓	✓	✓	✓
Historic England	Whilst Historic England are not a WMA, they should be consulted where proposals may affect heritage assets and their settings.	✓	✓	✓	✓	✓	✓
Highways England	When the quality and capacity of the Highways England (strategic) road network could be affected.	✓	✓	✓	✓	✓	✓
Lead Local Flood Authority (CCC)	Where the proposed work will either affect or use an ordinary watercourse or require consent permission, outside of an IDB's rateable area. As of the 15th April 2015 the LLFA should be consulted on surface water drainage proposal for all major developments (as defined in Town & Country Planning DMPO 2015)	✓	✓	✓	✓	✓	✓
Local Highway Authority(CCC)	Where the proposed development will either involve a new access to the local highway network or increase or change traffic movements.	✓	✓	✓	✓	✓	✓
City and District Councils	Refer to the guidance in Chapter 4. Additionally, where an awarded watercourse runs within or adjacent to a proposed development consultation is required with the relevant section of a district council.	✓	✓	✓	✓	✓	✓
Natural England	Natural England has mapped 'risk zones' to help developers and LPAs determine whether consultation is required. This is likely where water bodies with special local or European designations (e.g. SSSI or Ramsar) exist.	✓	✓	✓	✓	✓	✓

3 Working together with Water Management Authorities

Key Authorities	When to consult (not exhaustive)	Applicable to relevant district area/countywide					
		CCC	CCiC	ECDC	FDC	HDC	SCDC
Anglian Water	Anglian Water should be consulted where connection to surface water sewers is required or where the flow to public sewerage system may be affected. They should also be consulted where either new connections to the water supply network are required or if any alterations are made to existing connections.	✓	✓	✓	✓	✓	✓
Cambridge Water	Where either an installation of water systems is required or if any alterations are made to existing connections.	✓	✓			✓	✓
North Level Drainage Board	Proposed development in or in close proximity to an IDB district (refer to Appendix C)	✓			✓		
Haddenham Level Drainage Commissioners		✓		✓			✓
Ramsey IDB		✓				✓	
Whittlesey Consortium of IDBs		✓			✓	✓	
Bedford Group of IDBs		✓				✓	
Ely Group of IDBS		✓		✓			✓
IDBs represented by Middle Level Commissioners		✓		✓	✓	✓	✓

Environment Agency

3.2.4 The EA is a non-departmental public body responsible for protecting and enhancing the environment as a whole and contributing to the government's aim of achieving sustainable development in England and Wales. The EA has powers to work on main rivers to manage flood risk. These powers are permissive, this means they are not a duty, and they allow the EA to carry out flood and coastal risk management work and to regulate the actions of other flood risk management authorities on main rivers and the coast. The EA also has powers to regulate and consent works to main rivers. Prior written consent is required from the EA for any work in, under, over or within 9 metres of a main river or between the high water line and the secondary line of defence e.g. earth embankment. This should be sought in conjunction with any pre-planning discussions as set out in section 3.2. The EA also has a strategic overview role across all types of flooding as well as other types of water management matters. Guidance on when to consult the EA can be found in Chapter 4. For further information on the EA's roles and responsibilities see the gov.uk website.

Internal Drainage Boards

3.2.5 A large proportion of Cambridgeshire is specially managed by IDBs to ensure that the area retains its significant agricultural, industrial, leisure and residential functions. IDBs are predominantly associated with the Fen area however they do exist in other landscapes extending into The Fens, the Fen Margin and the Central Claylands.

3.2.6 IDBs are local public authorities that manage water levels. They are an integral part of managing flood risk and land drainage within areas of special drainage need in England and Wales. IDBs have permissive powers to undertake work to provide water level management within their Internal Drainage District. They undertake works to reduce flood risk to people and property and manage water levels for local needs. Much of their work involves the maintenance of rivers, drainage channels, outfalls and pumping stations, facilitating drainage of new developments and advising on planning applications. They also have statutory duties with regard to the environment and recreation when exercising their permissive powers.

3.2.7 IDBs input into the planning system by facilitating the drainage of new and existing developments within their districts and advising on planning applications; however they are not a statutory consultee to the planning process.

3.2.8 In some cases, a development meeting the criteria listed below may need to submit a FRA to the IDBs to inform any consent applications. This relates to the IDBs' by-laws under the Land Drainage Act 1991 (further information on the preparation of site specific FRAs can be found in Chapter 4).

- Development being either within or adjacent to a drain/ watercourse, and/ or other flood defence structure within the area of an IDB;
- Development being within the channel of any ordinary watercourse within an IDB area;
- Where a direct discharge of surface water or treated effluent is proposed into an IDBs catchment;
- For any development proposal affecting more than one watercourse in an IDBs area and having possible strategic implications;
- In an area of an IDB that is in an area of known flood risk;
- Development being within the maintenance access strips provided under the IDBs byelaws;
- Any other application that may have material drainage implications.

3.2.9 Some IDBs also have other duties, powers and responsibilities under specific legislation. For example the Middle Level Commissioners (MLC) is also a navigation authority. Although technically the MLC are not an IDB, for ease of reference within this document it has been agreed that the term IDB can be used broadly to refer to all relevant IDBs under its jurisdiction. A list of the IDBs can be found in Appendix C.

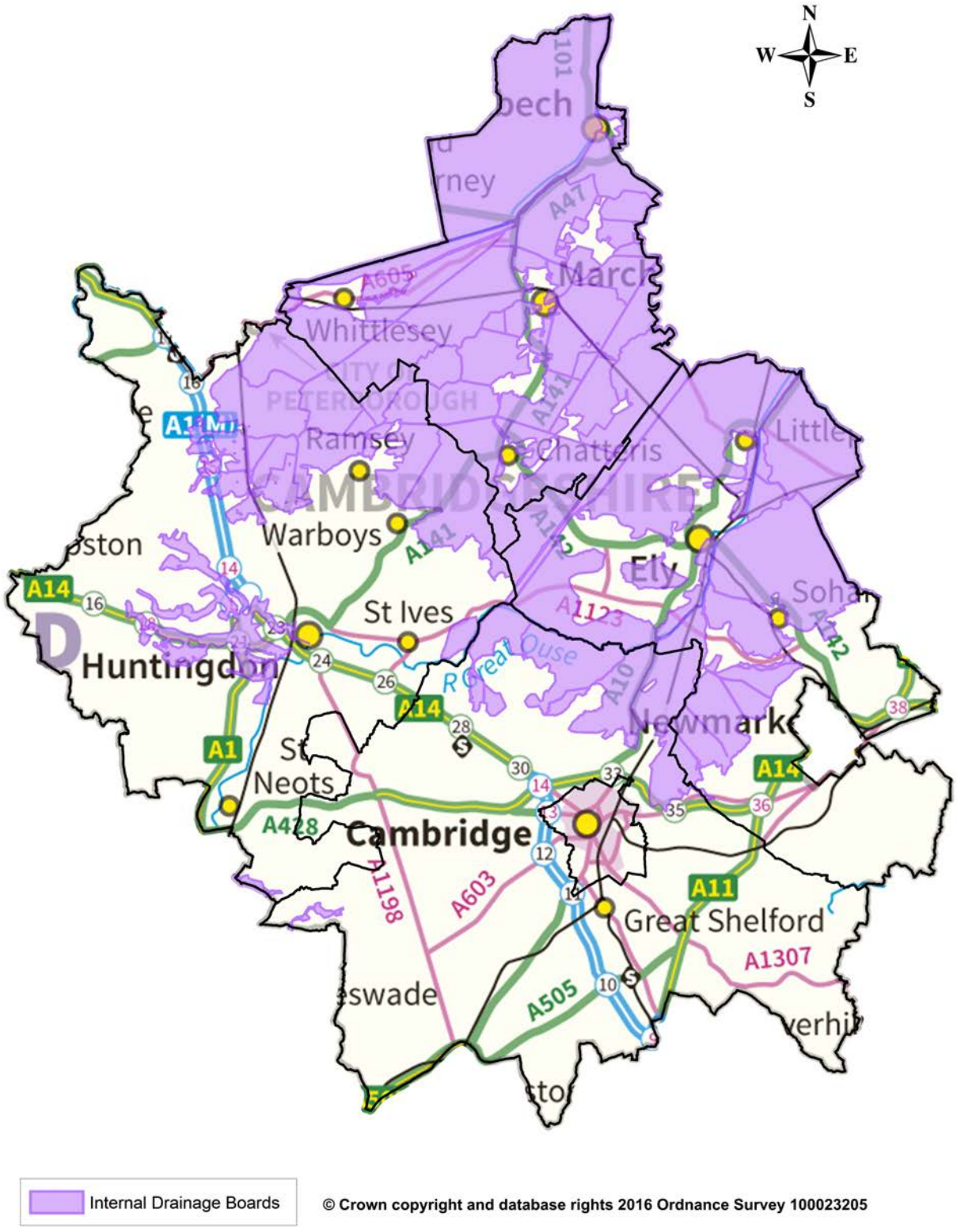
3.2.10 IDBs may have rateable and non-rateable areas within their catchments. It is recommended that applicants contact the relevant IDB to clarify which area proposed development falls into, and if there is an associated charge.

3.2.11 There are 53 IDBs within Cambridgeshire, Map 3.1 highlights the area of Cambridgeshire that is covered by IDBs. Some of the IDBs are represented or managed by Haddenham Level Drainage Commissioners**,** Whittlesey Consortium of IDBs, North Level District IDB, Ely Group of IDBs, Bedford Group of IDBs, Kings Lynn IDB and MLC. The names of the IDB groups covering each district are stated in Appendix C.

3.2.12 The maps in Appendix C show the IDB groups for the relevant City and District Councils. Detailed information on IDBs' boundaries can be found on their individual websites.

3 Working together with Water Management Authorities

Map 3.1 : IDBs within Cambridgeshire



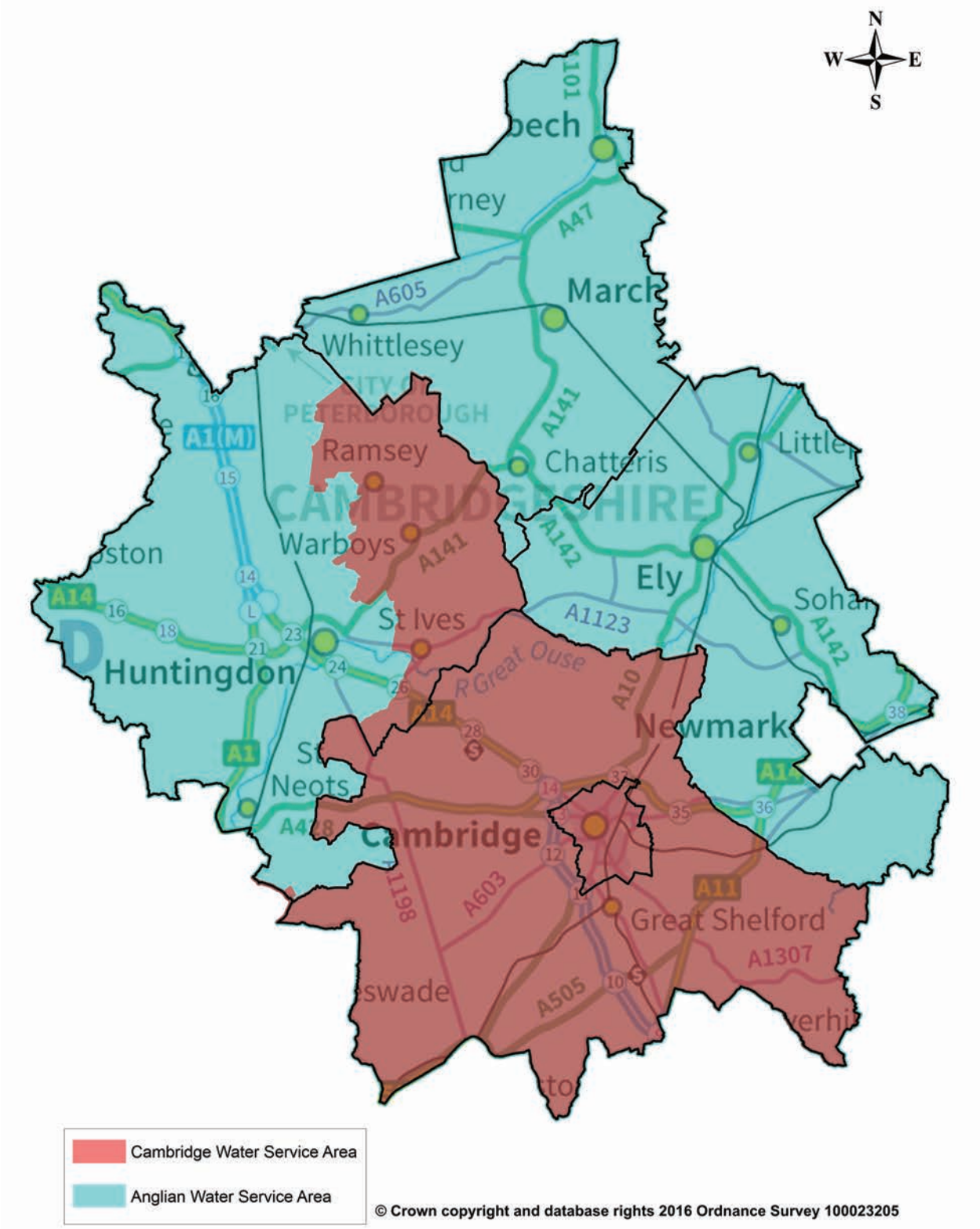
Water and wastewater providers

3.2.13 Two separate water service providers in Cambridgeshire provide potable water; Cambridge Water and Anglian Water. Cambridge Water supplies potable water to areas around Cambridge, South Cambridgeshire and parts of Huntingdonshire. Anglian Water supplies potable water to areas around Fenland, East Cambridgeshire and parts of Huntingdonshire. It is a statutory requirement to gain consent from the relevant service provider if you are intending to install water systems or make an alteration to existing connections, prior to the commencement of work. Map 3.2 identifies the water service areas covered by Anglian Water and Cambridge Water.

3.2.14 Anglian Water is also the sewerage undertaker for the whole of Cambridgeshire and has the responsibility to maintain foul, surface and combined public sewers so that it can effectively drain the area. When flows (foul or surface water) are proposed to enter public sewers, Anglian Water will assess whether the public system has the capacity to accept these flows as part of their pre-application service. If there is not available capacity, they will provide a solution that identifies the necessary mitigation. Information about Anglian Water's development service is available on their website. Anglian Water also comments on the available capacity of foul and surface water sewers as part of the planning application process.

3 Working together with Water Management Authorities

Map 3.2 : Cambridge Water and Anglian Water Coverage



Note: Anglian Water is the sewerage undertaker for the entire Cambridgeshire area

Cambridgeshire County Council

3.2.15 One of its key priorities as the LLFA is to coordinate the management of flood risk from groundwater, surface water and ordinary watercourses. This includes the development and implementation of a Cambridgeshire Local Flood Risk Management Strategy (LFRMS).

3.2.16 The RMAs have a duty to carry out flood risk management functions in a manner consistent with the national and local strategies. The RMAs in Cambridgeshire are highlighted below in Table 3.2.

Table 3.2 : Relevant Flood Risk Management Authorities

Flood Sources	EA	LLFA	City and District Councils	Anglian Water	Highway Authorities	IDBs
Rivers						
Main River	✓					
Ordinary Watercourse		✓				✓
Awarded Watercourse			✓			
Ground Water		✓				
Surface Runoff						
Surface water		✓				
Surface water originating on the highway					✓	
Other						
Sewer flooding				✓		
The Sea, Reservoirs	✓					

3.2.17 The LLFA has powers to require works to be undertaken to maintain the flow in ordinary watercourses that fall outside of an IDB districts.

3.2.18 The LLFA provides technical advice on surface water drainage proposals for 'major' applications to the City and District Councils.

3.2.19 Cambridgeshire County Council (CCC) is the Local Highway Authority and manages highway drainage, carrying out maintenance and improvement works on an on-going basis as necessary to maintain existing standards of flood protection for highways, making appropriate allowances for climate change. It has the responsibility to ensure that road projects do not increase flood risk. In addition, Highways England operates, maintains and improves a number of motorways and major A roads across the County.

3.2.20 In addition, CCC is the Minerals and Waste Planning Authority and has the role of planning authority for County matters such as schools and therefore has the same responsibilities as LPAs (refer to Section 3.2.21 to 3.2.23).

3 Working together with Water Management Authorities

City and District Councils

3.2.21 Each of the five city and district councils within Cambridgeshire are LPAs and assess, consult on and determine whether or not development proposals are acceptable, ensuring that flooding and other similar risks are effectively managed.

3.2.22 The LPA will consult the relevant statutory consultees as part of the planning application assessment and they may, in some cases also contact non-statutory consultees (e.g. Anglian Water or IDBs) that have an interest in the planning application.

3.2.23 The City and District Councils have a responsibility to maintain 'awarded' watercourses. They also have statutory powers to modify or remove inappropriate structures within channels on ordinary watercourses, along with other flood protection responsibilities. They have the powers to take the appropriate action against those whose actions increase flood risk or make management of that risk more difficult and are therefore an important consultee for flood risk matters.

4 Site selection and managing flood risk to developments

The aim of this chapter is to give advice to applicants on how to address flood risk in the planning process. It provides specific guidance on the principles of managing flood risk and emphasises how it should be considered at all stages of planning. There is guidance on the application of the sequential approach to flooding including the Sequential and Exception Tests and the production of site specific flood risk assessments to accompany planning applications. This chapter is also particularly important for assessing proposed developments on windfall and non-allocated sites.

4.1 Introduction

4.1.1 Developments can be affected by flooding from a number of 'sources' including:

- River flooding (fluvial)
- Surface water flooding (pluvial)
- Coastal and tidal flooding
- Reservoir flooding
- Sewer flooding
- Groundwater

4.1.2 Flood risk is an expression of the combination of the flood probability (how likely the event will happen) and the magnitude of the potential consequences (the impact such as economic, social or environmental damage) of the flood event.

4.1.3 The likelihood or risk of flooding can be expressed in two ways:

- **Chance of flooding:** As a percentage chance of flooding each year. For example, for Flood Zone 3a there is a 5% annual probability of this area flooding
- **Return period:** This term is used to express the frequency of flood events. It refers to the estimated average time interval between events of a given magnitude. For example, for Flood Zone 3a the return period would be expressed as 1 in 20 year

4.1.4 There is however a move away from using return periods as an expression of flood risk as this approach does not accurately express the risk of flooding. For example it is misleading to say that a 1 in 100 year flood will only occur once in every hundred years. This suggests that if it occurs in one year then it should not be expected to reoccur again for another 100 years; however this is not the case. The percentage chance of flooding each year, often referred to as **annual probability**, is now the preferred method of expressing flood risk.

4.1.5 Fluvial flooding is divided into flood zones based on the risk of flooding:

Figure 4.1 : Fluvial Flood Risk Zones

Functional flood plain	High probability/risk	Medium probability/risk	Low probability/risk	
3b	**3a**	**2**	**1**	**Flood Zones**
1 in 1	1 in 20	1 in 100	1 in 1000	Return period
100%	5%	1%	0.1%	Annual Exceedance Probability

High risk <----------> Low Risk

4.1.6 Maps showing Flood Zones are available on the gov.uk website. The Flood Zones refer to the probability of river and sea flooding, ignoring the presence of defences. Table 4.1 details the Flood Zones and their definitions taken from the PPG.

Table 4.1 : Flood Zone and Flood Risk(1)

Flood Zone	Definition
Zone 1 – Low Probability	Land having a less than 1 in 1,000 annual probability of river or sea flooding. (Shown as 'clear' on the Flood Map – all land outside Zones 2 and 3)
Zone 2 – Medium Probability	Land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding; or Land having between a 1 in 200 and 1 in 1,000 annual probability of sea flooding. (Land shown in light blue on the Flood Map)
Zone 3a – High Probability	Land having a 1 in 100 or greater annual probability of river flooding; or Land having a 1 in 200 or greater annual probability of sea flooding. (Land shown in dark blue on the Flood Map)
Zone 3b – The Functional Floodplain	This zone comprises land where water has to flow or be stored in times of flood. LPAs should identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the EA. (Not separately distinguished from Zone 3a on the Flood Map)

1. Source: Table 1: Flood Zones, National Planning Practice Guidance

4.1.7 To cope with the potential risks and forecasts of climate change (predicted 1.05m rise in sea levels in the East of England, warmer summers, wetter winters and increased river flows by 2115) and to ensure that new development is safe for its lifetime, the Government has emphasised that development in areas at risk of flooding should be avoided by directing development away from the highest risk areas. Where development is necessary it should be made safe without increasing flood risk elsewhere. Please see the DEFRA/ EA publication 'Flood Risks to People' for further information on what is considered 'safe'.

4.1.8 All proposals should therefore follow a Sequential Approach to flood risk. This means relevant development will be directed to the areas at the lowest risk of flooding at a strategic, local and site-scale level. It will be necessary to consider flooding from all sources: the sea (tidal), rivers (fluvial), surface water (pluvial) and ground water, and a possible combination of all of these. Further detail on the Sequential Test is provided in 4.4.

4.2 Flood risk and planning

The approach to flood risk in planning

4.2.1 The general approach (i.e. the Sequential Approach) to flood risk and planning is to ensure that, where possible, development is located in the areas of lowest flood risk. This can be applied at a variety of scales, including:

- At a strategic scale, when looking at a number of sites and then choosing the site with the lowest flood risk for development;
- At an individual site scale, where the area of lowest flood risk within the site boundary is the preferred location for the proposed development;
- At a building scale, where the part of the building that is the most vulnerable is located in the area of lowest flood risk.

4.2.2 The **Sequential Approach** should apply to all sources of flood risk and is central to the Government's approach as outlined in the National Planning Policy Framework (NPPF) and the PPG. An example of this is that when considering fluvial flood risk, all developments should be located in Flood Zone 1 unless there are no reasonably available sites. Only then should Flood Zone 2 be considered. Flood Zone 3 should only be considered if there are no reasonably available sites in Flood Zones 1 and 2.

The Sequential Test and Exception Test

4.2.3 The Sequential Test is a method for determining if a site is suitable for development because it is at the lowest risk of flooding, and there are no other reasonably available sites at a lower risk (refer to section 4.4 below). If this is not the case then the Exception Test may be required which will mean some further considerations are taken into account (refer to 4.5 below). Table 4.2 (within 4.5) identifies the 'flood risk vulnerability and flood zone compatibility' table taken from the NPPG, which assists in classifying your site against the exception test. These 'classifications' are under the following headings:

- Essential Infrastructure
- Highly Vulnerable
- More Vulnerable
- Less Vulnerable
- Water-Compatible Development

Strategic Flood Risk Assessments

4.2.4 SFRAs should be used by developers to inform site selection (see section 4.3, Step 1) and provide high level information for the site specific Flood Risk Assessments (FRAs) (see section 4.3, Step 4).

4.3 Site suitability and flood risk considerations for planning applications

4.3.1 Those proposing development in areas of flood risk are responsible for:

- Demonstrating that the proposed development is consistent with national and local planning policy (Chapter 2);
- Undertaking appropriate consultation with the water management authorities (Chapter 3);
- Providing a site specific flood risk assessment (FRA), as part of the planning process, which meets the requirements of this chapter and those set by the relevant WMAs;
- Integrating into proposals designs that reduce flood risk to the development and elsewhere by incorporating appropriate flood risk management measures (Chapter 5), including the use of sustainable drainage systems (SuDS) (Chapter 6);
- Ensuring that any necessary flood risk management measures are sufficiently funded to ensure that the site can be developed and occupied safely throughout its proposed lifetime.

4.3.2 Applications for sites in Flood Zones 2 and 3 where there is no Sequential Test information submitted will be deemed to have failed the Sequential Test (See Section 4.4).

4.3.3 The following sections set out the steps (1 – 6) that should be taken when determining if a site is suitable for development when considering flood risk. All requirements are consistent with the NPPF and PPG, with local requirements explained further. Reference should also be made to the developer checklist provided in Appendix B, which should be submitted with planning applications alongside other relevant and up to date information related to flood risk and the water environment.

Note that each of these steps applies to <u>all</u> scales of development.

Step 1 – Allocation within Local Development Plan

4.3.4 Applicants must consider allocations within the relevant local development plan. If the site has been allocated in the relevant Local Plan/development plan for the same land use type/vulnerability classification that is now being proposed, then an assessment of flood risk, at a strategic level, has already been undertaken. This will have included assessing the site, against other alternative sites, as part of a Sequential Approach to flood risk.

4.3.5 While the situation is rare it is possible that the flood zoning of a site may change after adoption of the relevant part of the Local Plan (the EA refines Flood Zones on a regular basis to ensure the data is up to date). In this situation the Local Planning Authority (LPA) may require the developer to pass part b) of Step 1.

4.3.6 In general where a site has not been allocated in a Local Plan or the flood zone classification has changed since adoption of the Plan (i.e. it is a windfall or non-allocated site), the Sequential Test and where appropriate the Exception Test will need to be undertaken following the overarching principles of the Sequential Approach. Details of the Sequential and Exception Tests are specified in Sections 4.4 and 4.5.

4.3.7 Applicants should indicate their site boundary on a plan and if applicable the boundary of any allocated site and check to see if there is any updated flood risk information after the preparation of the relevant SFRA.

Step 1

Consider Allocations

a. Can it be demonstrated by the developer that the type and location of the proposed development has been allocated in the relevant Local Plan/development plan?
b. Can it be demonstrated that the flood risk information contained within the SFRA and associated Sequential Test assessment accompanying the Local Plan/development plan (where applicable) is still appropriate for use?

If the answer to both of the above is yes, go to Step 3 (the Sequential and Exception Tests do not need to be completed). If the answer to either of the above is no, go to Step 2.

Step 2

Consider Flood Risk

Is the site:

a. In Flood Zone 2 or 3?
b. In Flood Zone 1 and within an area that has been identified in the relevant SFRA (or any updated available information) as having flooding issues now or in the future (for example, through the impacts of climate change)?
c. In an area of significant flood risk from sources other than fluvial or tidal such as surface water, ground water, reservoirs, sewers, etc. (see Stage C - Developer to obtain flood risk information for all sites for details)?

If the answer to any of the above questions is yes, the Sequential Test is required to be undertaken by the developer and the results submitted to the LPA for assessment. Note: Discussions on the Exception Test should not be taking place until the Sequential Test is undertaken and passed. Further information on the Sequential and Exception Tests can be found in Sections 4.4 and 4.5 respectively.

4.3.8 Following on from Steps 1 and 2, if no pre-application consultation has already been undertaken, it is strongly recommended that such discussions are undertaken with the relevant LPA and the appropriate WMAs. Refer to Chapter 3 for more details.

4.3.9 The purpose of pre-application consultations is to identify the range of issues that may affect the site and, following on from the Sequential Test and if necessary the Exception Test, determine whether the site is suitable for its intended use. A FRA should not be undertaken until Step 1, Step 2 and Step 3 have been carried out.

Step 3

Undertake pre-application consultation

Meaningful, on-going and iterative discussions with the LPAs and relevant WMAs can resolve issues prior to the submission of a planning application and can result in a more efficient planning application process. As a starting point it is recommended to consider the following at this stage:

a. Does the LPA confirm that the proposed development may be acceptable in principle from the perspective of other planning constraints rather than flood risk?
b. Does the LPA confirm that the Sequential Test, and if required the Exception Test, has been undertaken appropriately and that it covers all relevant issues?
c. Is there potential for contamination on site which could affect site design and layout and the types of SuDS components used?
d. How can the site meet national and local SuDS standards?
e. Is a site specific FRA required? If so, what is the scope of an appropriate site specific FRA?
f. Are there any major opportunities or constraints to the site with regards to the management of flood risk, drainage, contamination or the quality of related water environments?
g. Agree the discharge points for site drainage with the LPA and relevant WMA;
h. Obtain any relevant data needed in order to prepare the site specific FRA and drainage strategy.
i. Are any consents required from the EA/Internal Drainage Boards (IDBs)/ Lead Local Flood Authority (LLFA)/ Anglian Water?

Once all these stages have been considered please go to Step 4.

4.3.10 In areas of Cambridgeshire that are defended from flooding the residual risk of breaching of the defence can mean that some locations in Flood Zone 1 could be at risk of flooding. While the EA's recognised flood maps show the areas that would be at risk if there were no defences, the failure of such structures can produce different results. The pressure the water may be under at the time of breach and the pathway that it is forced to take may not be the same as if water were naturally overtopping the river banks. For this reason a FRA may be required for sites proposing people-based uses in defended areas that are actually within Flood Zone 1. If this situation applies, breach modelling is also likely to be required as part of the planning process since this would enable determination of the actual risk to a site (see Section 5.1.5 below). Advice should be sought from the EA if further explanation is required on this point.

4.3.11 A large part of Cambridgeshire is low lying agricultural land and prior to drainage comprised traditional fen. Since flood risk management practices in this area vary, there are some scenarios not listed by the NPPF, where a FRA could be required. FRAs that are acceptable to all parties prior to submission may avoid further amendments being required to the document during determination by the relevant LPA, as well as any post-planning permission variations.

4 Site selection and managing flood risk to developments

Step 4

Site Specific Flood Risk Assessment (FRA)

A site specific FRA is required:

a. For proposals of 1 hectare or greater in Flood Zone 1;
b. For all proposals for new development (including minor development and change of use) in Flood Zones 2 and 3; or
c. In an area within Flood Zone 1 which has critical drainage problems (as notified to LPAs by the EA); or
d. Where proposed development, or a change of use to a more vulnerable class, may be subject to other sources of flooding.

A FRA may also be required for some specific situations:

1. If the site may be at risk from the breach of a local defence (even if the site is actually in Flood Zone 1);
2. Where the site is intended to discharge to the catchment or assets of a WMA which requires a site specific FRA;
3. Where the site's drainage system may have an impact on an IDB's system;
4. Where evidence of historical or recent flood events have been passed to the LPA; or
5. In an area of significant surface water flood risk.

A site specific flood risk assessment must demonstrate that the new development is safe in flood risk terms and does not increase flood risk elsewhere.

4.3.12 Flood risk, site design and emergency access and escape can affect the value of land, the cost of developing it and the cost of its future management and use. Such matters should be considered as part of the site specific FRA as early as possible in preparing the development proposal.

4.3.13 The box below sets out the requirements of a FRA, with the FRA checklist in Appendix B.2 detailing what information should be contained within it. In the preparation of FRAs, applicants are advised to consult the relevant WMAs.

FRAs should:

a. **Be proportionate** to the risk and appropriate to the scale, nature and location of the development;
b. Be undertaken **as early as possible** in the particular planning process, by a competent person, to avoid abortive work raising landowner expectations where land is unsuitable for development. Whilst a FRA must be considered at an early stage this is not to be undertaken until Step 1, Step 2 and Step 4 have been completed;
c. Consider and quantify the **different types of flooding** (whether from natural or human sources and including joint and cumulative effects). The LPA will expect links to be made to the management of surface water as described in Chapter 6. Information to assist with the identification of surface water and groundwater flood risk is available from the LLFA, the EA and the LPA. Applicants should also assess the risk of foul sewage flooding as part of the FRA. Anglian Water as sewerage undertaker can provide relevant information to the applicant to inform preparation of FRAs;
d. Consider the effects of a range of flooding events including the **impacts of extreme events** on people, property, the natural and historic environments and river processes;
e. Consider the **vulnerability of occupiers and users** of the development, taking account of the Sequential and Exception Tests and the vulnerability classification, and include arrangements for safe access (Please see the Defra/EA publication 'Flood Risks to People' for further information on what is considered 'safe');
f. Identify relevant **flood risk reduction measures** for all sources of flood risk not just for the site but elsewhere i.e. downstream existing flooding problems;

g. Consider both the potential adverse and beneficial **effects of flood risk management infrastructure** including raised defences, flow channels, flood storage areas and other artificial features together with the consequences of their failure;
h. Include assessment of **the 'residual' (remaining) risk** after risk reduction measures have been taken into account and demonstrate that this risk is acceptable for the particular development or land use. Further guidance on this is given in Chapter 5;
i. Be supported by appropriate **evidence data** and information, including historical information on previous events;
j. Consider the risk of **flooding arising from the proposed development** in addition to the **risk of flooding to development on the site**. This includes considering how the ability of water to soak into the ground may change after development. This would mean the preparation of surface water drainage proposals. This includes all flow routes including flood flow paths or ordinary watercourses flowing onto the development site and therefore needing to be taken account of;
k. Take a **'whole system'** approach to drainage to ensure site discharge does not cause problems further along in the drainage sub-catchment/can be safely catered for downstream and upstream of the site;
l. Take the appropriate **impacts of climate change** into account for the lifetime of the development including the proposed vulnerability classification. Guidance is available on the .gov.uk website; and
m. The FRA must clearly demonstrate that the **Sequential Test and Exception Test** have been passed.

4.3.14 A surface water drainage strategy contains the proposals for the surface water drainage of the development. Such a strategy should include initial proposals that are sufficient to demonstrate a scheme can be delivered that will adequately drain the proposed development whilst not increasing flood risk elsewhere.

4.3.15 If an outline application is to be submitted for a major development then an outline surface water drainage strategy should be submitted outlining initial proposals and quantifying the conceptual surface water management for the site as a whole. This should detail any strategic features, including their size and location. A detailed surface water drainage strategy should subsequently be submitted with each reserved matters application that comes forward and demonstrate how it complies with the outline surface water drainage strategy.

Step 5

Surface Water Drainage Strategy

Prepare the surface water drainage strategy, ensuring consistency between the surface water flood risk and any initial drainage proposals discussed in the FRA. The surface water drainage strategy should be included within or alongside the FRA as part of your planning application submissions.

a. Check which river catchment the site is in and its specific characteristics. Bear these in mind as site drainage is designed so that any constraints can be mitigated against and advantages can be taken of any opportunities.

b. Work up your drainage strategy in tandem with your site layout and highway designs. This will help avoid abortive work in any one area. Use Chapter 6 to ensure that the following have been considered:

i. The submission requirements, including any supporting investigations

ii. Sustainable drainage design principles

iii. Interception, infiltration, flow rate runoff control, volumetric runoff control, and exceedance flow management

iv. Site discharge location and attenuation provision

v. Water quality treatment, habitat provision and biodiversity

vi. Health and safety, access and amenity

vii. Use the correct climate change allowances for the development based on its lifetime

c. Ensure that the required management and maintenance of all site features has been clearly set out as part of the drainage strategy. Get initial agreements in place to cover management funding for the lifetime of the development.

d. Check that the quality of the water environment and therefore the Water Framework Directive (WFD) impacts have been specifically considered as part of all of the flood and drainage measures proposed. Is development of the site likely to cause detriment to the WFD status of a water body? Have opportunities been taken to enhance the water environment? Use Chapter Water Environment to support this process.

Step 6

Submission of planning application

Once all these issues have been satisfactorily addressed then a planning application supported by where necessary, evidence of the Sequential Test, the Exception Test, a site specific FRA and a surface water drainage strategy, can be submitted. This will be formally reviewed by the LPA in consultation with the relevant WMAs as outlined in Chapter 3. All relevant authorities and consultee comments are taken into consideration in the determination of the planning application.

4.4 The Sequential Test

4.4.1 The Sequential Test was developed to steer developments to areas with the lowest probability of flooding. Generally development will not be permitted if there are reasonably available sites appropriate for the proposed development in areas with a lower probability of flooding. This is applicable for all sources of flooding.

4.4.2 The Sequential Test does not need to be applied for:

i. Individual developments on sites which have been allocated in development plans as the Sequential Test process has already been undertaken (unless the Flood Zones for the site have changed);
ii. Minor development or change of use (except for a change of use to a caravan, camping or chalet site, or to a mobile home or park home site); or
iii. Sites located wholly in Flood Zone 1

4.4.3 The definition of minor development for the purposes of the Sequential Test is:

- **Minor non-residential extensions:** industrial/commercial/leisure etc. 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.

4.4.4 All sources of flood risk should be considered when assessing the need for the Sequential Test as well as undertaking the test.

4.4.5 It is generally expected that in areas with extensive Flood Zone 1, the Sequential Test will be more effective at steering development away from Flood Zones 2 and 3. However, where there is extensive Flood Zone 3 in the area of search, the development's objectives are less likely to be met in Flood Zone 1. In these cases, developers may need to carry out further flood risk appraisal work to determine which sites are safest and at lowest risk to develop.

4.4.6 The following sets out how **applicants** should undertake the Sequential Test for assessment by the LPA. This would normally take the form of the submission of a report commensurate in size to the scale of development.

Stage A: Applicant to agree with the LPA the geographical area over which the test is to be applied

This is usually over the entire LPA area and may only be reduced in discussion with the LPA because of the functional requirements and objectives of the proposed development (e.g. catchment area for a school, community facilities, a shop, a public house, appropriate land use areas and regeneration zones etc.) and because there is an identified local need for that type of development.

The relevant local plan should be the starting point to understand areas of local need.

For uses that have a sub-regional, regional or national impact it may be appropriate to expand the area beyond the LPA boundary.

Developers should agree the geographical area for the search with the relevant LPA before undertaking the search and state a justification at the start of the report.

Stage B: Developer to identify and list reasonably available sites

These sites will usually be sites that are known to the LPA and that meet the functional requirements of the application in question and are considered to be reasonably available.

Reasonably available sites will be identified from a number of sources, including:

- Local Plan allocations;
- Sites with planning permissions for the same or similar development, but not yet developed;
- Five year Land Supply and/or Annual Monitoring Reports;
- Housing and Economic Land Availability Assessments (HELAAs);
- Local property agents' listings;
- Historic windfall rates, where appropriate.

Additionally, a site is only considered to be reasonably available if **all** of the following apply:

- The site is within the agreed area of search;
- The site is not safeguarded in the relevant Local Plan for another use;
- It does not have any issues (e.g. constraints or designations) that cannot be overcome and that would prevent development on the site.

Reasonably available sites will include a site or a combination of sites capable of accommodating the proposed development. These may be larger, similarly sized or a combination of smaller sites that fall within the agreed area of search.

Developers should list the reasonably available sites considered and where they obtained the information within the report.

Stage C: Developer to obtain flood risk information for all sites

This can be obtained from a number of organisations (see below); the starting point should be the LPAs Strategic Flood Risk Assessment (SFRA) which contains known flood risk information at the date of its publication.

However, flood risk information is updated on a regular basis and there may be more up to date information available, so the content of the SFRA should be checked against the following:

- The EA's Flood Zone Maps for Planning (River and Seas);
- The Updated Flood Map for Surface Water (Cambridgeshire County Council (CCC)/EA);
- Areas Susceptible to Surface Water Flooding (Environment Agency);
- Areas Susceptible to Groundwater Flooding (British Geological Society);
- Surface Water Management Plans (Cambridgeshire County Council);
- The Level 2 SFRA for Wisbech , which is primarily to inform the Exception Test (specific to Fenland District Council);
- Flood Asset Data:
- Any other source of local flood risk known to the WMAs; and
- Hazard Mapping and other information, where available.

Developers should note the flood risk from all sources against each reasonably available site under consideration.

Stage D: Developer to apply the Sequential Test

Compare the flood risk from **all sources** on all of the reasonably available sites to the original site.

Are there any reasonably available sites, including a combination of sites, that have a lower flood risk?

Developments should be located within areas with the lowest flood risk, and if possible in Flood Zone 1. The presence of existing defences should not be taken into consideration when undertaking the Sequential Test. The maintenance of the defences may change over time and climate change will have an impact on the level of protection that they offer, particularly in low-lying areas noted for their organic sub strata. These are generally peaty areas which are prone to desiccation and shrinkage.

The Sequential Approach is required at all stages of the planning process. Only where it is not possible to locate development in Flood Zone 1 and there is a recognised need for the development, it will be necessary to compare alternative sites within the same Flood Zone. In these circumstances the actual risks of flooding can be taken into consideration using available flood hazard information. The aim will be to locate development in the lowest risk areas of that Flood Zone taking into account the ambient probability and consequences of flooding. The Exception Test (see Section The Exception Test) may also still be required depending on the Flood Zone and the development type.

Proposed site mitigation measures should not be taken into consideration when undertaking the Sequential Test - these are assessed through the Exception Test and the site specific FRA.

Developers should list the reasonably available sites considered against the original site, state how they compare regarding flood risk and any reasons why they are unsuitable or not available within the report.

Stage E: Conclusion

If your site is not within Flood Zone 1 are there any reasonably available sites in areas with a lower probability of flooding that would be appropriate to the type of development or land use proposed?

If no, this still does not mean that the proposed development is acceptable in terms of flood risk as it may be necessary to undertake the Exception Test and a site specific flood risk assessment.

4.5 The Exception Test

4.5.1 As explained within paragraph 102 of the NPPF, the Exception Test is applied to the proposal by the developer where, following application of the Sequential Test it is not possible, consistent with wider sustainability objectives, for the development to be located in zones with a lower risk of flooding.

4.5.2 Development is classified, according to the PPG, depending on the impact of flooding on the development. This is known as its Flood Risk Vulnerability Classification and Table 2 of the PPG is replicated in Table 4.2 below.

Table 4.2 : Flood risk vulnerability and flood zone compatibility(1)

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, including electricity generating power stations and grid and primary substations; and water treatment works that need to remain operational in times of flood.
- Wind turbines.

Highly Vulnerable

- Police and ambulance stations; fire stations and command centres; telecommunications installations required to be operational during flooding.
- Emergency dispersal points.
- Basement dwellings.
- Caravans, mobile homes and park homes intended for permanent residential use.
- Installations requiring hazardous substances consent. (Where there is a demonstrable need to locate such installations for bulk storage of materials with port or other similar facilities, or such installations with energy infrastructure or carbon capture and storage installations, that require coastal or water-side locations, or need to be located in other high flood risk areas, in these instances the facilities should be classified as 'Essential Infrastructure').

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.

* Landfill is as defined in Schedule 10 to the Environmental Permitting (England and Wales) Regulations 2010.

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.
Water-Compatible Development • 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. • Ministry of Defence (MoD), defence installations. • 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.

1. Source: Table 2: Flood Risk Vulnerability Classification, National Planning Practice Guidance

4.5.3 Using Tables 4.2 and 4.3, developers are required to check whether the vulnerability classification of the proposed land use is appropriate to the Flood Zone in which the site is located and to see if the Exception Test is required.

Table 4.3 : Flood risk vulnerability and flood zone compatibility(1)

Flood risk vulnerability classification	Essential infrastructure	Water compatible	Highly vulnerable	More vulnerable	Less vulnerable
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	✓	Exception Test required	✓	✓
Zone 3a	Exception Test required	✓	×	Exception Test required	✓
Zone 3b 'functional flood plain'	Exception Test required	✓	×	×	×
Key:	✓ : Development may be appropriate		× : Development should not be permitted		

1. Source: Table 3: Flood risk vulnerability and flood zone 'compatibility, PPG

4.5.4 The definition of the functional floodplain is land where water has to be stored in times of flood. It includes the land which would flood with an annual probability of 5% (1 in 20) and the associated water conveyance routes and flood storage areas. The definition of the functional floodplain may differ from 5% annual probability (1 in 20) in some locations. This will be defined in the SFRA for the area.

4.5.5 Table 4.3 cannot however be taken as the final answer to whether or not a development is appropriate; the Sequential Test and the Exception Test, where necessary, must be completed in full for all sources of flood risk. For example, if a 'more vulnerable' development is proposed to be located on a site in Flood Zone 2 (and hence receives a tick in Table 4.3) it will then be necessary for this site to be compared to other reasonably available similar sites within lower risk areas (i.e. for this example in Flood Zone 1). This table is not a justification for not undertaking the Sequential Test.

4.5.6 As shown in Table 4.3, the Exception Test should be applied in a number of instances. Application of the Exception Test ensures that new developments which are needed in medium or high flood risk areas will only occur where flood risk is clearly outweighed by other sustainability benefits and the development will be safe for its lifetime, taking climate change into account.

For the Exception Test to be passed:

- It must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk, informed by a SFRA where one has been prepared; **and**
- A site specific flood risk assessment (FRA) must demonstrate that the development will be safe from all sources of flood risk, will not increase flood risk elsewhere, and, where possible, will reduce flood risk overall. Please see the DEFRA/ EA publication 'Flood Risks to People' for further information on what is considered 'safe'

Both elements of the test will have to be passed for development to be permitted.

Source: Paragraph 102, NPPF

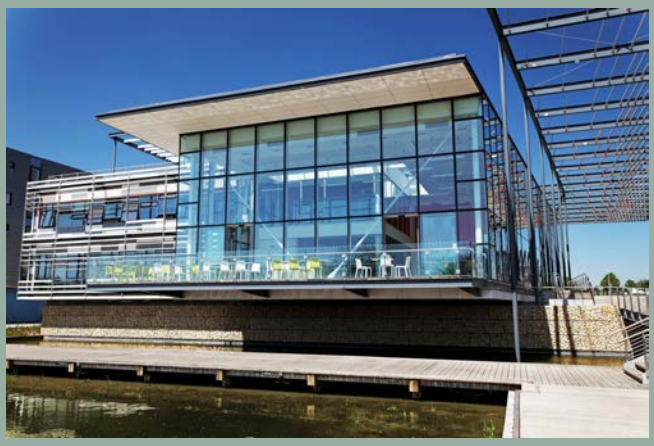
4.5.7 It is **the responsibility of the applicant** to provide evidence that the Exception Test has been carried out, with the LPA being responsible for assessing the evidence provided, in consultation with the EA, and consider whether both parts of the Exception Test have been passed.

4.5.8 The assessment of wider sustainability benefits should refer to the Local Plans' Sustainability Appraisals, which identify key sustainability issues and objectives for each district. All LPAs within Cambridgeshire will have considered the wider sustainability objectives in producing their Local Plans. The sustainability themes and issues are generally:

- Land and water resources
- Biodiversity and green infrastructure
- Landscape, townscape and historic environment
- Climate change mitigation and renewable energy
- Flood risk and climate change adaptation
- Pollution
- Healthy and inclusive and accessible communities
- Economic activity
- Transport

4.5.9 Any development undertaking the Exception Test should demonstrate the sustainability issues that the proposal is seeking to address. The general provision of housing by itself would not normally be considered as a wider sustainability benefit to the community which would outweigh flood risk; however confirmation should be sought from the LPA.

4.5.10 Examples of wider sustainability benefit to the community that would be considered could include the regeneration of an area, or the provision of new community facilities such as green infrastructure, woodland community centres, cycle ways/footways or other infrastructure which allow the community to function in a sustainable way.



5 Managing and mitigating risk

The aim of this chapter is to cover ways of managing risk through site design to ensure that developments will be safe from flooding. The information in this chapter is intended for use only after it has been demonstrated that developing in flood risk areas has been avoided as much as possible and the site and location are appropriate for the chosen type of development. Site specific Flood Risk Assessments must detail how a site will be made safe and this chapter will assist with this requirement.

5.1 Measures to manage flood risk

5.1.1 When undertaking a Flood Risk Assessment (FRA) applicants are strongly encouraged to work closely with Water Management Authorities (see Chapter 3). WMAs must agree that proposed developments are safe and that flood risk management partners (e.g. Emergency Services) would be able to respond quickly and appropriately to any incidents.

Modelling and mapping

5.1.2 The following flood related factors can influence the safe design of new developments and should be considered in the site's FRA (as outlined in of Chapter 4):

- Flood source;
- Flood mechanism;
- Predicted flood level;
- Flood duration;
- Frequency;
- Velocity of floodwaters;
- Debris;
- Flood depth; and
- Amount of warning time.

5.1.3 If developers need to undertake more detailed modelling for their sites to be able to accurately demonstrate the timings, velocity and depth of water inundation to their site, then it is recommended that the scope of works is discussed with the Environment Agency (EA) and the relevant Internal Drainage Board (IDB) (if applicable).

5.1.4 Breach modelling may be appropriate for certain areas of Cambridgeshire. There are two types of breach modelling (see the EA's publication – Flood Risk Assessment Guidance for New Development for further information):

- **Instantaneous breach:** the maximum extent of one or more breaches. This information is required by the EA for specific areas.
- **Progressive breach:** this involves modelling a breach over time, as the breach size increases, the impact on a development site over time can be assessed.

5.1.5 A limited amount of high level breach modelling has already been undertaken within Cambridgeshire. Fenland District Council has produced a Strategic Flood Risk Assessment (SFRA) Level 2 for Wisbech. This focuses on residual risks, such as the rate and depth of flooding in the event that flood defences fail. It also provides some breach and hazard mapping information. For developments within the Wisbech SFRA Level 2 Study Area this should be referred to in the first instant. The EA should be contacted to find out if any more recent data is available for this or other defended locations.

5 Managing and mitigating risk

Climate change information

5.1.6 Climate change is predicted to exacerbate extreme weather patterns; causing more frequent and intense rainfall duration, hence it is likely to heighten the risk of flooding. By implementing sustainable practices as part of new developments, as set out in both national and local planning policies, the associated risk of climate change can be managed and reduced.

5.1.7 The National Planning Policy Framework (NPPF) (Section 10) conveys the Government's plan to proactively help mitigate and adapt to climate change by taking full account of flood risk when developing strategies. Local Plans emphasise the need to take account of climate change and the associated factors e.g. flood risk, as clearly advised in the NPPF.

5.1.8 In making an assessment of the impacts of climate change on flooding from the land, rivers and sea as part of a FRA, the sensitivity ranges in Table 5.1 provide an appropriate precautionary response to the uncertainty about climate change impacts on rainfall intensities, and river flow.

Table 5.1 : Recommended national precautionary sensitivity ranges for peak river flows

Allowance category	Total potential change anticipated for '2020s' (2015-2039)	Total potential change anticipated for '2050s' (2040-2069)	Total potential change anticipated for '2080s' (2070-2115)
Upper end	25%	35%	65%
Higher central	15%	20%	35%
Central	10%	15%	25%

a. *For guidance, residential development should be considered for a minimum of 100 years, unless there is specific justification for considering a shorter period. An example of this would be if the development was controlled by a time limited planning condition.*

b. *For proposals with exceptional vulnerability to flooding (e.g. new settlements, strategic urban extensions or hazardous installations) and/or an expected lifetime of over 100 years, consideration should be given in FRAs to the potential implications of climate change beyond 100 years. This may include an extended climate change horizon for phased developments. Hazardous installations should consider climate change scenarios beyond the upper end as part of sensitivity testing. Pre-application discussions are especially important in these cases.*

c. *For development other than residential, its lifetime will depend on the characteristics of that development. Applicants should justify why they have adopted a given lifetime for the proposed development when they are formulating their FRA. It should be noted that it needs to be the actual lifespan of the building and not the design life; there tends to be a difference in that the actual service life tends to be greater than the design service life. It would need to be demonstrated with a degree of certainty that the building will no longer be present on the site for a lesser amount of climate change allowance to be used in the design calculations.*

5.1.9 Use Table 5.2 to decide which allowances apply to your development or plan. Further detail on when and how to use the climate change allowances in FRAs can be found here.

Table 5.2 : Using Peak River Flow Allowances for Flood Risk Assessments

Use vulnerability	Flood Zone		
	2	3a	3b
Essential infrastructure	Higher central & upper end to assess range of allowances	Upper end	Upper end
Highly vulnerable	Higher central & upper end to assess range of allowances	Development should not be permitted	Development should not be permitted
More vulnerable	Central & higher central to assess range of allowances	Higher central & upper end to assess range of allowances	Development should not be permitted
Less vulnerable	Central	Central & higher central to assess range of allowances	Development should not be permitted
Water compatible	N/A	Central	Central

5.1.10 The EA has produced a sensitivity test for the development of flood maps by using the 20% allowance for peak flows between 2025 and 2115. It suggests that changes in the extent of inundation are negligible in well-defined floodplains, but can be dramatic in very flat areas e.g. the Fens. However, changes in the flood levels under climate change could in time reduce the return period of a given flood. This means that a site currently located within a lower risk zone (for example, for Flood Zone 2 see Table 4.3 in future could be re-classified as lying within a higher risk zone (for example, for Flood Zone 3a see Table 4.1), which could have implications for the type of development being proposed. It is therefore important that applicants refer to the current flood map, the Local Planning Authority's (LPA) SFRA and the EA's latest guidance when preparing and considering proposals.

5.1.11 The sensitivity ranges in Table 5.3 provide an appropriate precautionary response to the uncertainty about climate change impacts on peak rainfall intensity.

Table 5.3 : Peak rainfall intensity allowance in small and urban catchments (use 1961 to 1990 baseline)

	Total potential change anticipated for:		
	2010- 2039	2040- 2059	2060- 2115
Upper end	10%	20%	40%
Central	5%	10%	20%

5.1.12 The central estimate should be used for design purposes to assess the impact on surface water drainage networks. The upper end estimate should be used to assess the potential flood risk implications in the critical duration design rainfall event including whether there is any increased flood risk to third parties as a result of the development.

Site layout

5.1.13 The site layout of any proposed development should take into consideration areas of flood risk present on the site and this should influence the choice of where to locate elements of the proposed development including sustainable drainage systems (SuDS) (see Chapter 6). This is in line with the Sequential Approach to flood risk as outlined in Chapter 4. If areas of flood risk cannot be avoided then the least vulnerable

elements of the proposed development should be located to coincide with the highest level of flood risk. For example, locating the open space element of the proposed development where the risk of flooding from surface water is higher (this would be on a case by case basis and advice should be sought from the relevant LPA in terms of its acceptability).

5.1.14 The inclusion of good quality green infrastructure (including trees and other vegetation) within a development master plan has the potential to significantly increase the profile and profitability of developments. Low lying ground can be designed to maximise benefits by providing flood conveyance and storage as well as recreation, amenity and environmental purposes. Where public areas are subject to flooding easy access to higher ground should be provided. Structures, such as street furniture and play equipment, provided within the low lying areas should be flood resistant in design and firmly attached to the ground.

5.1.15 Site layout does not only have to cater for the flood risk on the site but can also accommodate flood water that may contribute to a problem downstream. For example, where a proposal has a watercourse flowing through which contributes to flooding downstream in the existing community or further downstream within an adjacent community, the proposed development should offer flood risk betterment by holding back flood flow peaks within the site in a green corridor and by making space for this water. This is a proactive approach to flood risk management in Cambridgeshire where new developments offers enhancements to the surrounding area. All developments with watercourses identified within their site must consider this approach.

5.1.16 The site layout should also respond to the characteristics of the location and the nature of the risk. In some areas it is more appropriate to make space for water and allow controlled flood water onto areas of the development site. This is particularly relevant to riverside developments where extreme events can be catered for in multi-function open space areas (likely to form part of the green infrastructure provision) that would normally be used for recreation but infrequently can flood. The use of such features in these areas should be appropriate and compatible with the frequency, depth and duration of any flooding. However, signage clearly explaining the use of such areas for flood control and recreation should be fully visible so that infrequent flood inundation does not cause alarm (see section 5.2).

5.1.17 The following three examples are of developments that integrate flood risk management into the development master plan. These measures may not be appropriate in all locations. Further details of each development, including costing can be found in the LifE Project – Long-term Initiatives for Flood-risk Environments publication EP98.

5.1.18 In Figure 5.1 the objective was to develop a medium density suburban development with high quality landscape for suburban living that would provide multi-functional open spaces which adapt for flood mitigation, sports and play, biodiversity enhancements, local food and energy.

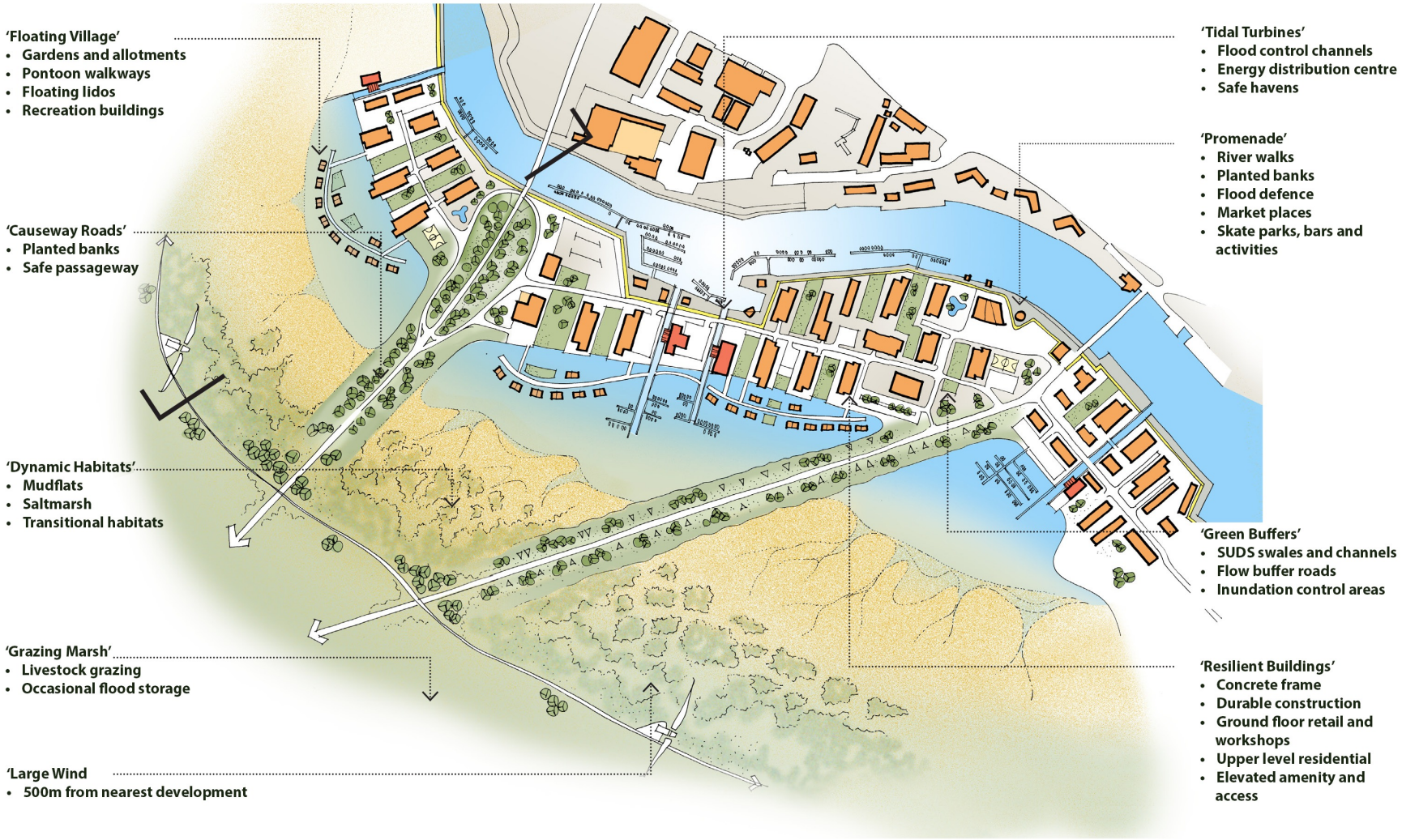
Figure 5.1 : Upper river catchment development ©BACA Architects

5.1.19 In Figure 5.2 the objective was to create a landscape-rich medium density development that has high density clusters to minimise development foot print and preserve land for future adaptation. Enhancement of the river corridor for waterfront and cultural activities allows integration into the existing urban green infrastructure network, provides flood and water management and opportunities for local food and energy to re-connect the town with the river.

Figure 5.2 : Middle river catchment development ©BACA Architects

5.1.20 In Figure 5.3 the main objective is to create a highly diverse landscape to provide multiple benefits to new and existing residents through flood protection, amenity and habitat generations, tourism and economic sustainability. This involved large-scale restoration of the river flood plain which would provide a number of opportunities for improvements to the landscape including improved access, tourism and recreation, provide wetland habitat and land for food and energy crops.

Figure 5.3 : Lower river catchment development ©BACA Architects



5.1.21 Short-term car parking may be appropriate in areas subject to flood risk provided that flood warnings and signs are in place. It is important to consider the need that people should be able to move their cars to a recognised safe area within the warning time (hence the unacceptability of long term and residential car parking where residents may be away from the area for long periods of time). Car parks should ideally not be subject to flood depths in excess of 300mm depth since vehicles can be moved by water of this depth and may cause obstruction and/or injury. A guidance document titled 'Flood Risks to People' was published by DEFRA/ EA in 2006 which developed a method for estimating risks to people, both during and immediately after a flood event. This document contains useful information on the hazards of flooding.

5.1.22 The use of SuDS which are designed to cater for exceedance events should not be sited within the floodplain as they are important in reducing the risk of surface water flooding on site and cannot be utilised if flooded from the river. Additionally the river will want to fully use its floodplain and these systems in the floodplain may compromise this ability. Chapter 6 provides more information on the design of drainage systems and exceedance events.

Raising floor levels

5.1.23 Where it is not possible to avoid flood risk or minimise it through site layout, raising floor levels above the predicted flood level (including an appropriate allowance for climate change) is a possible option in some circumstances to manage flood risk to new developments however this can increase flood risk elsewhere; it can create an 'island effect' with surrounding areas inundated during a flood, makes access and egress difficult; can affect river geomorphology; can have further potential impacts, such as erosion on site and changes to erosion and sedimentation elsewhere and can also have an impact on the landscape value and amenity of the river flood plain.

5.1.24 If floor levels are raised to mitigate flooding to the development, this may not prevent the roads and gardens from flooding which can affect house (flood) insurance and cause concern to the owners of the properties seeing flood water surrounding their property.

5.1.25 Raising floor levels can have an adverse impact on the street scene as building and feature heights will increase. In addition there may be implications for access ramps for wheelchairs which in turn can also take up flood storage leading to an overall loss of floodplain. Raising floor levels may also be significantly more difficult to achieve privacy standards with higher windows and this may also create the need for significantly higher boundary treatments or screens.

5.1.26 Therefore raising the floor level may not be appropriate in all situations and should not be seen as a development wide solution, but may be considered alongside other solutions if acceptable to the LPA and other Water Management Authorities (WMAs). It is important that the design will ensure that safe access and egress will always be available and this will be an essential part of the ongoing maintenance and legal agreements for the development. Please see the Defra/EA publication 'Flood Risks to People' for further information on what is considered 'safe'.

5.1.27 An alternative could include the placing of parking or other flood compatible uses at ground level with more vulnerable uses at higher levels. This is only appropriate for areas of low frequency flood risk and must ensure safe access and escape from the development and that the development is habitable for the duration of the flood, i.e. services to the properties will continue to function. When undertaking this approach no built elements should interrupt flood flow paths or reduce floodplain storage capacity.

5.1.28 Single storey residential development and ground floor flats are generally more vulnerable to flood damage as occupants do not have the opportunity to retreat to higher floor levels and salvage belongings to higher ground. For this reason single storey housing and ground floor flats in flood risk areas should not be allowed unless finished floor levels are set above the appropriate flood level for the lifetime of the property (taking into account the appropriate climate change allowance), and there is safe access and escape. In

areas of extensive floodplain (e.g. Wisbech), single storey housing could be supported where a purpose built stairway is provided to the roof area and escape from this area is in the form of easily accessible and easy to open roof light windows or similar (this must be as agreed by the relevant LPA in advance).

5.1.29 Sleeping accommodation on the ground floor that relies on flood warnings and the implementation of flood proofing measures is hazardous. Change of use from commercial to residential that results in proposed ground floor flats in Flood Zone 3 is unlikely to be acceptable (even with the use of flood proofing measures to mitigate the flood risk) unless finished floor levels are or can be raised above the predicted flood level (with an appropriate allowance for climate change), and there is safe access to and escape from higher storeys of the building.

Flood compensation

5.1.30 Any proposals to modify ground levels will need to demonstrate in the FRA that there is no increase in flood risk to the development itself or to any existing property elsewhere. Where land on site is raised above the level of the floodplain to protect properties, compensatory land must be returned to the floodplain. This is to ensure that new flood risk is not created elsewhere in an unknown or unplanned for location. Land raising would generally only be applicable on smaller development sites or for a small portion of the developable site area.

5.1.31 For undefended sites, floodplain compensation must be both 'level for level' and 'volume for volume'. Direct (onsite or opposite bank) flood compensation is preferable since it is more appropriate, more cost effective and will ensure it functions correctly. If strategic off-site upstream flood compensation is to be considered, developers should liaise with the LPA, the EA and the relevant IDB to understand whether storage sites are available that could protect multiple developments, potentially lead to shared costs, and reduce flood risk overall. CIRIA's report C624 entitled 'Development and Flood Risk - Guidance for the Construction Industry (2004)' provides detailed advice on floodplain compensation.

5.1.32 In defended areas, flood compensation need not normally be provided to the same extent. This applies, for example, in the Fens. Developers should however assess the risks to the site and surroundings and undertake mitigating action if the raising of land has the potential to create additional risk elsewhere. Consultation should be undertaken with WMAs (for example the EA, Lead Local Flood Authority (LLFA) or the relevant IDB) to determine what type of flood compensation or other mitigating actions would be appropriate.

New flood defences

5.1.33 The construction of new flood risk defences may enable development to take place provided that there are wider sustainability benefits associated with their construction (this could be demonstrated through a sustainability appraisal for example). Their construction needs to be very carefully considered with the LPA, the EA and the relevant IDB. New defences create new residual risks that can take significant investment to fully understand and plan. WMAs who maintain defences (such as the EA or IDBs) are not obliged to maintain defences and could potentially reprioritise or reduce expenditure in this area. Where defences are required, maintenance agreements will need to be reached through Section 106 of the Town and Country Planning Act 1990 or Section 30 of the Anglian Water Authority Act 1977. The latter can be used by the EA to adopt flood defences directly. In addition, IDBs may also adopt new flood defences if appropriate agreements and funding are in place.

5.1.34 Under the Flood and Water Management Act 2010 (FWMA), the EA, LLFA, District Councils and IDBs have legal powers to designate structures and features that affect flood risk and are not directly maintained by these organisations. Where a defence is being built to protect a development or area, it may be designated as a 'flood asset' by the relevant body. Further information on the designation of structures can be found in Defra's Designation of Structures and Features for Flood and Costal Erosion Risk Management Purposes - Information Note.

5.2 Managing the residual risk

5.2.1 Residual risks are those remaining after the Sequential Approach has been applied to the layout of the different site uses and after specific measures have been taken to control the flood risk. At this stage management measures are no longer about reducing the risk, but about planning for flooding. Management of the residual risk must therefore be the very last stage of designing and planning a site, where all options for removing and reducing risk have already been addressed.

5.2.2 This document only provides an overview of residual risk related management measures. More detailed information is included in 'C688 - Flood resilience and resistance for critical infrastructure (CIRIA, 2010)', - 'Improving the Flood Performance of New Buildings – Flood Resilient Construction (CLG, 2007)' and 'Flood resilient building (BRE DG523)'.

5.2.3 Where flood defence and drainage infrastructure has been put in place there will be risks associated with both its failure and with the occurrence of flood events more significant than the design level of the defence or system. These are residual risks which can be managed. The costs of managing residual risk may be low compared to the damage avoided. It should be noted that climate change is expected to increase the level of residual risk.

5.2.4 Different types of measures to manage residual risk include:

- Developer contributions towards publically funded flood alleviation schemes;
- Designing sustainable drainage systems so that storm events which exceed the design standard are properly planned for and the exceedance routes are known and appropriate (this requirement is explained in sections 5.1.10 and 6.4);
- Incorporating flood resistance and resilience measures into building design;
- Flood warning and evacuation plans.

5.2.5 There are two main strategies for managing property level flood risk:

- **Water exclusion strategy** – where emphasis is placed on minimising water entry whilst maintaining structural integrity, and on using materials and construction techniques to facilitate drying and cleaning. This strategy is favoured when low flood water depths are involved (not more than 0.6m). It should be noted that even with this strategy, water is still likely to enter the property.
- **Water entry strategy** – where emphasis is placed on allowing water into the building, facilitating draining and consequent drying. Standard masonry buildings are at significant risk of structural damage if there is a water level difference between outside and inside of about 0.6m or more. This strategy is therefore favoured when potentially high flood water depths are involved (greater than 0.6m).

Flood resistance measures

5.2.6 Flood resistance measures reduce the risk of flood water from entering a building and can be referred to as ‘dry proofing’. Measures include exterior water retaining walls and barriers built into building facades, gates that protect basement areas, doorway flood barriers, and airbrick covers (see Figure 5.4).

5.2.7 The effectiveness of flood resistance measures depends upon the occupier understanding the features, utilising them correctly when required and carrying out any needed maintenance. Passive measures such as flood doors and self-closing airbricks are one way of reducing the risk. Water pressure and carried debris can also damage buildings and result in breaching of barriers. As a result these measures should be used with caution and accompanied by flood resilience measures.

5.2.8 Flood resistance measures cannot be used in isolation as the only form of flood mitigation, but they may be useful within a suite of measures including appropriate high finished floor levels and safe access and escape routes. Flood resistance measures can aid recovery from an extreme and rare flood event(s).

Figure 5.4 : Reinforced concrete flood resistant wall faced with local stone

© Robin Stott

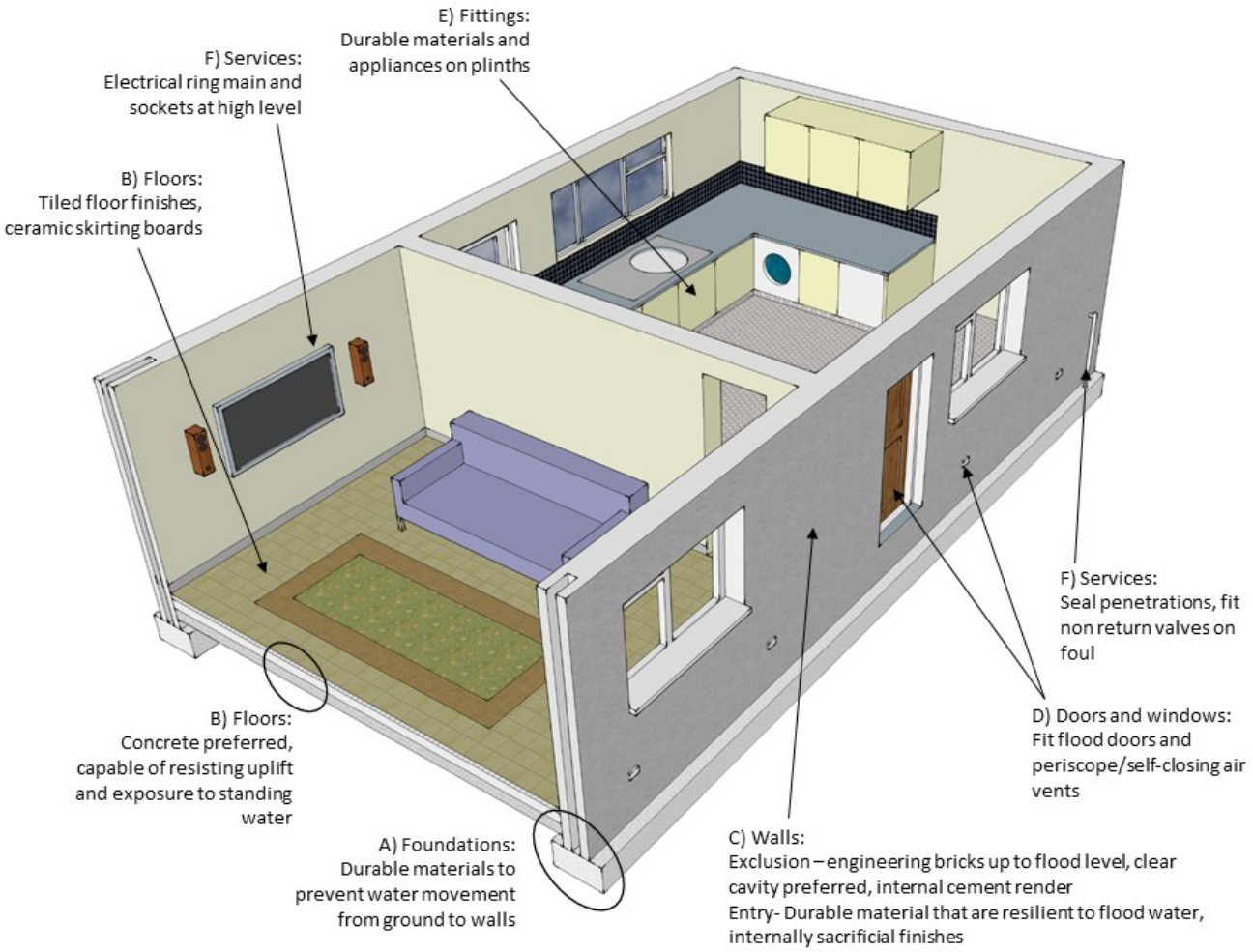
Flood resilient construction

5.2.9 Flood resilient construction accepts that water will enter the building, but with careful design minimises the damage to allow the re-occupancy of the building as soon as possible. This is encouraged in water compatible developments within the functional floodplain e.g. boat club houses. Resilient construction can be achieved more consistently than resistance measures and is less likely to encourage occupiers to remain in buildings that could be inundated by rapidly rising water levels. Total prevention of water entry or 'dry proofing' to a building is very difficult to achieve and flood resilient measures are about reducing the impact caused by flooding (see Figure 5.5).

5.2.10 Further details can be found in Improving the Flood Performance of New Buildings (DCLG, 2007).

Building components and flood resilience

Figure 5.5 : Flood resilience measures



5.2.11 Figure 5.5 provides an example of flood resilient measures that can be used within a development. Further details of each component can be found in Appendix D.

5.2.12 Flood resilience measures also include information based actions and planning such as:

- The use of clear signage within a development to explain the remaining risks or required responses from residents in the event of a flood such as displaying information on access doors and when to use them, in car parks explaining when to move cars, or on riverside walkways (i.e. when car parks are designed to flood), and defined flood conveyance routes and storage areas;
- Evacuation pathways and routes should be clearly signed, and where possible, markers (colour coded) used on bollards/lampposts to define the path and changes in depth from shallow to deep for the users. Any chamber covers should not be designed within access routes as covers can lift during floods and become hazardous to pedestrians;
- Ensuring that appropriate flood insurance is available and is in place for buildings and contents. Further information and links about flood insurance are available on the National Flood Forum website;
- Businesses developing and maintaining business continuity plans. It is encouraged that business continuity planning is undertaken across all risk areas;
- Preparing and acting on flood warning and evacuation plans.

5.2.13 These plans are an essential part of managing the remaining risk. Particular attention should be given to communicating warnings to and the evacuation of vulnerable people.

5.2.14 Evacuation plans must include dry access and escape routes wherever possible. Any variation in this, particularly the consideration of on-site refuge must be agreed by emergency service partners. In this situation the LPA will seek to organise a technical meeting with their Emergency Planner that deals with Evacuation Plans for the district, Cambridgeshire's Fire and Rescue Service, and the Police Force in order to agree whether the development's strategy for access, escape and refuge is appropriate.

5.2.15 The areas of Cambridgeshire covered by the EA's flood warning scheme can be viewed on the EA's online map. While this scheme provides prompt telephone calls and SMS text messages to registered individuals, it is dependent on residents signing up to the scheme. Developers must also bear in mind that warning areas may not be extended to cover new development areas. The EA's scheme only covers flooding from main rivers. Flooding from rainfall, surface runoff and groundwater often occur much more quickly, making warning more difficult. No specific local or national warning system currently exists for these more localised events and developers will need to consider this in ensuring developments will be safe from all sources of flooding.

6 Surface water and sustainable drainage systems

This chapter discusses how effective SuDS can be incorporated into the overall design of a proposal in any area of Cambridgeshire. Within Cambridgeshire the aim is to achieve the design and delivery of high quality sustainable drainage that complements the urban and rural landscapes of the county whether natural or man-made and which:

- **Effectively manages water (quantity and quality – see Chapter 7);**
- **Is aesthetically pleasing;**
- **Conserves, accommodates and enhances biodiversity and the historic environment; and**
- **Provides amenity for local residents (ensuring a safe environment).**

6.1 Introduction

6.1.1 Sustainable Drainage Systems (SuDS) re-create the benefits of natural drainage systems by integrating water management with urban form to create and enhance the public realm, streets and open spaces that we all value. The flexibility of SuDS components means that SuDS can apply in both the urban and rural context and in both natural and man-made environments.

6.1.2 SuDS allow the delivery of high quality surface water drainage whilst at the same time supporting urbanised areas in coping with severe rainfall. SuDS generally replace traditional underground, piped systems that gather runoff using grates or storm water drains. They control flows to prevent deluges during times of high rainfall and reduce the risk of flooding whilst also providing benefits for amenity and biodiversity. The SuDS approach keeps water on the surface as much as possible to avoid concentration and acceleration of flows in piped systems while also taking the opportunity to provide valuable amenity assets for local residents and increase the provision of green infrastructure in urban areas. Keeping water on the surface also means that any problems with the system are quicker and easier to identify than with a conventional system and are generally cheaper and more straightforward to rectify.

6.1.3 SuDS offer a great opportunity to improve and connect habitat in urbanised environments, as well as playing an important role in delivering and reinforcing wider green infrastructure ambitions for Cambridgeshire. SuDS can improve quality of life as well delivering recreation and education opportunities. Additionally, developers benefit from this environmental improvement by constructing highly desirable, affordable and saleable commercial and residential properties.

6.1.4 Even across man-made areas such as the Fens there is the potential to make use of many different SuDS components as they can reduce the immediate impact of intense rainfall ultimately having a cumulative beneficial effect on flood risk from main rivers. Together SuDS and IDB systems can be a strong combination providing significant benefits for future development.

6.1.5 This chapter presents information for designing water sensitive developments providing the first stage for any SuDS designer. It also provides information on the steps a developer must take at the different stages of the development process to ensure SuDS meet their full potential. For further background information on SuDS including the different types are set out in The SuDS Manual (CIRIA, C753).

6.1.6 Please note that reference is made to 'SuDS' throughout this chapter, rather than 'surface water drainage' as the National Planning Policy Framework (NPPF), Planning Practice Guidance (PPG), Non-Statutory Technical Standards for Sustainable Drainage and adopted and emerging Local Planning policies require a SuDS solution to surface water management for new development. Many of the general principles within this chapter can also be applied to traditional surface water drainage and so this chapter needs to be complied with on all development sites and the provision of SuDS maximised. Even on very constrained sites SuDS can be implemented in one form or another.

6.1.7 Organisations such as CIRIA, British Standards and Interpave provide the information that should form the basis of any SuDS design. Responsibility will rest with the designers for ensuring that the scheme is designed to the requirements of the relevant Local Planning Authority (LPA) and the relevant Water Management Authorities (WMAs).

6.2 The Cambridgeshire SuDS design context

Topography and drainage patterns

6.2.1 Cambridgeshire's topography is predominantly flat, with many parts situated below sea level. However, there are some important topographical differences; the Fens area is consistently level and low-lying, while southern and western parts of Cambridgeshire include some significant variations in topography. Undulating hills define much of the land to the northeast of the River Cam, while the topography to the southwest of the river is more varied. Other main rivers, which flow through Cambridgeshire, include the River Nene, River Great Ouse and River Kym. Due to the county's low-lying geography, it is highly sensitive to sea level change; particularly near The Wash. Structured landscapes using a highly organised drainage pattern of overland flow channels are common across the county.

Rainfall and water availability

6.2.2 Cambridgeshire is one of the driest counties in the UK. On average, the county receives less than 600mm of rainfall per annum; however, this can drop below 500mm in particularly dry years. This is less than half the national average of 1,176mm. Accordingly, water management is an important issue and source control measures like rainwater harvesting that enable water use reduction locally are important along with retention of water for irrigation purposes. Equally, in some areas infiltration to re-charge local groundwater supplies is important due to the low rainfall conditions in Cambridgeshire and SuDS such as soakaways can help by encouraging infiltration wherever it is achievable and acceptable. In Fen areas where water levels are closely managed to sustain development and agriculture, the Internal Drainage Boards (IDBs) can use their systems to manage water supplies for agriculture. Equally, trees and woodland, where used appropriately can reduce the impact of drought as, under the right conditions, shelterbelts can enable crops to use water more efficiently (by reducing evapotranspiration losses) which could reduce the need for irrigation and lead to less abstraction.

Flood Risk and Surface Water Management

6.2.3 Fluvial and tidal flooding are the dominant sources of flood risk in Cambridgeshire. There is a strong reliance on pumping stations for water conveyance particularly in the low-lying Fen areas of Cambridgeshire to prevent flooding. Surface water flooding is however also considered a key issue in the county with an estimated 23,100 homes at risk from this type of flooding. New development across the county alters the natural landscape and affects the hydrological processes of the catchment in which it is situated. It often removes natural vegetation and reduces the permeability of the land through the construction of roofs, roads, car parks and other areas of hardstanding, all of which can significant increase the rate of surface water runoff. SuDS are therefore an important component in reducing the quantity surface water runoff. It is important to note that SuDS cannot be used to mitigate for flood risk to the site from fluvial, tidal or other sources of flooding.

Geology

6.2.4 The geology in the north and central areas of Cambridgeshire is relatively impermeable, consisting mainly of soils with properties similar to clay. These soil types are not generally conducive to infiltration, and this will need to be considered in SuDS design but it does not preclude the use of non-infiltrating SuDS. Some of the LPA's water cycle strategies including that for Huntingdonshire identify where geology may affect the use of infiltration SuDS. In some areas there are sand and gravel deposits over the top of clay soils that may be suitable for infiltration. The presence of chalk and greensand in the southern part of the county

means that high infiltration rates may be achievable, and SuDS can be designed to infiltrate water to the ground. A comprehensive investigation should be carried out at the earliest stage of the planning process to establish ground conditions.

6.2.5 A number of factors should be considered when deciding whether to use infiltration SuDS, though where possible, they should be utilised in order to supplement groundwater recharge. The British Geological Society has produced a tool that uses Geographic Information Systems (GIS) to show suitability for infiltration. It is important to note that this information only serves as a high level indication of broad geological areas, and is not to be used as a substitute for a comprehensive site investigation and soakage testing. Infiltration potential is very localised and while suitable sites exist even in the fen areas, in some locations infiltration based systems will not be appropriate.

Biodiversity and green infrastructure

6.2.6 Many of Cambridgeshire's nationally and locally designated nature conservation areas are designated because of their water environment. The integration of SuDS into the landscape needs to be sensitive to the local biodiversity and equally, biodiversity needs to be designed into SuDS. At present one of the main risks to biodiversity in Cambridgeshire is the extent of fragmentation of habitats and loss of species due to historical farming practices and more recently increased pressures from development. Inclusion of SuDS networks could help to re-connect existing habitats and re-create new areas. Cambridgeshire's Habitat Action Plans and Species Action Plans provide specific information on desirable habitat design in the county. Biodiversity should be integrated into SuDS at the early design stage to avoid unnecessary conflict over maintenance and the disturbance of protected species. Additionally if protected species are likely to be attracted to SuDS features, the protection of these habitats during maintenance and operation should be considered in the design.

6.2.7 A UK government objective is, "connecting people with nature" (DEFRA 2011) and the use of SuDS can help deliver this objective. Through careful design, SuDS can respect, enhance and connect local habitats and support biodiversity and green infrastructure in Cambridgeshire. As recognised in the CIRIA SuDS Manual (C753), water within a SuDS system is essential for the growth and development of plants and animals and biodiversity value can be delivered on any scheme from small, isolated systems to large strategic developments where SuDS are planes as part of the wider green landscapes. The creation of rough grasslands, woodland, wetland meadows, aquatic planting and open water can provide shelter, food and foraging and breeding opportunities for a wide variety of wildlife.

6.2.8 There are several Biodiversity Action Plan (BAP) species and habitats that can be supported by well-designed SuDS. In appropriate locations, design of retention ponds and wetlands should consider the integration of well-designed sanctuary areas wherever possible, to give spaces for the more sensitive wildlife species. To make sure SuDS can provide the best benefits to wildlife, ecological expertise is strongly advised. Consultation with nature conservation groups can also help access such expertise. Further information and a list of useful contacts can be found in the RSBP and WWT publication 'Sustainable Drainage Systems: Maximising the Potential for People and Wildlife'.

6.2.9 SuDS can also contribute to a network of functional green corridors. As part of a green infrastructure network, SuDS can be an important asset in supporting the creation of green spaces for local communities' recreational use. The vision for green infrastructure in the county is set out in the Cambridgeshire Green Infrastructure Strategy 2011, which includes connecting habitats, enhancing landscapes and biodiversity and extending access to green spaces as key objectives. The strategy also emphasises the provision of multi-functional landscapes, where SuDS could be integrated with other green infrastructure uses such as recreational space (when dry), landscaping, wildlife habitats, water quality control and flood alleviation.

Character and urban design

6.2.10 Many parts of the Cambridgeshire landscape are typified by flat open landscapes and there is also a strong presence of surface water and water meadows. Water has historically helped define Cambridgeshire, including the man-made Cambridgeshire Lodes, Hobson's Conduit and extensive waterways in the Fens. River valleys play an important role in defining rural landscapes and market towns. In urban areas, undeveloped waterways provide natural relief from the built-up urban form. Above ground SuDS will positively contribute to the county's history and acceptance of water, as well as providing amenity and quality of life value. They will also complement the existing extensive network of waterways, improving the quality of water within them.

6.2.11 The county also has a diverse and distinctive built heritage within its cities, towns, villages and historic buildings. The architectural quality of many buildings within Cambridgeshire's towns and villages, both traditional and modern, is of a high national and international significance. SuDS design will need to reinforce and reflect the quality of the built and natural environment including heritage assets and their settings.

Presence of water features

6.2.12 Historically, Cambridgeshire included large areas of low lying wetlands that have been subsequently drained to allow urban areas and modern farming practices to develop. The use of wetland features in SuDS provides an opportunity to regain some of the benefits of this original landscape, particularly in terms of the varied wildlife value that these sites can bring, without losing touch with the reasons why it was drained in the 17th century.

6.2.13 A famous Cambridgeshire characteristic is its water meadows or floodplains adjacent to the River Cam and the Fens, which in some cases are bounded by residential developments. These water meadows are often grazed and are unique in as much as they extend into urban environments.

6.2.14 Cambridgeshire also has regionally, nationally and internationally important archaeological sites, and the design of SuDS and ground works will need to be sensitive to potential archaeological interests, historic assets and their settings. Where heritage assets are preserved in a waterlogged environment, the recharge of groundwater systems will be extremely important.

Designing a SuDS scheme

6.2.15 Designing SuDS effectively requires an interdisciplinary team with a range of skills such as planning, drainage engineering, landscape design and biodiversity knowledge. SuDS in Cambridgeshire should be designed by a competent design team that works together from the outset to deliver a successful scheme. In many cases, overall costs savings can be realised where multiple benefits such as improved open spaces, recreational areas and surface water drainage function in one area.

6.3 Cambridgeshire SuDS design principles

6.3.1 Principles governing SuDS design in Cambridgeshire are outlined in Table 6.1 and discussed in detail in the following sections.

Table 6.1 : Cambridgeshire SuDS Design Principles

- Plan in SuDS from the start (See Page 57)
- Mimic natural drainage (See Page 63)
- Use the SuDS management train (See Page 67)
- Water reuse first (See Page 69)
- Follow the drainage Hierarchy (See Page 69)
- Use infiltration where suitable (See Page 69)
- Keep surface water on the surface (See Page 70)
- Place-making through SuDS design (See Page 70)
- Landscape-led approach (See Page 70)
- Recognise and conserve the historic and archaeological environment (See Page 71)
- Minimise embodied carbon in SuDS (See Page 71)
- Minimise waste in SuDS (See Page 71)
- Design for wildlife and biodiversity (See Page 71)
- Design for easy maintenance and access (See Page 72)
- Design SuDS for brownfield sites (See Page 72)
- Consider flood extents in SuDS design (See Page 73)
- Design open spaces to incorporate SuDS (See Page 73)
- Design streets to incorporate SuDS (See Page 75)
- Design SuDS to match the density of developments (See Page 76)
- Design SuDS for flat sites (See Page 80)
- Design industrial and agricultural sites to incorporate SuDS (See Page 82)

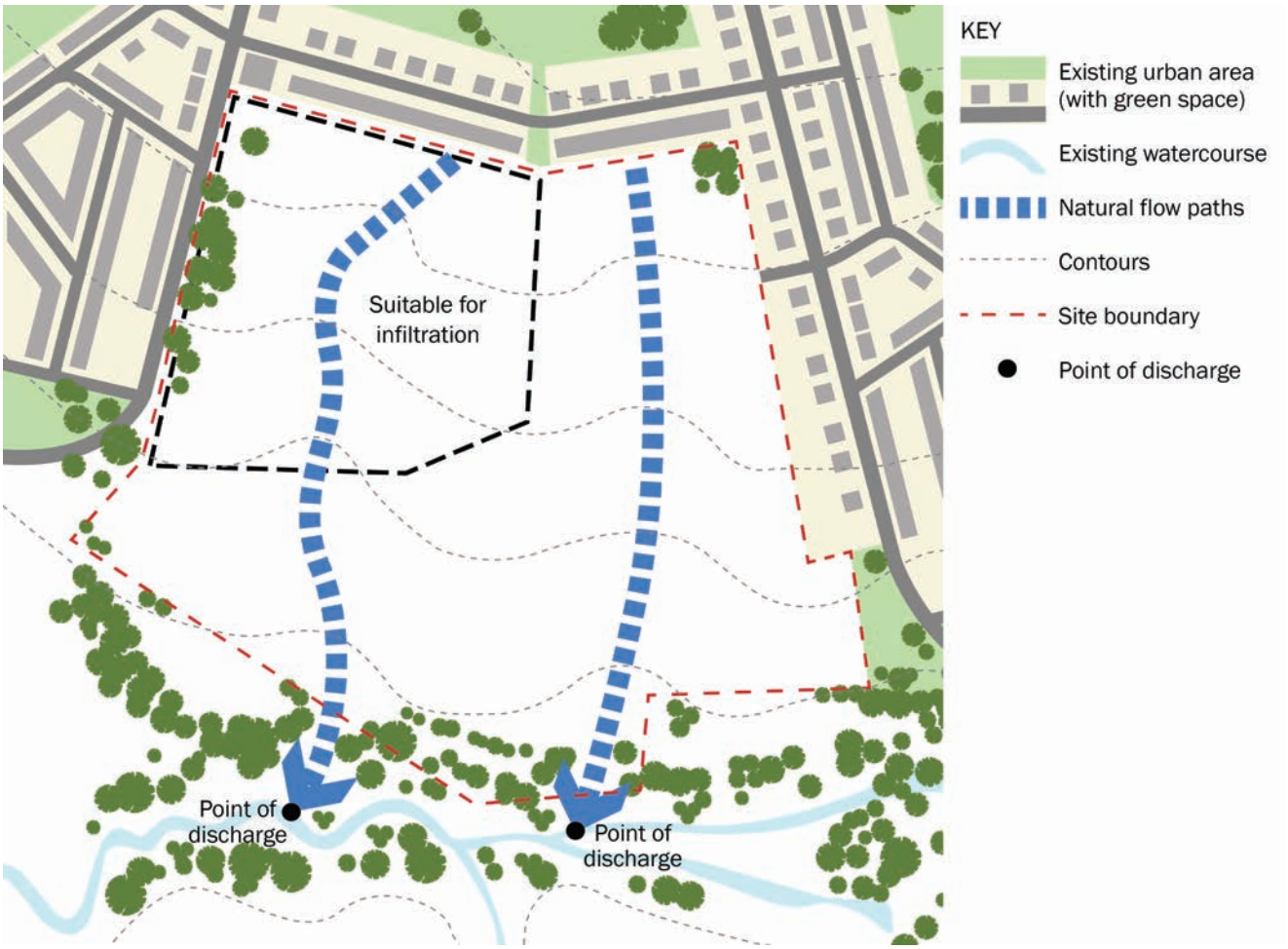
Plan in SuDS from the start

6.3.2 Considering SuDS during the preliminary stages of site design provides the opportunity to incorporate features that are appropriate to the local context and character of an area. Integrated design to achieve multi-functional benefits is inherent to the site master planning and layout process; therefore it is most efficient and cost effective to design SuDS schemes into a site as early as possible. When drainage is accounted for from the beginning of the design process, it provides opportunity for the built up areas to be designed in-line with the topography, rather than to fit the drainage around the site at a later stage which is much less effective.

6.3.3 Land uses that have different pollution potential can also be clustered and phased so that management trains can be designed most effectively. The result of early inclusion of SuDS is a more effective and efficient layout which will avoid the need for abortive work and changes at a later stage which can escalate costs.

6.3.4 The better the SuDS design the more options for adoption that might be available to a development. The stages described in Figure 6.1 to Figure 6.5 show how a design can integrate SuDS spatially through the evolution of a masterplanning exercise.

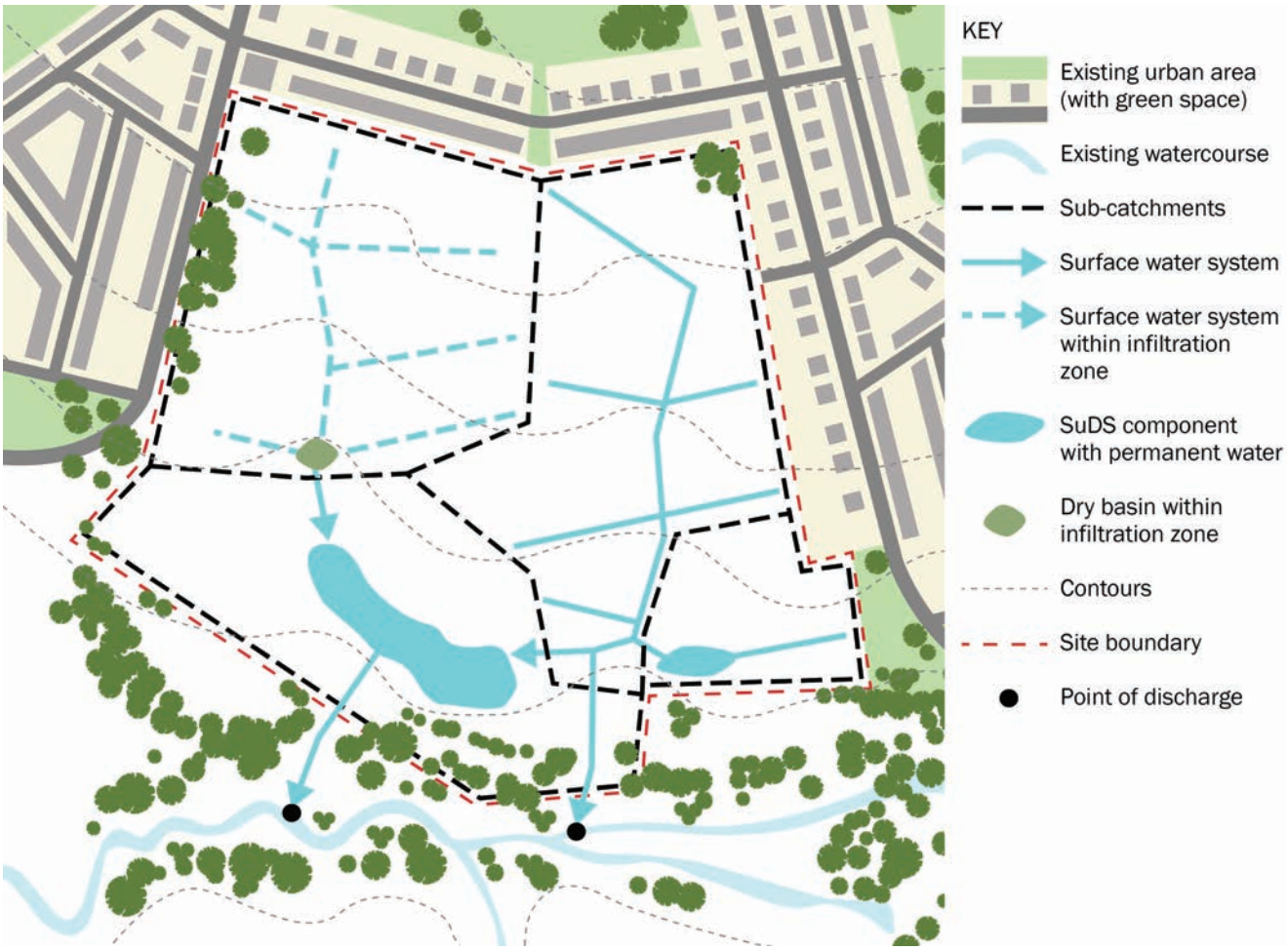
Figure 6.1 : Stage One



Source: Woods Ballard, B., et al (2015) The SuDS Manual, CIRIA, C753

Examine site typography and geology: Aim to mimic the natural drainage systems and processes as far as possible. Identify key natural flow paths, existing water bodies and potential infiltration areas to understand opportunities and constraints.

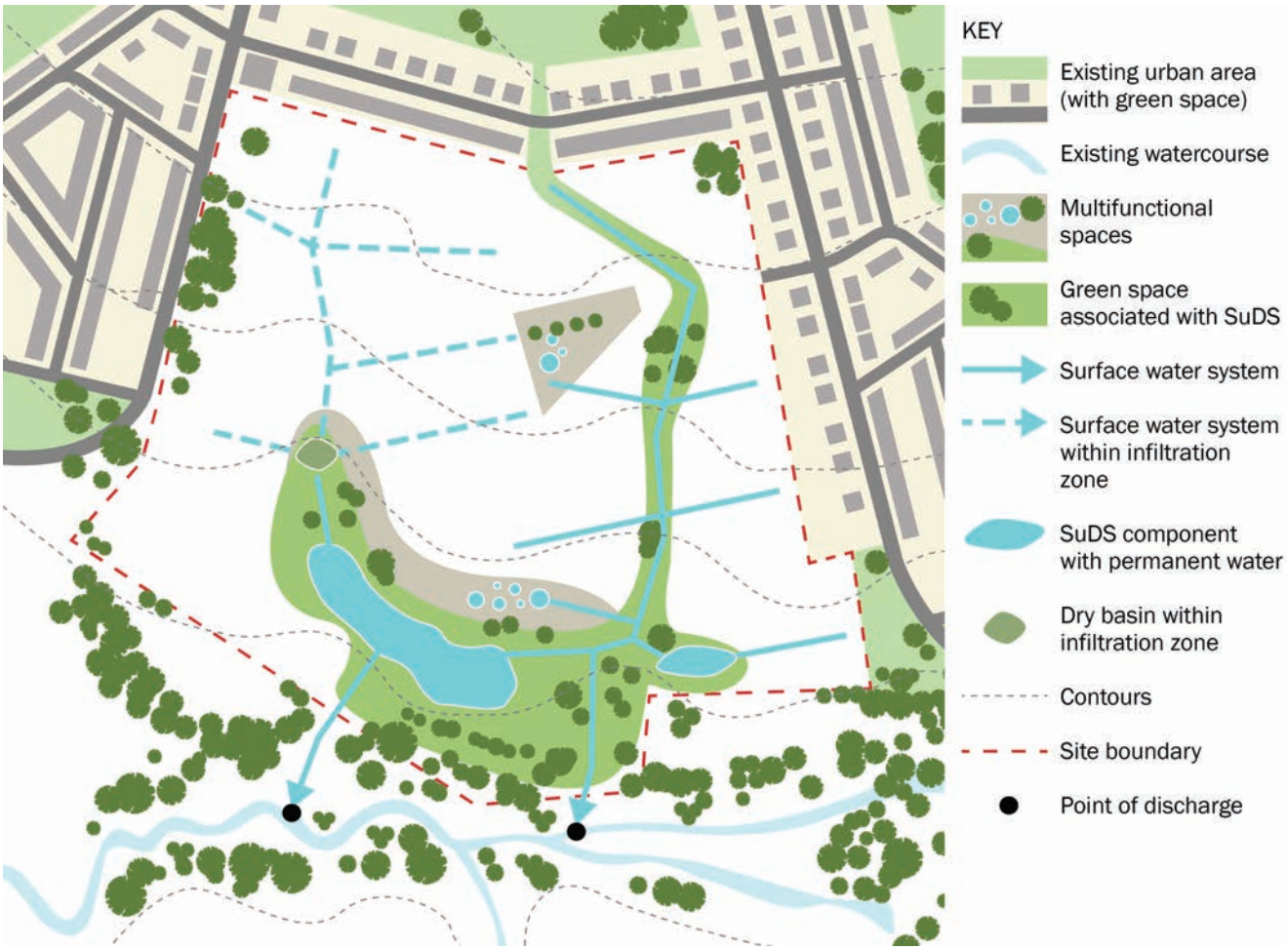
Figure 6.2 : Stage Two



Source: Woods Ballard, B., et al (2015) The SuDS Manual, CIRIA, C753

Create a spatial framework for SuDS: Minimise runoff by rationalising large paved areas and maximising permeable surfaces. Consider likely space needs for site control SuDS based on character of development and the proposed degree of source control. Use flow paths and possible infiltration or storage areas to inform development layout.

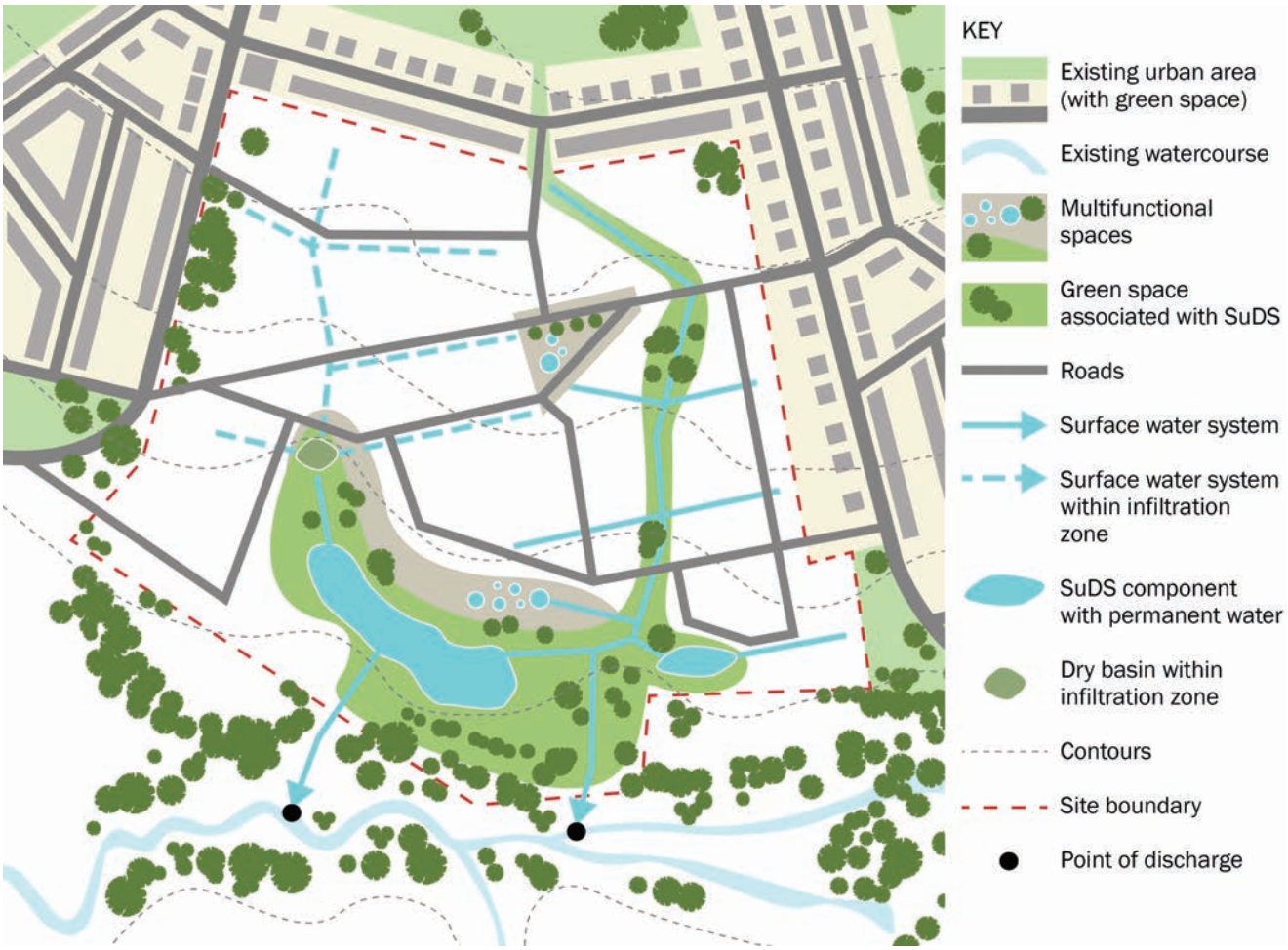
Figure 6.3 : Stage Three



Source: Woods Ballard, B., et al (2015) The SuDS Manual, CIRIA, C753

Look for multi-functional spaces: Consider how SuDS features can be co-located with green infrastructure, open space and public realm areas to create multi-functional spaces. SuDS can be designed to be valuable amenity and ecological features.

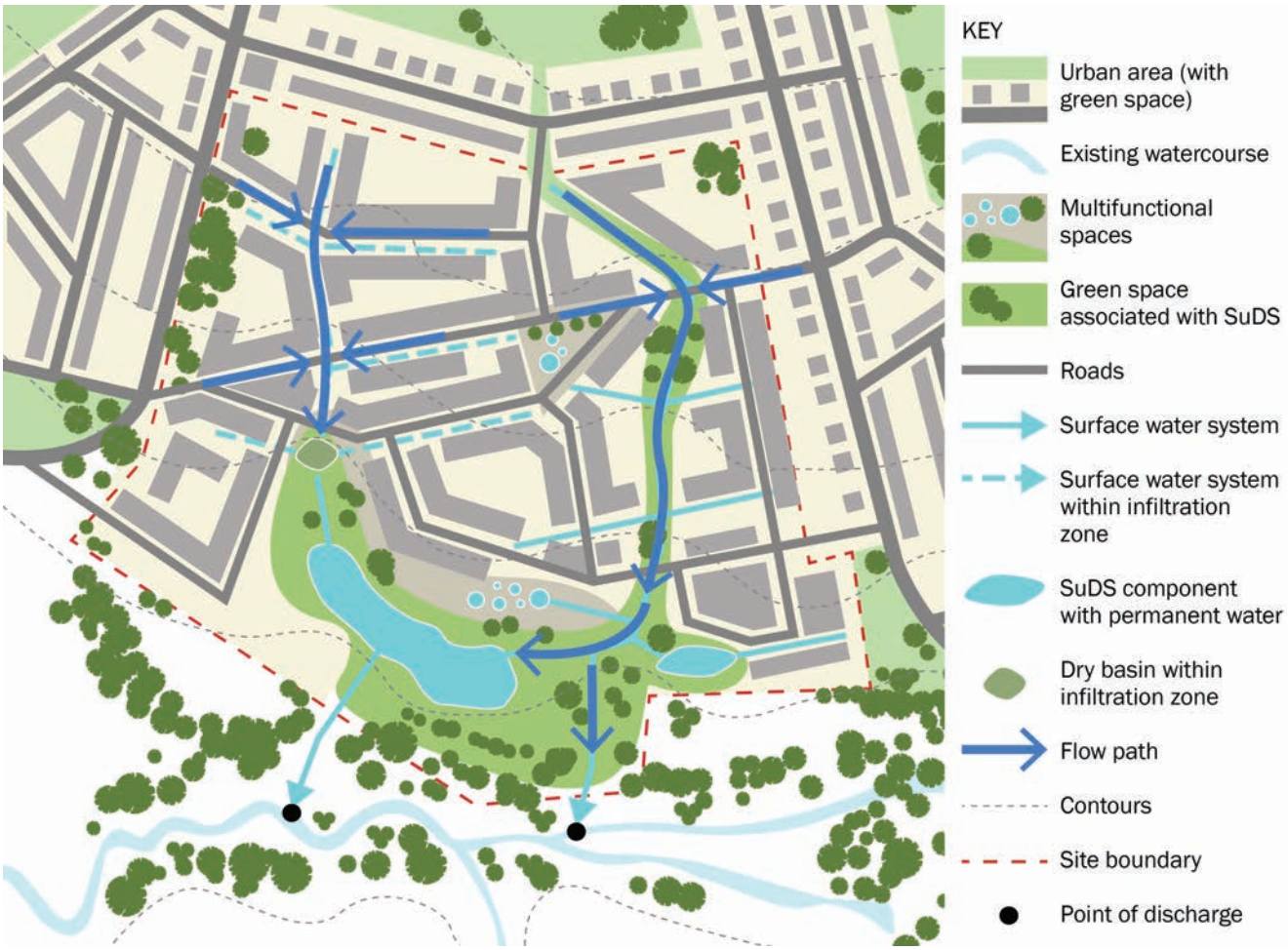
Figure 6.4 : Stage Four



Source: Woods Ballard, B., et al (2015) The SuDS Manual, CIRIA, C753

Integrate the street network with SuDS: Structure the street network to complement and manage flow pathways. Integrate SuDS features into street cross-sections, ensuring street widths are adequate. SuDS should be used to enhance the streetscape providing amenity and multi-functionality by integrating with other street features including tree planting, traffic calming, parking bays, verges and central reservations.

Figure 6.5 : Stage Five



Source: Woods Ballard, B., et al (2015) The SuDS Manual, CIRIA, C753

Cluster land uses to manage pollution: The number, size and type of SuDS selected will be affected by land uses and the corresponding pollution risk. Potential polluters, e.g. industrial development should have their own isolated SuDS network. Integrate a series of SuDS features that will provide water treatment throughout the networks, responding to the level of pollution risk. Clustering should be considered alongside other mixed use ambitions.

Mimic natural drainage

6.3.5 The topography of an undeveloped site provides a good indication of natural flow routes and can therefore assist in defining appropriate and efficient flow routes through a developed site without relying on additional infrastructure. The most effective and cost efficient designs make use of the local topography, increase landscape permeability, and reduce the amount of surface water flowing off site as much as possible. Allowing surface water runoff to follow the natural physical geography requires less soil movement and can eliminate the need for additional underground piping and pumping of water. Where the site is suitable for infiltration, opportunities to discharge water to the ground should be taken to mimic natural infiltration and recharge groundwater aquifers.

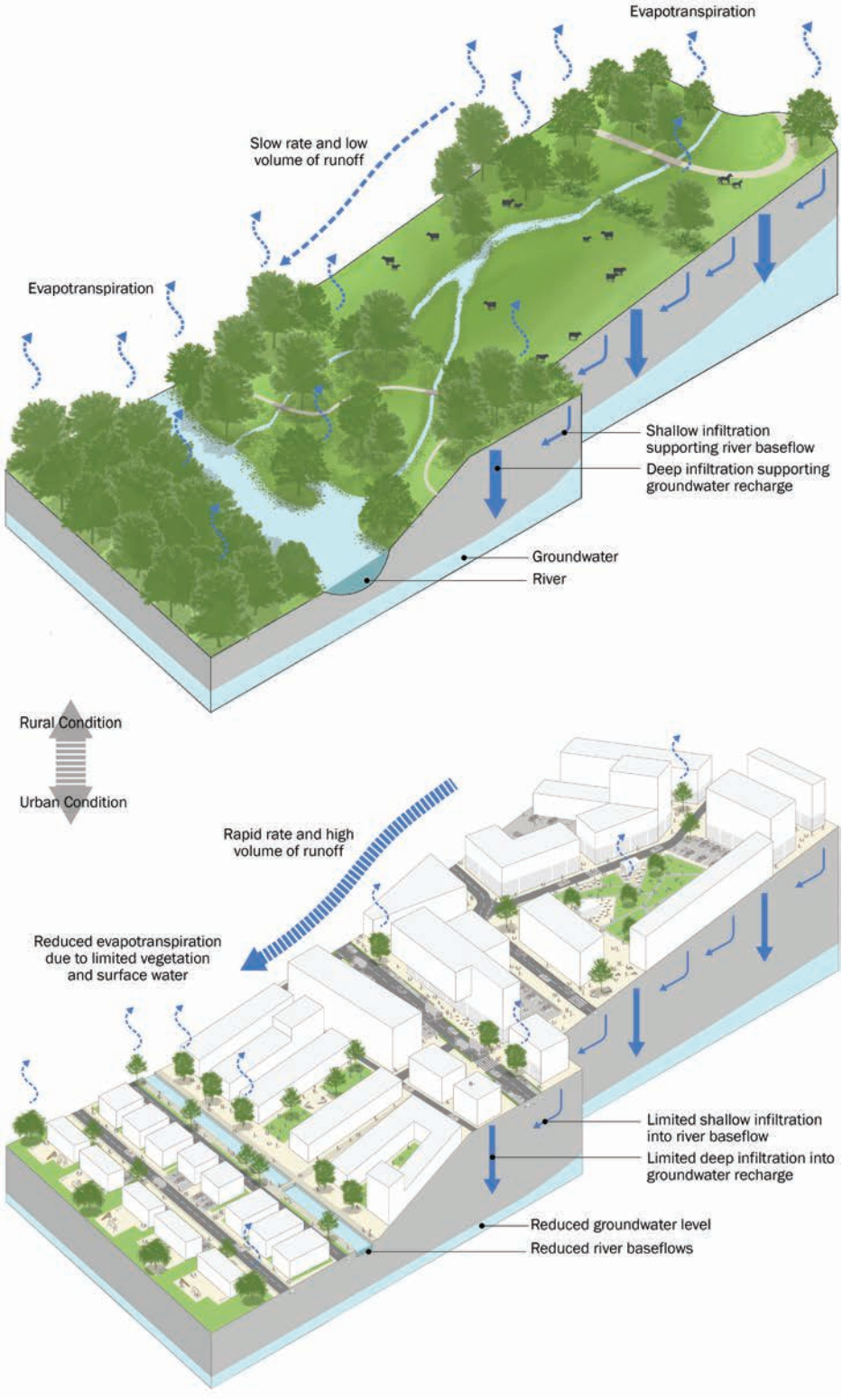
6.3.6 All new developments on greenfield land are required to discharge the runoff from the impermeable areas at the same greenfield runoff rate, or less than, if locally agreed with an appropriate authority or as detailed within the local planning policies of District and City Councils. For example the IDB may stipulate its rates of discharge for developments within its areas and the Lead Local Flood Authority (LLFA) or LPA may stipulate an acceptable discharge rate outside of these areas. Note that in IDB areas, consent will be required for any discharge into an IDB watercourse.

6.3.7 The LPA may allow a reduced level of attenuation prior to discharge to a watercourse where a strategy or study undertaken by or in partnership with an IDB or other WMA demonstrates that no increase in flood risk would occur to the site or elsewhere. It must however be demonstrated by the applicant that the site can continue to drain when receiving water bodies are in flood conditions. Irrespective of any agreed runoff rates, source control methods must be implemented across sites to provide effective pre-treatment of surface water. This must be demonstrated as part of the proposal.

6.3.8 Brownfield (previously developed land) sites must reduce the existing runoff from the site as part of the redevelopment. Where possible, in order to provide betterment, redevelopments should look to reinstate greenfield runoff rates. Note that in some parts of Cambridgeshire there are specific policy requirements related to acceptable runoff rates for brownfield sites set out in Local Plans.

6.3.9 Figure 6.6 shows the differences in drainage patterns between natural landscapes and built-up areas. Mimicking the natural landscapes in urban areas is the best strategy to mitigate flood risk and improve downstream water quality.

Figure 6.6 : Difference between natural landscape and urban drainage



Source: Woods Ballard, B., et al (2015) The SuDS Manual, CIRIA, C753

6.3.10 In addition to natural and urban catchments, as already detailed, the Fen area of Cambridgeshire has an extensive network of artificial drainage channels that are mostly pump drained. The majority of these are under the control and management of IDBs. Map 6.1 shows those areas of Cambridgeshire where the watercourses are designated by the Environment Agency (EA) as 'Heavily Modified Water bodies'. Such designation relates to the Water Framework Directive (WFD) (see Chapter 7); however it provides a useful visualisation of those watercourse across Cambridgeshire that have been heavily modified.

6 Surface water and sustainable drainage systems

Map 6.1 : Heavily Modified Waterbodies across Cambridgeshire

Use the SuDS management train

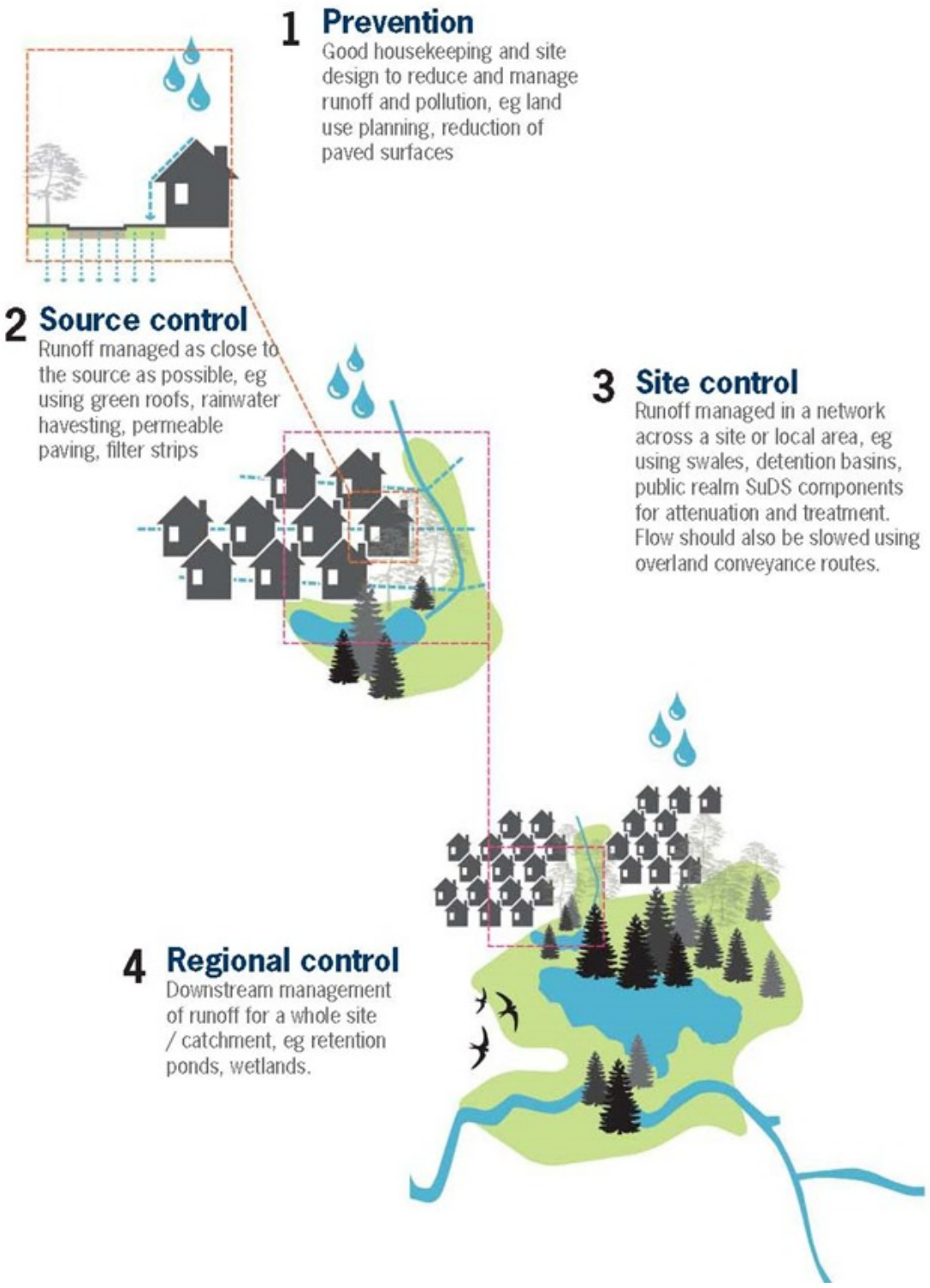
6.3.11 The SuDS management train is a central design concept for SuDS. It describes the use of a, "sequence of components that collectively provide the necessary processes to control the frequency of runoff, the flow rates and the volumes of runoff, and to reduce the concentrations of contaminants to acceptable levels" (CIRIA 2015). The management train begins with land use decisions and prevention measures, followed by interventions at the property scale and street scale (source control), through to considerations for downstream run-off controls within the overall site boundary, and wider initiatives downstream that are designed to manage the overall catchment. Source control includes features such as permeable paving, rainwater harvesting, living walls, rain gardens, filter strips, green roofs and bio retention areas. These allow water to penetrate the feature thereby reducing the proportion of surface water runoff that is conveyed into the drainage system.

6.3.12 Once all measures to minimise surface water runoff at source have been designed into the layout, site control initiatives which collect and treat water for larger areas of the site should be considered. Site control initiatives may include soakaways, ponds and wetlands, which work to slow the conveyance of water off the site and provide secondary stages of treatment. Appropriately planted vegetation can also help to attenuate water flow and provide a stage of treatment.

6.3.13 Regional controls are larger in scale and may be implemented in large sites, or by third parties as part of catchment wide initiatives. Such initiatives may include retention ponds, wetlands and infiltration basins. Figure 6.7 portrays this management train.

6.3.14 Above ground conveyance systems such as swales and rills should be used wherever possible to convey water between SuDS components. It is however acknowledged that for those developments where space is a limiting factor (e.g. redevelopment), the use of below ground pipework may prove more efficient.

Figure 6.7 : SuDS Management Train



Source: The SuDS Manual, CIRIA, C697

Water reuse first

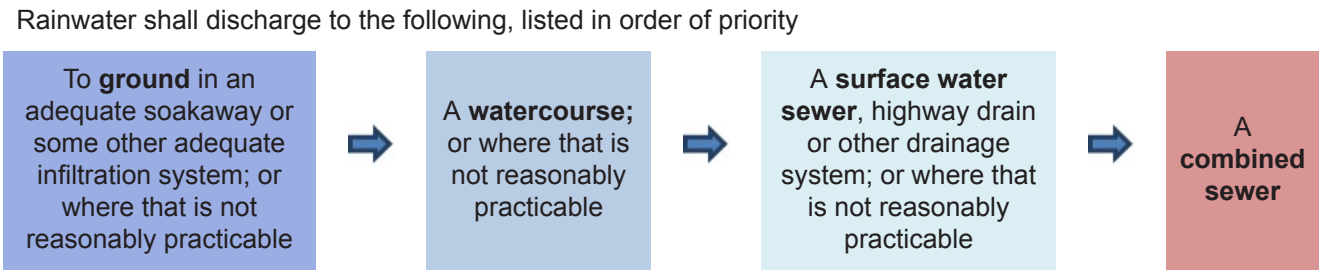
6.3.15 Cambridgeshire is one of the driest areas in England, therefore reusing water whenever possible is important to improving the county's water resilience, and reducing pressures on precious water supplies. Recycled rainwater and surface water runoff can be used for non-potable purposes, such as toilet flushing and irrigation. Water can be collected for reuse from both roofs and/ or paved surfaces and can be stored for reuse using a water butt or rainwater recycling system. Surface water runoff from streets or public areas can also be collected and treated using SuDS features, such as a rain garden, before storing it for surrounding buildings to reuse.

6.3.16 IDBs have a responsibility for overall water level management in their area, which can include the retention and reuse of water to facilitate irrigation during dry periods. Proposed development sites in IDB areas should be discussed with the relevant IDB as a development may provide the opportunity to improve water supply to the surrounding land. Existing and emerging Local Plans provide planning policies in relation to this matter.

Follow the drainage hierarchy

6.3.17 It is a Building Regulations and PPG requirement that the discharge hierarchy in Figure 6.8 is used when considering proposals.

Figure 6.8 : Surface water drainage hierarchy



Note: in all instances adequate stormwater storage will need to be provided in order to meet the relevant infiltration or discharge rates and volumes (see Section 6.4).

Use infiltration where suitable

6.3.18 The potential for infiltration measures on a site should be considered at the outset. Careful consideration of the acceptability of infiltration drainage should be given particularly in relation to potable water sources (e.g. drinking water) or land contamination issues.

6.3.19 The British Geological Survey can provide maps and reports to support decisions with regards to the suitability of the subsurface for the installation of infiltration type SuDS type systems. The suitability for infiltration across an area should be based on:

- Existing constraints prior to planning infiltration SuDS;
- Drainage capacity and rate of infiltration into the ground;
- Potential for ground instability when water is infiltrated;
- Impact on groundwater quality as a result of infiltration;
- Development on contaminated land or Source Protection Zones (SPZ) (vulnerable aquifers).

6.3.20 Infiltration should be assessed on-site using infiltration tests that follow the detailed SuDS design principles covered in BRE365/CIRIA 156 procedure. SPZ's should be taken into account when considering infiltration and guidance provided by the EA should be consulted to determine infiltration constraints and requirements in these areas. Where infiltration drainage is proposed on previously developed land, contamination risk

needs to be considered. This may not rule out the use of infiltrating SuDS but will require site investigations and information on remediation prospects which are outside the scope of this Supplementary Planning Document (SPD).

6.3.21 The maximum acceptable depth for an infiltration device is usually 2.0m below ground level, with a minimum of 1.2m clearance between the base of the feature and peak seasonal groundwater levels. In some areas of the Fens the maximum depth of infiltration (of 2.0m below ground level) is often not viable and in such areas 1.0m below ground level would be the best achievable depth. In these areas however, the possibility of incorporating shallow infiltration features such as trenches should be investigated. Deeper ('deep bore') soakaways pose a serious pollution risk and are not acceptable, and it is expected they will become contrary to the European Union (EU) WFD.

Keep surface water on the surface

6.3.22 It is acknowledged that infiltration will not be possible on all sites. Low permeability soils are often cited as a reason for not including SuDS; however this is not acceptable in Cambridgeshire as solutions do exist. Although soakaways and other infiltration methods may not be suitable, many other methods such as swales, ponds and wetlands should be prioritised, selected and designed accordingly. It is also possible to allow some water to soak into the ground (for example out of the bottom of an unlined swale), even if drainage design calculations do not allow for it.

6.3.23 Design and layout should seek to manage and convey surface water above-ground, avoiding the use of underground piping as far as possible. This is particularly pertinent in Cambridgeshire due to the flat landscape and areas of high groundwater. Managing surface water runoff at the surface has the benefit of:

- Avoiding concentration and acceleration of surface water into waterways which causes downstream erosion;
- Integrating removal of pollutants by filtering water during conveyance;
- Reducing construction and maintenance requirements and costs;
- Creating habitats;
- Contributing to public amenity by better quality urban and landscape design;
- Increasing residents' awareness of water management; and
- Detecting blockages and obstructions more easily.

Place-making through SuDS design

6.3.24 When using conventional surface water management systems, water is hidden in pipes underground. By bringing water management to the surface using SuDS, there is an opportunity to enliven public spaces and streetscapes. The presence of water features within the urban environment can promote a strong sense of place, bring an urban space to life and create unique spaces that can be enjoyed by all. SuDS features such as ponds, wetlands, pools, fountains and planted rills which can be purely aesthetic or interactive in nature, can be integrated into the public realm and open spaces to enrich the area with green infrastructure. Note that interactive SuDS should include an appropriate level of natural pre-treatment upstream before coming into human contact, such as in the case of water play areas. Designing for water quality is discussed further in Section 6.5.

Landscape-led approach

6.3.25 The selection of SuDS types and the creation of the SuDS network should both respond to and contribute to the surrounding built and natural landscape. A landscape-led approach uses SuDS as a mechanism to create strong green infrastructure networks and is important to increase connectivity to the wider ecosystem and landscape. Effective integration will also require carefully researched and selected plants, which work to improve the local green infrastructure and enhance biodiversity. Also selection of hardscape materials used in SuDS construction, such as concrete, brickwork, wood, aggregate and paving, should

consider the surrounding landscape and urban character and be developed alongside the overall urban design vision. Using a landscape led approach will improve the amenity value of SuDS for local residents, and provide water management and design benefits.

Recognise and conserve the significance of Cambridgeshire's historic and archaeological environment

6.3.26 Cambridgeshire has a strong history and tradition of water management, dating back two thousand years. SuDS design should recognise the importance and significance of what has been done before and where possible duplicate or enhance it. Materials used should be sympathetic to the built environment and reflect local design guides or other planning policy documents.

6.3.27 Where proposals will impact on the significance of designated or non-designated heritage assets, appropriate mitigation should take place as part of the SuDS proposal. Buried archaeological deposits can be damaged by changes to the water management regime in an area such as a change in groundwater levels or soil moisture content. The design of SuDS should take the presence of any buried archaeology into consideration and developers should undertake early discussions with Historic England and Cambridgeshire County Council's Historic Environment Team.

Minimise embodied carbon in SuDS

6.3.28 One of the advantages of SuDS is their ability to improve the natural environment. It is important that environment improvements from SuDS are not reduced by incorporating high carbon solutions. The excessive use of concrete and other aggregates with high levels of embodied energy is discouraged. Eliminating energy consuming water pumps whenever possible is also encouraged. Vegetated SuDS components can have a positive impact by storing carbon as they grow, through a process known as carbon sequestration.

Minimise waste in SuDS

6.3.29 When undertaking the maintenance of SuDS, waste will be generated. This will be predominantly grass and other vegetation, and may be managed on site in wildlife piles. There is still a requirement to comply with all relevant waste management legislation and ensure waste is taken to an appropriately licensed site. This is even more pertinent when waste is disposed off-site. Management of SuDS on industrial sites will need to ensure hazardous waste is disposed of separately.

Design for wildlife and biodiversity

6.3.30 SuDS can provide the ideal opportunity to bring urban wetlands and other wildlife-friendly green spaces into towns and cities. They can be linked with existing habitats to create blue and green corridors whilst providing an amenity and education resource for the community.

6.3.31 Where possible, existing habitats should be retained and incorporated into the landscape design. SuDS features are likely to have greater species diversity if existing habitats are within dispersal distance for plants, invertebrates and amphibians. It should however be noted that existing wetlands should not be incorporated into SuDS unless there is a guaranteed supply of clean water.

6.3.32 An aim should be to create new habitats based on the ecological context and conditions of the site. Habitats and species objectives that contribute to local, regional and national biodiversity targets should be prioritised. Further information on local objectives can be found in local (BAPs). Guidance on maximising the biodiversity potential of SuDS can be found in the Royal Society for the Protection of Birds (RSPB) publication, Maximising the Potential for People and Wildlife.

Design for easy maintenance and access

6.3.33 When designing SuDS it is crucial to consider throughout the process how features will be maintained and accessed, who is ultimately responsible for the lifetime of the development, and the likely costs involved. Embedding foresight into every stage of the design process will produce a more effective, better maintained SuDS scheme upon completion. Design should also consider Construction Design and Management (CDM) Regulations from the outset to ensure that access is provided for maintenance and that health and safety measures are adhered to. Those responsible for SuDS across a development should ideally be provided with an operation and maintenance manual by the designer and this could be part of the documentation provided under CDM. Aspects that should be included within the operation and maintenance manual are shown in Table 6.2:

Table 6.2 : What to Include in the Operation and Maintenance Manual

- Location of all SuDS components on site
- Brief summary of the design intent, how the SuDS components work, their purpose and potential performance risks
- Depth of silt that will trigger maintenance
- Visual indicators that will trigger maintenance
- Depth of oil in separators etc. that will trigger maintenance
- Maintenance requirements (i.e. maintenance plan) and a maintenance record proforma
- Explanation of the objectives of the maintenance proposed and potential implications of not meeting those objectives
- Identification of areas where certain activities are prohibited (e.g. stockpiling materials on pervious surfaces)
- An action plan for dealing with accidental spillages of pollutants
- Advice on what to do if alterations are to be made to a development or if service companies need to undertake excavations or similar works that could affects SuDS
- Details of whom to contact in the event that pollution is seen in the system or if it is not working properly

Source: CIRIA 753 (Chapter 32)

6.3.34 Consideration should be given to access to, and maintenance of, existing infrastructure which includes existing watercourses. Many IDBs, Local Authorities and the EA have requirements and/or byelaws requiring maintenance strips adjacent to a watercourse and should be contacted for exact requirements in their area.

Design SuDS for brownfield sites

6.3.35 Previously developed land (brownfield sites) should not be seen as a barrier to using SuDS. When developing on brownfield sites, existing drainage infrastructure should be documented and mapped to determine what can be reused as part of the SuDS scheme.

6.3.36 The use of shallow surface features can often be a benefit in brownfield sites as they limit excavations into contaminated soils. The impact of the proposed SuDS features on any contamination and vice versa needs to be carefully assessed by an experienced professional. The presence of contamination in the ground may limit the use of certain features (e.g. soakaways) or require liners below ponds, basins and permeable pavements; however, it will never prevent the use of all SuDS features and a suitable system can be designed. The separation of surface water drainage and foul drainage should be a priority in these areas.

Consider flood extents in SuDS design

6.3.37 The natural floodplain must be protected and considered in the design of SuDS. Where SuDS are proposed in a fluvial or tidal floodplain (Flood Zones 3a or 3b) the features may fill during a flood event and would therefore not have capacity to hold the rainfall runoff from the site as originally intended. Large areas of Cambridgeshire, where land is low lying, are in the floodplain, and a pragmatic approach to SuDS design needs to be taken where flood risk is carefully considered. However, the presence of a floodplain should not explicitly exclude the integration of SuDS features for day-to-day water management provided the SuDS do not contribute towards stormwater storage requirements. Above ground SuDS should not be included in areas where water regularly flows or is stored.

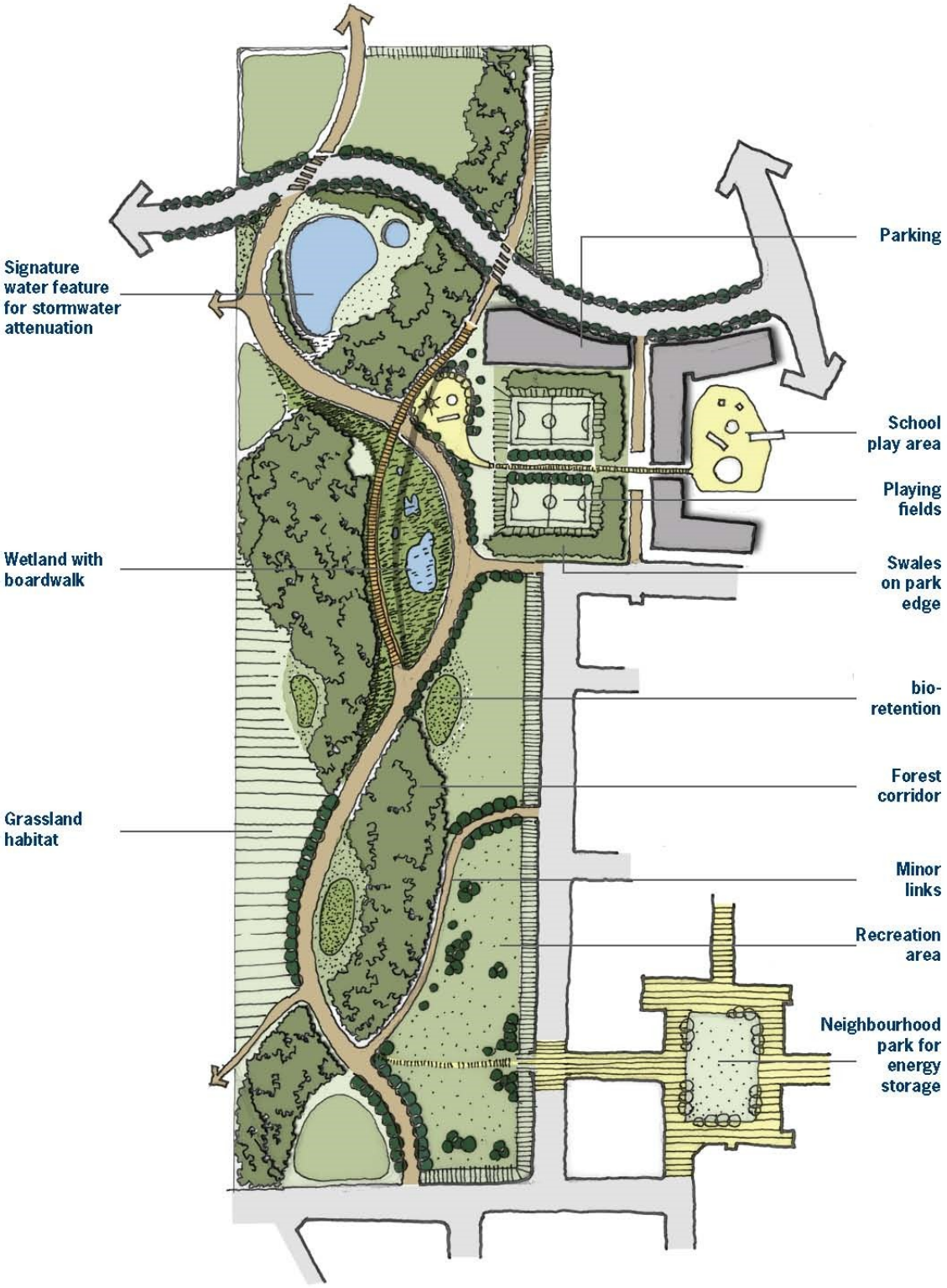
Design open spaces to incorporate SuDS

6.3.38 Open spaces are an asset to the community and to the environment and form an important component of a wider green infrastructure network. A network of woodland, recreational and open spaces, whether green or paved will be essential for well-designed developments . Open spaces can provide space for SuDS features to provide attenuation and treatment of surface water runoff. Good design will seek ways to integrate SuDS with the rest of the open space and to make SuDS features multifunctional. In these areas there is a need to concentrate on design and amenity value, recreational use, and fit with surrounding landscape (see Figure 6.9). Examples of multi-functional uses in open spaces include; temporary storage areas doubling as playing fields or recreation areas, hardscape attenuation doubling as water features and public art, bioretention areas doubling as landscaped garden areas, wetlands and ponds doubling as amenity and habitat areas, and bioretention planters linking with open space divisions or seating areas. Within open spaces, SuDS design will also need to consider:

- The interaction with the public – safety, education, and controlled access via boardwalks or similar structures;
- Areas of the ground that are likely to be seasonally wet should not be used for formal or informal recreation and play space such as sports pitches;
- An appropriate balance between visual amenity and water treatment needs to be achieved – while amenity value is of increased importance, it should not impinge on SuDS treatment and water management;
- Situating SuDS away from floodplains that might impact on SuDS treatment and floodplain storage and conveyance;
- Ecological needs – existing vegetation of biodiversity value should be retained whenever possible, and land stability taken into account.
- Opportunities to reuse recycled surface water for irrigation or other purposes.
- LPA's specific policy regarding water ponding in or near play areas. It is the responsibility of the developer to be aware of relevant local policy.

6.3.39 Where the local authority will adopt SuDS in public open spaces, they must still be able to function and be accessible as useable open space for the majority of the time for them to be included within the open space calculations.

Figure 6.9 : Intergration of SuDS features into open space design



Source: Woods Ballard, B., et al (2015) The SuDS Manual, CIRIA, C753

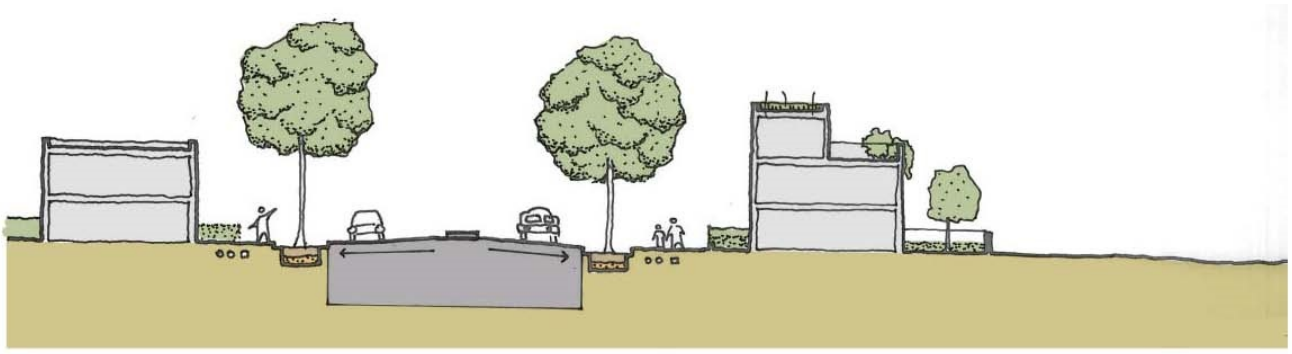
Design streets to incorporate SuDS

6.3.40 Within a catchment, streets and roads are a significant source of surface water runoff and pollutants. Streets are often used as a conveyance of surface water drainage from adjoining sites via underground pipes, and in a SuDS network they are likely to also be key conveyance routes for example through the use of roadside swales. Therefore there is a prime opportunity in streetscapes to integrate SuDS features that capture, treat and attenuate surface runoff. Improving upon traditional drainage, streetscapes can include bioretention technology (rain gardens) with appropriate conveyance such as swales or under-drained SuDS features to minimise the need for conventional piping. A number of standard streetscape features can include SuDS and become multifunctional, including verges, tree pits, traffic calming islands, and parking dividers. To implement SuDS effectively either along or within streets, there is a need to consider:

- Easy and safe access for all highway users, irrespective of mode of travel;
- Easy access to utilities for maintenance workers;
- Improvement to the urban design of streetscapes and contribution to sense of place; and
- Robust design to reduce maintenance and replacement requirements

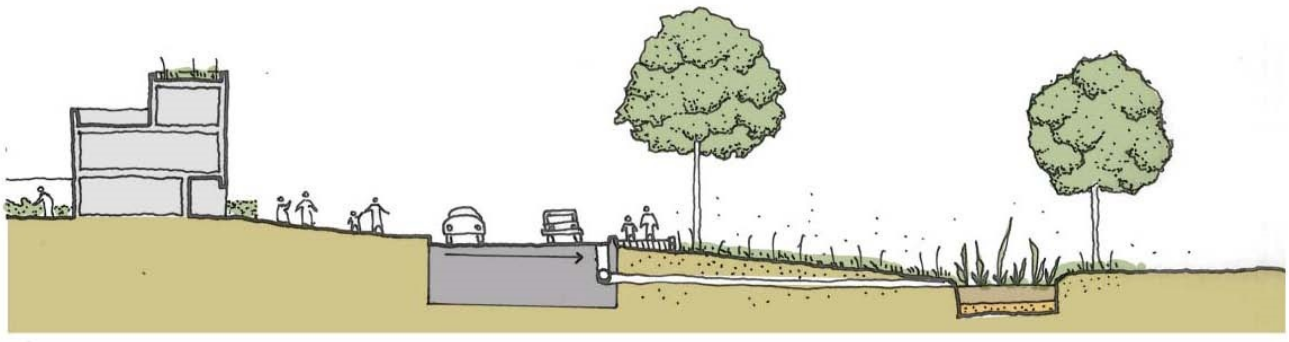
6.3.41 Figure 6.10 to Figure 6.12 demonstrate how SuDS can be incorporated into street design.

Figure 6.10 : Street design to drain SuDS features to either side



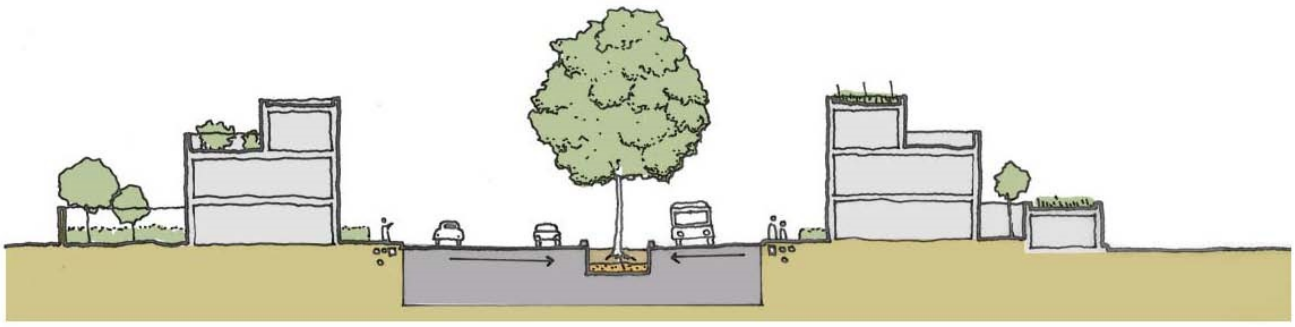
Source: Woods Ballard, B., et al (2015) The SuDS Manual, CIRIA, C753

Figure 6.11 : Street design to drain to adjoining lower ground SuDS feature



Source: Woods Ballard, B., et al (2015) The SuDS Manual, CIRIA, C753

Figure 6.12 : Street design to drain to central SuDS feature



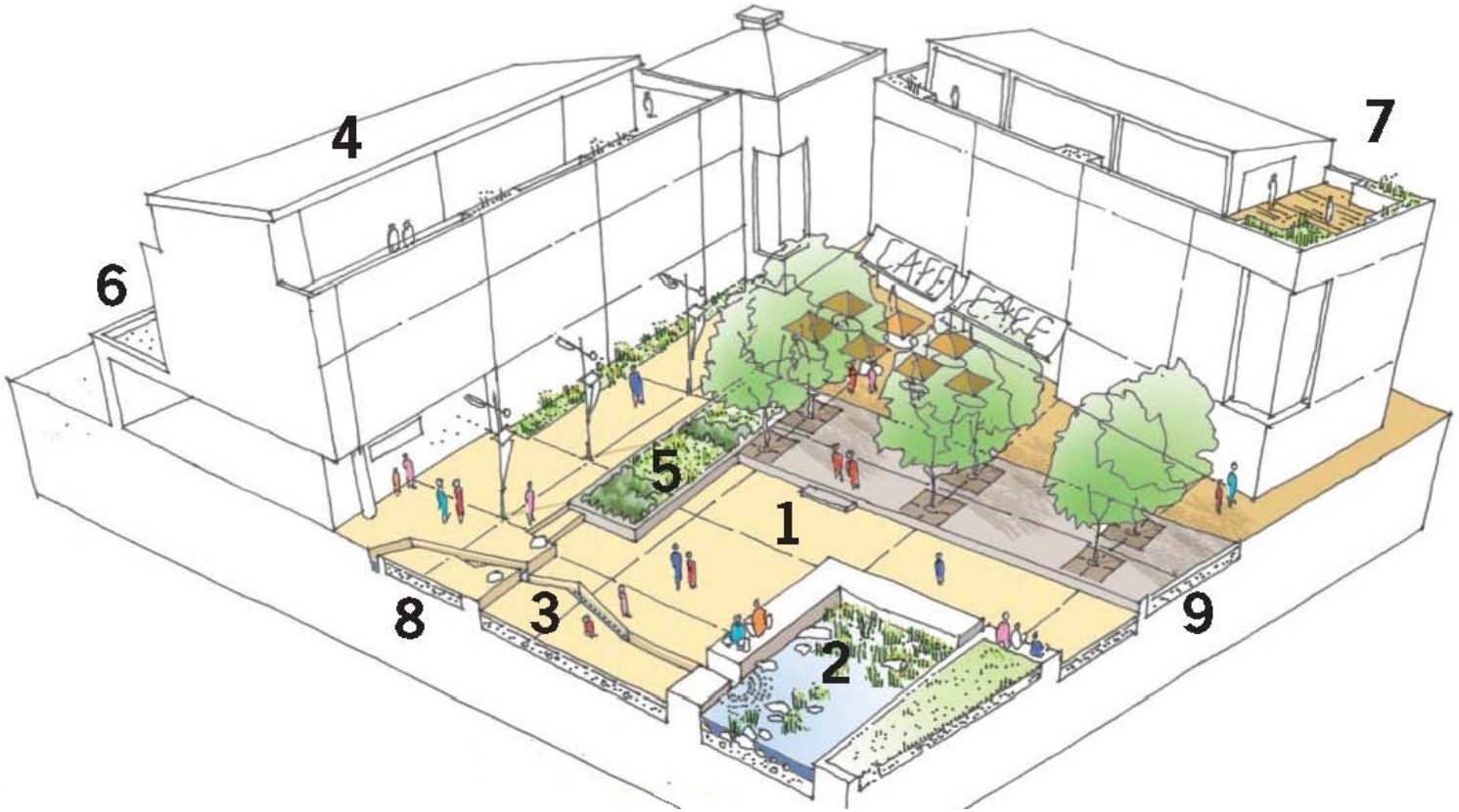
Source: Woods Ballard, B., et al (2015) The SuDS Manual, CIRIA, C753

Design SuDS to match the density of development

6.3.42 Limited space is often cited as a reason for not including SuDS, which is not acceptable in Cambridgeshire as solutions do exist. Ideally, initial layout should consider how source control and localised SuDS features can be sized and located to provide adequate attenuation and treatment of runoff from high density areas. It is still possible to use SuDS in high density developments, but design needs to be suitable. Source control measures like green roofs and rainwater harvesting are strategies to reduce runoff. Additionally, building downpipes can be altered or disconnected to feed into gardens, soakaways or permeable paving. In high density courtyards and streets there is also potential to incorporate bioretention features and planted rills. Figure 6.13 to Figure 6.15 demonstrate how SuDS can be incorporated into developments of varying densities.

Figure 6.13 : SuDS options in high density developments.

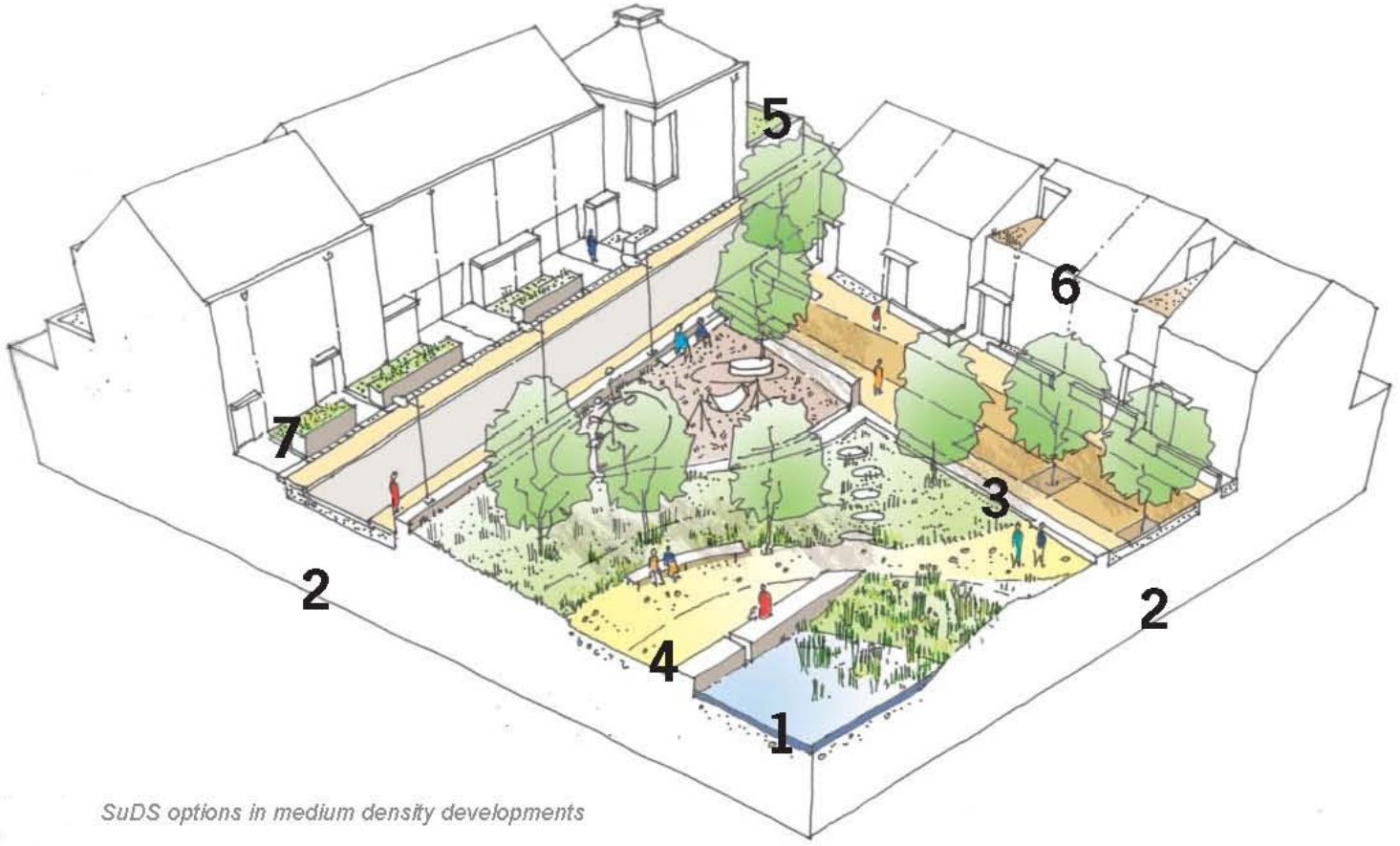
1 Urban square with permeable paving
2 Retention pond with integrated seating
3 Rill within pedestrianised shopping street
4 'Brown' roofs within town centre
5 Rain garden/planted bio-retention element
6 Green roofs
7 Roof gardens
8 Permeable paving within street
9 'Bio-retention tree pits within square



Source: Woods Ballard, B., et al (2015) The SuDS Manual, CIRIA, C753

Figure 6.14 : SuDS options in medium density developments

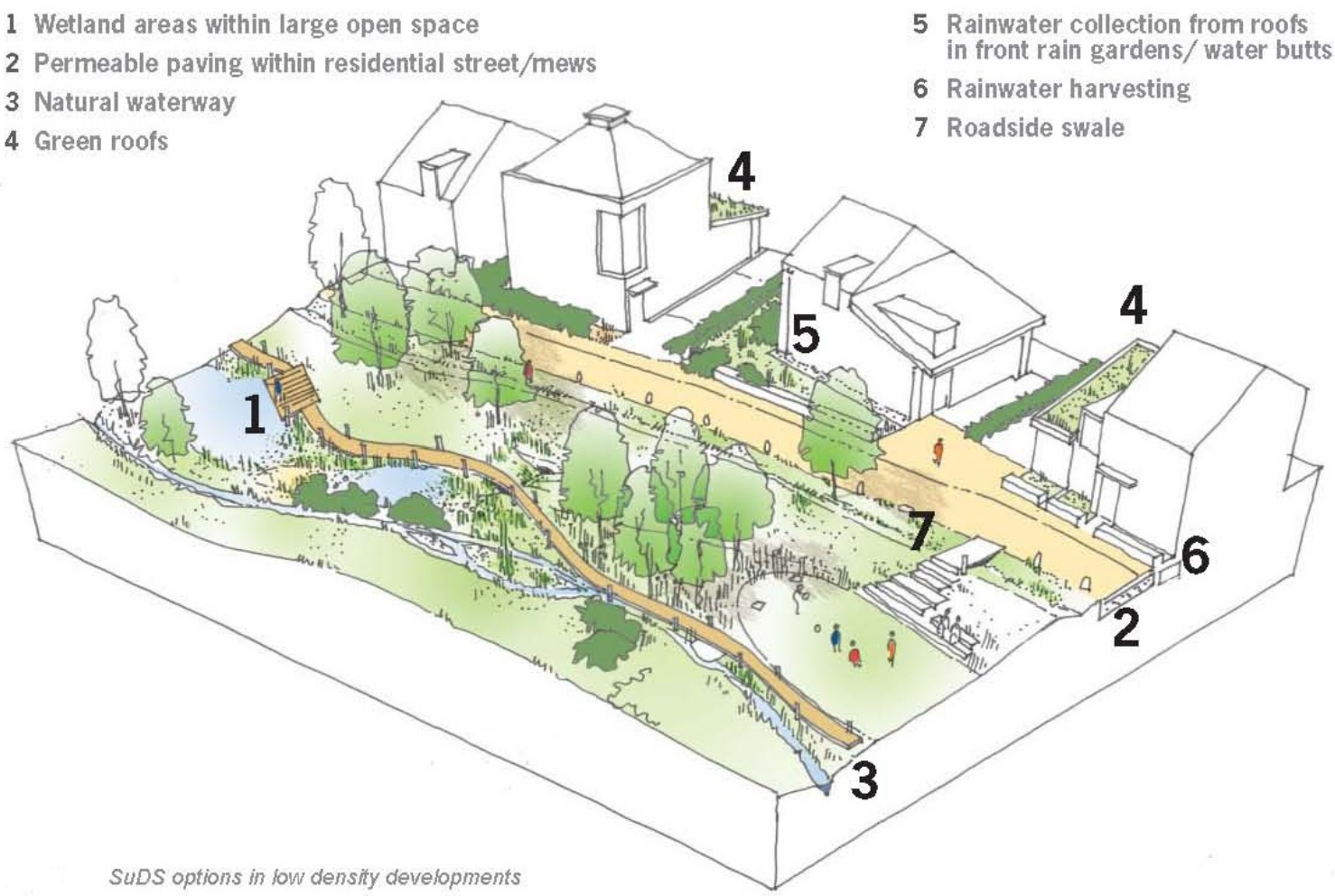
1 Filter strip and retention pond within residential square
2 Permeable paving within residential street/mews
3 Roadside bio-retention tree pits
4 Gravel/permeable surfaces within residential square
5 Green roofs
6 Roof gardens
7 Rainwater collection from roofs in front rain gardens/water butts



SuDS options in medium density developments

Source: Woods Ballard, B., et al (2015) The SuDS Manual, CIRIA, C753

Figure 6.15 : SuDS options in low density developments

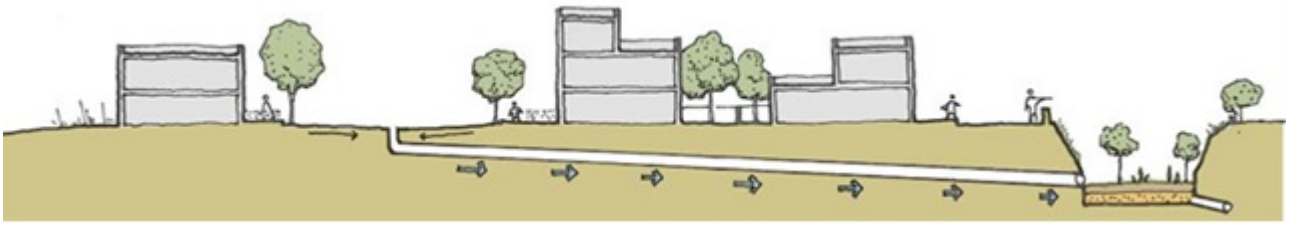


Source: Woods Ballard, B., et al (2015) The SuDS Manual, CIRIA, C753

Design SuDS for flat sites

6.3.43 Drainage is particularly important on flat sites that do not have the opportunity to take advantage of gravity. Hydraulically efficient kerbs should be designed to channel water directly onto above ground SuDS, before draining to underground storage, or a piped network. Alternatively, roadside swales located within the road verge with flush kerbs can enable surface water to discharge directly into the swale, where it is pre-treated before discharging to a SuDS feature downstream, such as a retention pond, rain garden, or wetland. By keeping water on the surface as much as possible, deep downstream management features can be avoided. Deep features are undesirable due to increased excavation, the potential need for unnecessary pumping and the requirement for mitigation measures. Figure 6.16 demonstrates the negative impact a piped system can have on flat sites.

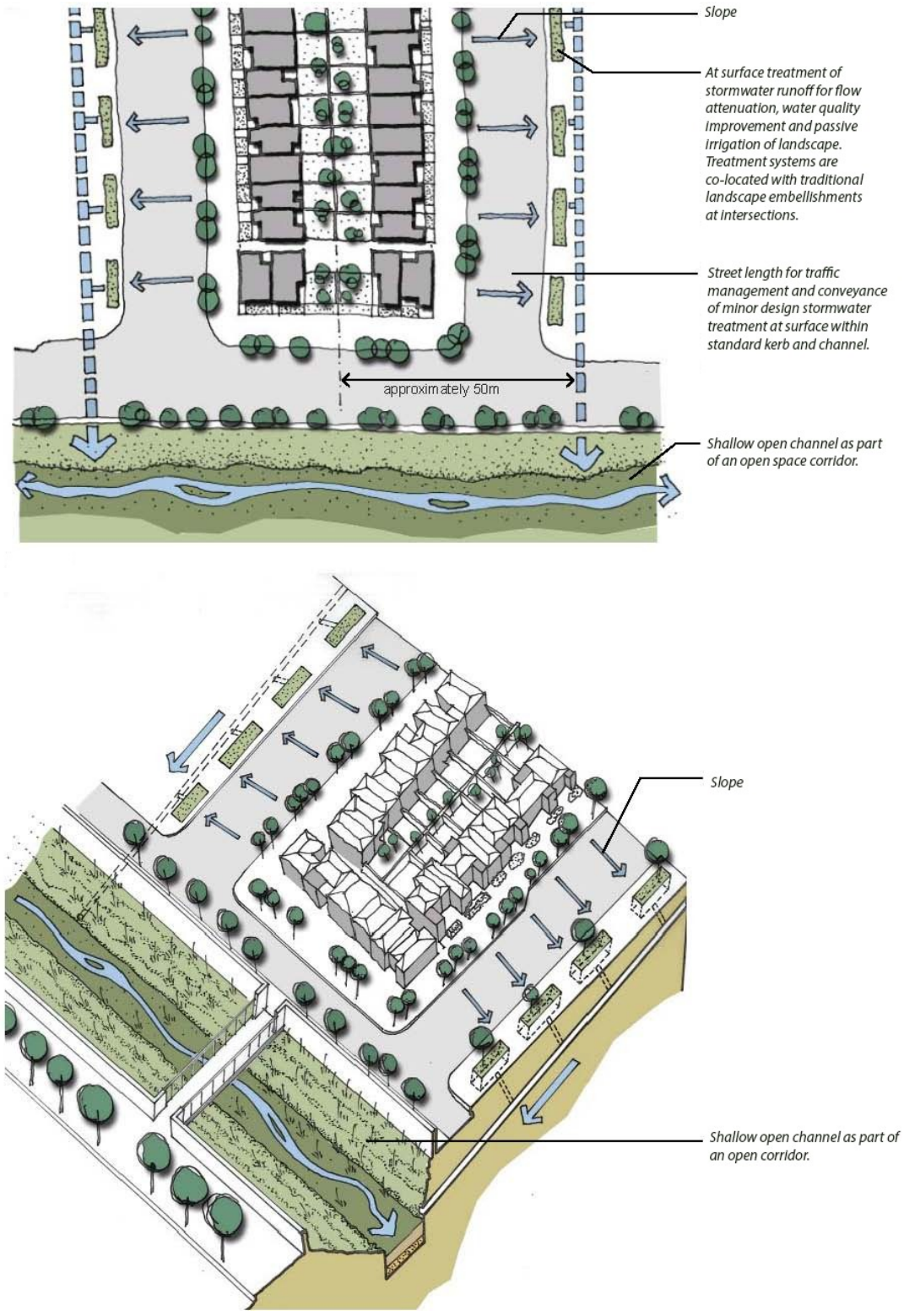
Figure 6.16 : Negative impact of piped drainage on a flat site



Source: Woods Ballard, B., et al (2015) The SuDS Manual, CIRIA, C753

6.3.44 Figure 6.17 shows how SuDS could possibly be incorporated into a flat, urban site.

Figure 6.17 : Possible urban layout for a flat site



Source: Woods Ballard, B., et al (2015) The SuDS Manual, CIRIA, C753

Design industrial and agricultural sites to incorporate SuDS

6.3.45 Industrial and agricultural sites often have larger volumes of water discharge with higher levels of pollutants, and as such they require special attention. The best strategy is to separate water discharging from work areas, car parks and roofs. Water runoff from high-risk work areas should be separated into interceptor tanks and treated as industrial waste. This separation is vital to ensuring the surface water from non-work areas of the site that do not have the same contaminants, can be treated similarly to surface water runoff from residential and commercial properties. Additional treatment stages are required where runoff is being drained from higher contamination risk area, such as car parks. Each site should be designed based on the risk posed. Figure 6.18 demonstrates how SuDS can be incorporated in an industrial setting.

Figure 6.18 : Incorporating SuDS on industrial sites

Source: Woods Ballard, B., et al (2015) The SuDS Manual, CIRIA, C753

6.4 Design standards and designing for exceedance

6.4.1 In a new development there should be no flooding of any properties as a result of that development for a 1 in 100 annual probability (critical) rainfall event plus an appropriate allowance for climate change (refer to Chapter 5 for details of climate change allowances). In line with Sewers for Adoption, there should also be no water outside of the designed system for a 1 in 30 annual probability (critical) rainfall event.

6.4.2 Consideration should also be given as to how the system performs for events that exceed the design capacity of the system or if a part of the system blocks or fails. This is generally referred to as designing for exceedance. Guidance on how to apply this can be found in Designing for Exceedance in Urban Drainage: Good Practice (C635).

6.5 Designing for water quality

6.5.1 SuDS have a considerable advantage over traditional drainage as a well-designed system will provide a level of treatment to surface water runoff before it is discharged into the receiving water body. It does this through a number of processes including filtration, settlement, and uptake by plants.

6.5.2 To protect the water quality of receiving waters, runoff from a site should be of an acceptable water quality to help ensure current and/or future water quality objectives are not compromised. As there can be a wide range and level of contaminants contained within surface water runoff, water quality needs to be managed using a risk-based approach, facilitated by the SuDS management train. The SuDS management train refers to a variety of SuDS components in a series that provide treatment processes to deliver a gradual improvement in water quality as water moves through the system.

6.5.3 The size and number of treatment stages required is based on the level of pollution entering into the system. For example, industrial sites will contain a higher level of pollutants within surface water runoff than from a small residential road. Please refer to Chapter 4 of the Ciria SuDS Manual (C753) for further detail on designing SuDS for water quality.

6.6 Designing a safe environment

6.6.1 All SuDS schemes should be designed as a safe environment that can be accessed and enjoyed by residents and visitors. The use of fencing and barriers should not be the approach to making SuDS features safe, particularly in residential developments. It is however recognised that there may be cases in less sensitive environments (such as industrial areas) where steeper earthworks and safety measures are appropriate. The SuDS features themselves should be designed to be safe through measures such as:

- Following the topography of the site, this will minimise the depth of the features throughout the development.
- Ensuring gently sloping sides and that they are planted with vegetation to act as a barrier to unintended entry into the water.
- Ensure open areas of water are obvious to residents and visitors and any vertical drops are easily identified. The use of safety rings are generally not appropriate for SuDS as they are designed to be dropped vertically and not thrown any distance as they are heavy and awkward to handle. Their use should be limited to areas where they will be effective.
- Use of appropriate signage in the right locations. These should not be used as a replacement for appropriate design.

6.6.2 Further information can be found in the CIRIA publication, The SuDS Manual (C753) and the RoSPA publication Safety at Inland Water Sites.

6.7 Developing a surface water drainage strategy

Masterplanning

6.7.1 For larger developments a masterplan will be necessary. It is at this stage the SuDS layout (taking into account flow routes, topography, geology and green space) and proposed maintenance of the system should be determined whilst, ensuring a safe design and mitigation of flood risk (see Figure 6.1). Seeking advice at the earliest opportunity from the relevant WMAs will help avoid any costly issues or redesigns at a later stage. Effective master planning should ensure a robust, viable and cost-effective scheme from the outset, where objectives of the development are informed by the SuDS scheme and vice versa.

Pre-application

6.7.2 The majority of planning applications do not require a masterplan but all applicants should engage in pre-application discussions with the relevant WMAs before developing a surface water drainage strategy. This is the point at which key documents and information should be reviewed including topographic surveys, Strategic Flood Risk Assessment (SFRAs), geological maps, relevant site surveys and Flood Risk Assessments (FRAs) that have already been undertaken. Again Figure 6.1 can be used as a stage guide for how to integrate SuDS across sites. See Appendix E for details of the matters which should be considered at this stage.

Outline planning application

6.7.3 When an outline planning application is required the applicant should include an outline drainage strategy with the planning application. It should include enough design information that demonstrates the conceptual surface water drainage design across the site. The assessment submitted should outline the existing surface water run-off rates from the site and an indication of post development run-off rates with associated storm water storage requirements. SuDS should have been appropriately considered taking into account site specific drainage requirements and constraints and incorporated effectively into the overall masterplan. Appendix F includes a drainage proforma to be followed to ensure the correct information is included within the drainage strategy.

Full planning application or reserved matters application

6.7.4 Many developments move straight to a full planning application following pre-application discussions with the relevant WMAs. At this stage applicants will also be expected to submit a detailed surface water drainage strategy with the planning application. Whilst most topics will have been covered to some degree in the outline drainage strategy (if applicable) the applicant will be expected to provide more detail at this stage. The strategy should demonstrate that opportunities to integrate SuDS have been maximised and where obstacles to their use do persist this should be fully justified within the report. Where proposing to discharge into a third party asset (such as a watercourse or public sewer), appropriate permissions and required consents should have been discussed with the asset owner.

6.7.5 The key information a surface water drainage strategy must contain includes:

- How the proposed surface water scheme has been determined following the drainage hierarchy;
- Pre-development runoff rates;
- Post development runoff rates with associated storm water storage calculations
- Discharge location(s);
- Drainage calculations to support the design of the system;
- Drawings of the proposed surface water drainage scheme including sub catchment breakdown where applicable;

- Maintenance and management plan of surface water drainage system (for the lifetime of the development) including details of future adoption;
- Completed drainage proforma – the applicant must ensure that the surface water strategy contains the appropriate level of information in relation to the points covered in the proforma.

6.7.6 Note that the size and complexity of the site will determine how much information is included within the surface water drainage strategy however using the pre-application design checklist and drainage proforma in Appendix F will ensure the right matters are covered with the appropriate level of detail.

6.8 Approval of SuDS

6.8.1 SuDS are approved as part of the planning application for a development. It is the LPAs responsibility to ensure that the design submitted as part of either an outline or full planning application is robust and contains adequate detail to ensure that the SuDS are appropriate for the development and will be adequately maintained throughout their lifetime. The LPA may also seek expert advice from the LLFA as part of this process. For major developments national guidance for SuDS can be found in the PPG, additionally the Non-Statutory Technical Standards for Sustainable Drainage Systems provides the high level principles all SuDS designs must follow.

6.8.2 A surface water drainage strategy is required to be submitted with a planning application which should contain details of the SuDS. Its scope should be commensurate with the size of development and can range from a paragraph describing the proposed drainage measures with a discharge location for residential extension, to extensive hydrological modelling accompanied by a full report with drawings for a larger site. Further details on what should be considered or included can be found in Appendix E; this guidance is likely to be updated over time to focus more specifically on different scales of development.

6.9 Adoption and maintenance of SuDS

6.9.1 The LPA may seek advice for developers looking to source an appropriate body for SuDS adoption and maintenance. It is recommended that a statutory organisation takes on the role of maintaining the SuDS as this will guarantee maintenance of the drainage system in perpetuity; however where this is not possible, alternative bodies may also be able to maintain SuDS, provided that a suitable maintenance plan has been submitted to and agreed with the LPA. Statutory organisations in Cambridgeshire may include organisations such as the local authorities, Anglian Water and IDBs. For SuDS serving the highway these should be discussed with the Highways Authority at Cambridgeshire County Council (CCC) to ensure suitability for adoption.

6.9.2 Open space provision within development sites is a normal planning requirement and offers suitable landscaped areas for the inclusion of a wide range of SuDS features (e.g. ponds, basins and swales). These features can enhance the nature conservation and amenity value of the site, although a primary consideration should be the effectiveness and maintenance of the SuDS.

6.9.3 Where local authorities are adopting the open space provision, this could include adoption of the SuDS features within the open space (seek clarification from individual local authorities). In adopting these features, a range of issues will need to be addressed:

- The primary purpose of the SuDS features relate to drainage. If the open space is to be used for other purposes, such as nature conservation or as a play area, this must not conflict with the effective working and maintenance of the SuDS.
- Safety issues will come into play if a body of water is involved.
- There is a need to ensure that a long-term, effective maintenance regime is in place along with a long term habitat management plan where appropriate

6.9.4 Some local authorities may have specific design and adoption standards in place, for example in Cambridge City, and these should be referred to and early consultation undertaken with the relevant LPA.

6.9.5 If the applicant is minded to choose Anglian Water as the appropriate body for SuDS adoption they should ensure the proposed design meets Anglian Water's adoption criteria, referencing relevant guidance and advice where appropriate. Further guidance on Anglian Water SuDS adoption (including their Sustainable Drainage Systems Adoption Manual) is available on the Anglian Water website.

6.9.6 In some situations, IDBs may adopt above ground SuDS features. If this option is pursued, the developer should engage in early stage discussions with the relevant IDB to ensure it meets their criteria. Further guidance is available from the individual IDBs.

6.9.7 Section 106 of the Town and Country Planning Act 1990 provides a suitable mechanism by which properly designed SuDS features can be transferred into the management and maintenance responsibilities of a local authority or other statutory organisation. The local authority should secure a financial mechanism through commuted sums, identified in the adoption agreement, to facilitate maintenance and management requirements. This would allow adoption of the areas within an acceptable timeframe without placing additional burdens on the local authority's resources. Clarification will also need to be sought from the relevant LPA on whether SuDS are delivered through the Community Infrastructure Levy or Section 106.

6.9.8 In certain circumstances where a management company is required to maintain the SuDS, a legal agreement tied to the title of the property will need to be agreed with the LPA (usually via a Section 106 agreement). If this is the case then discussions will need to take place during the pre-application stage of the development so that assurances can be made that this is the correct option for the development. Evidence should be provided by the applicant on the suitability and experience of the management company during this process.

7 Water Environment

The aim of this chapter is to consider the water environment in response to the requirements (e.g. ecological matters) set out within the European Water Framework Directive, and it looks at what supporting plans are in place to support those objectives from a planning perspective. For the majority of planning applications, compliance with the Directive will be dealt with via the Environment Impact Assessment requirements, but for some applications that have a direct impact upon a waterbody, a more detailed assessment may be required.

7.1 Introduction

7.1.1 The European Water Framework Directive (WFD) is an established legal framework for managing the water environment. Under the WFD the UK must aim to achieve 'good ecological status' by 2015 in all surface freshwater bodies, including rivers, lakes, groundwater, transitional and coastal waters regardless of size and characteristics. Other objectives of the WFD include preventative deterioration of the status of all bodies of surface water, including groundwater.

7.1.2 Development proposals may affect the water environment in various ways. Impacts leading either to deterioration in the status of a water body or to the water body being unable to achieve its WFD objectives can only be permitted in wholly exceptional circumstances. New development must be assessed to identify if it will cause deterioration, or lead to failures to achieve ecological objectives. New development also offers the opportunity to enhance the quality of the water environment.

7.2 River basin management plans

7.2.1 River Basin Management Plans produced by the EA, in consultation with the LPA, detail the pressures facing the water environment and what actions need to be taken in order for the WFD to be met in each area. The Anglian District River Basin Management Plan (ARBMP - December 2009) covers Cambridgeshire; an updated 2015 Plan is currently under consultation.

7.2.2 The ecological benefits of improved water quality in Cambridgeshire are significant. High water quality attracts species and encourages habitat creation; improving the biodiversity of the surrounding area. Species such as fish, newts, kingfishers and water voles are dependent on high water quality. The following areas in Cambridgeshire are considered to have habitat importance and maintaining high water quality is required.

- Ouse Washes Ramsar, SAC and SPA
- Fenland SAC
- Portholme SAC
- Devils Dyke SAC
- Breckland SAC and SPA
- Fenland SAC (Woodwalton Fen, Chippenham Fen, Wicken Fen)
- The River Cam - designated wildlife site
- Stourbridge Common Local Nature Reserve
- Sheep's Green and Coe Fen Local Nature Reserve

7.2.3 If sensitively managed, the river and its banks provide opportunities for declining species to recover and disperse.

7.3 Water Framework Directive and the planning process

7.3.1 Where developments require an Environmental Impact Assessment (EIA), applicants should include the impact resulting from development on the water environment in the EIA assessment using information from the ARBMP or directly from the EA. However, there will be instances where an EIA is not required. A screening opinion should be sought from the relevant LPA to determine whether an EIA is required for the particular development.

7.3.2 Where developments do not require an EIA but have the potential to impact on water bodies then applicants should consult the EA as a separate assessment might be required.

7.3.3 There may be proposals that do not need EIA but have potential WFD-related impacts for example marinas, development in close proximity to a river bank, channel diversions, new culverts on main rivers, mineral extraction close to watercourses or intensive agriculture. In most cases the EA can confirm where the WFD assessment might be most appropriate to be undertaken.

7.3.4 WFD Assessments are sometimes required by the EA for developments where permissions are required for works near/on main rivers under the Water Resources Act 1991.

7.3.5 Sustainable Drainage Systems (SuDS) should be utilised in as they support good quality water environments by mimicking the way nature deals with rain water, rather than piping surface water run-off from a development directly to a watercourse, evening out peaks and troughs in the amount of run off and reducing pollutants reaching watercourses.

7.3.6 SuDS can provide water quality improvements by reducing sediment and contaminants from runoff either through settlement or biological breakdown of pollutants. The full potential for the use of SuDS should be reviewed in the initial stages of planning the development (Refer back to Chapter 6 for further guidance on using SuDS).

7.3.7 Another source of information leading on from the WFD are Water Cycle Studies (WCS). The WCS assesses the capacities of water bodies and water related infrastructure to accommodate future development and growth throughout Cambridgeshire, for each of the city and district councils, and is intended to support the evidence base for their relevant local plans.

7.4 Water resources and waste water

7.4.1 If the water supply or wastewater discharge needs of any future development are likely to cause deterioration to the WFD status, the LPA and applicant will need to take this into consideration and determine and manage the impacts accordingly.

7.4.2 The supply of drinking water to Cambridgeshire involves abstraction from water resource zones across the County and the wider area. The resilience of the supply systems have the potential to be affected by the impact of climate change and severe weather related events. Both Cambridge Water and Anglian Water have encompassed the potential effects of climate change within their Water Resource Management Plans, which have determined the need for investment in both mitigation and adaptation, specifically to reduce water consumption particularly in water stress areas.

Table 7.1 : Water resource zones in Cambridgeshire

Council/ Area	Water resource zone
Cambridge Urban Area	Reservoir to the east of the city and boreholes within the network.
East Cambridgeshire	Chalk Aquifer within the Cambridgeshire and West Suffolk Zone (WRZ9)
Fenland	Chalk Aquifer- Fenland WRZ (supplying Wisbech and surrounds), Ruthamford (supplying March, Doddington, Chatteris and Peterborough)
Huntingdonshire	Ruthamford North and Ruthamford South Water Resource Zone
South Cambridgeshire	Ground water Borehole Abstraction within the Cam and Ely Ouse Catchment Area

7.4.3 When water is removed from a river it can reduce water quality due to reduced dilution of pollutants. Standards are in place between the EA and the relevant water company to ensure that most of the time water levels within the river are maintained at an appropriate level for fish and other wildlife. However, in drought periods or with increasing demand water companies may need to apply for a permit to increase abstraction, and hence reduce river levels. Queries regarding increases to abstraction should be directed to the EA in the first instance.

7.4.4 If the local water and sewerage company reaches a point where it needs to apply for a permit for increased discharge flows from a sewage treatment work (STW), it is likely that the water quality limits will be tightened. This is intended to aid achievement of the water quality objectives of the receiving water body under the WFD. Details of treatment work infrastructure can be found with the relevant LPAs WCS and their update reviews.

7.4.5 Any additional discharges beyond those permitted into the Middle Level Commissioners (MLC) and associated Internal Drainage Boards' (IDBs) systems will require their prior written consent together with the payment of the relevant fee.

7.5 Development location in relation to catchment or watercourse

7.5.1 Under the WFD, a development's location within a catchment or its proximity to a watercourse is relevant. Proximity to a watercourse is relevant where, for example, development or engineering works could affect the ability of the body responsible for maintaining the watercourse to access, maintain or improve the water body, or where it could affect the flow in a watercourse. Riverside development must therefore be set back a reasonable distance from the water's edge, allowing a corridor between the two environments.

7.5.2 IDB's and some awarded watercourses have a specific minimum width for a maintenance strip. While this corridor is crucial for access for maintenance, it is also the most effective means of ensuring there is potential for habitat and ecological benefits. Appropriate form and landscaping of the riverbanks can be fulfilled through good design. The width of 'maintenance access strips' may vary depending on the size of the watercourse, the type of maintenance that is required, and the organisation responsible for maintenance. The width will therefore be determined on a case by case basis with developers bearing in mind the need for access and green infrastructure. Queries regarding maintenance should be directed to the IDBs in the first instance.

7.5.3 Special consent may be required from Cambridgeshire's water management authorities (WMAs) for development that takes place inside or within a certain distance of a non-main river watercourse. Developers should contact Cambridgeshire County Council (CCC) (the Lead Local Flood Authority (LLFA)) for further details.

7.6 Aquatic environment

7.6.1 Planning Policies in Local Plans provide guidance to ensure development adjacent to watercourses protects and enhances the physical and natural landscape. Proposals for new development should where possible enhance the natural resources of the river corridor, and offer opportunities where applicable for the re-naturalisation of the river to improve water quality, increase public access to adjacent open spaces and improve the integrity of the built environment in terms of its location, scale, design and form.

7.6.2 Where a watercourse must still serve a function for which it has been modified or was originally created, naturalisation and habitat measures may need to be more subtle or more carefully considered since they must not, for example, increase flood risk. This could be the case in Cambridgeshire where a large number of the watercourses in the north and east of the county are managed by an IDB. Smaller changes such as the installation of fish passes alongside pumping stations or bank-side planting can be particularly valuable to improve the habitat for native species. Reference should be made to the Drainage Channel Biodiversity Manual (NE121). This document has been written for use by IDBs operating in England and looks to tackle the challenge of making space for both flood waters and wildlife through the integrated planning and management of drainage catchments. Examples of some of the measures are set out below:

- Forming marginal ledges in open channels
- Changing the timing of works to accommodate species
- Having maintenance rotation periods
- Using 'softer' erosion control measures such as sedge plugs and coir roll revetments

7.6.3 The EA's online WFD mitigation measures manual provides examples of methods currently used (where appropriate to individual sites) to bring about river naturalisation and improve the WFD status of rivers.

7.7 Highways

7.7.1 Highway developments may result in negative impacts on water bodies. Where this occurs, positive measures must be considered. The following are some examples of how positive measures can be included in highways developments:

- Where a bridge crosses a watercourse or a road runs down towards a river, surface water exceedance flows may lead water to run off these surfaces directly into a water body, taking heavy metals and hydrocarbons with it. Balance and holding ponds should be installed adjacent to bridges and other highways enabling pollutants to collate.
- The design of new bridges may require river edges to be strengthened and hardened on both sides potentially cutting off a wildlife corridor and increasing for example otter mortality on our roads. The installation of an otter crossing, including a mammal ledge and guide fencing, under the A1 at Hail Bridge (near St Neots) has helped to minimise such an impact by providing a safe crossing for mammals when water levels are high.
- Culverting of a watercourse under a carriageway causes a loss of ecological diversity and habitat continuity which may interrupt the migration routes of animals. Using culverts that create the natural river bed morphology and natural invert levels can help reduce such impacts. Retrofitting baffles and/or ripracks to existing culverts can help improve fish passage.

7.8 Land contamination

7.8.1 Groundwater beneath development sites can provide a base flow to surface waters in that the water will find its way to the surface via channels which are often not apparent. Ground conditions on brownfield land potentially affected by contamination should therefore be investigated prior to decisions being made about site layout and design of drainage systems.

7.8.2 If there is potential for land contamination on site then this can affect more areas than just drainage and water environments. Planning policies contained within the Local Plans require that sites with the potential to be affected by contamination undertake a preliminary assessment prior to a planning decision being made (see Appendix A). This will identify if additional measures and investigations need be carried out before development commences. Pre-application advice can be sought from the relevant LPA and the EA to assess the possible contamination of a site to ensure a smoother planning application process.

7.8.3 Planning conditions can control pollution during construction, but this may not be appropriate for land contamination, which should be addressed in principle prior to development decisions. Further information is included in the planning policies and supporting text in each LPAs Local Plan (see Appendix A for further details on relevant planning policies).

7.8.4 Developers seeking further guidance about land contamination should refer to the following documents, or any successor documents, available on the Environmental Agency Website:

- Technical Guidance on the management of contaminated land (2014).
- The risk management framework provided in CLR11: Model Procedures for Management of Land Contamination; and
- Guiding Principles for Land Contamination for the type of information required in order to assess risks to controlled waters from the site.

Appendix A Local plan policies

Each Local Planning Authority (LPA) within Cambridgeshire has its own adopted (or is working towards adoption of its own) Local Plan. Local Plans set out a vision for their administrative area and the planning policies necessary to deliver the vision. The relevant LPAs and their adopted or emerging planning policies that this SPD supports Local Plans are listed below:

A.1 Cambridgeshire County Council

The Cambridgeshire & Peterborough Minerals & Waste Development Plan 'Core Strategy Development Plan Document'(adopted July 2011), sets the type and amount of Minerals and Waste development that will be accommodated in Cambridgeshire up until 2026.The relevant planning policies are as follows:

- CS22 (Climate Change)
- CS35 (Biodiversity and Geodiversity)
- CS39 (Water Resources & Pollution Prevention)

The Cambridgeshire & Peterborough Minerals & Waste Development Plan 'Site Specific Proposals DPD' (adopted February 2012) identifies sites for development to meet the vision of the Core Strategy.

The County Council has also produced a number of (SPDs) to accompany the development plans. The relevant SPDs are as follows:

The Location and Design of Waste Management Facilities SPD (Adopted July 2011)

This SPD provides detailed guidance to help implement policy CS22 (Climate Change) of the Core Strategy DPD, and makes particular references to flood risk and water resources/quality. The document also supports and cross references the following planning policy:

- CS35 (Biodiversity and Geodiversity)

The Block Fen/Langwood Fen Master Plan SPD (Adopted July 2011)

The Master Plan provides a more detailed land use planning framework for mineral and waste activity in the Earith / Mepal area, and builds upon the proposals set out in the Core Strategy. Water storage and flood prevention are a common theme within the SPD. The SPD aims to guide developers on the implementation of proposals for the Block Fen/Langwood Fen area mainly through policies:

- CS3 (Strategic Vision & Objectives for Block Fen/Langwood Fen)
- CS5 (Earith/Mepal)
- CS20 (Inert Landfill)

A.2 Cambridge City Council

The 'Cambridge Local Plan 2014: Proposed Submission' sets out how Cambridge City Council will meet the development needs of Cambridge to 2031. The key policies that are of relevance are as follows:

- Policy 27: Carbon reduction, community energy networks, sustainable design and construction, and water use
- Policy 31: Integrated water management and the water cycle
- Policy 32: Flood risk
- Policy 33: Contaminated Land

The City Council also has a number of SPDs that are of relevance to this Flood & Water SPD, which are as follows:

Draft Planning Obligations Strategy Supplementary Planning Document (June 2014)

This draft SPD has been written to support the emerging Cambridge Local Plan 2014 and the emerging Cambridge Community Infrastructure Levy (CIL), both of which the Council expects to adopt in 2015. This SPD supports Policy 85 (Infrastructure delivery, planning obligations and the Community Infrastructure Levy) of Cambridge's draft Local Plan. Strategic improvements to landscape, habitats, access to the countryside and major green infrastructure projects could be funded by CIL. Environmental mitigation measures will be considered on a site by site basis. Depending on the scale of the development there may be circumstances where schemes require mitigation measures to be included in a Section106 Agreement. Matters which could be included in a S.106 Agreement include:

- Ecological Mitigation/Remediation
- Major contamination issues

Open Space & Recreation Strategy (adopted October 2011)

This document, which forms part of the technical evidence base for the Local Plan, seeks to ensure that open space supports the development of sustainable communities, and the enhancement of the health and well-being of residents and the biodiversity of the city.

The Council is also due to update its Sustainable Design and Construction SPD, which will provide further guidance on policy requirements regarding water conservation measures and water sensitive urban design.

The Council has also adopted the Cambridge Sustainable Drainage Design and Adoption Guide, which sets out the Council's requirements for the design of SuDS in public open spaces.

A.3 East Cambridgeshire District Council

The 'East Cambridgeshire Draft Local Plan (pre-submission version, February 2013)' sets out a blueprint for the future growth of East Cambridgeshire, covering a period up to 2031. Contained within the draft document are planning policies which are relevant to this SPD. The SPD is intended to supplement the following Local Plan policies:

- Policy HOU 9: Gypsies, travellers and travelling show people sites
- Policy ENV 2: Design
- Policy ENV 7: Biodiversity and geology
- Policy ENV 8: Flood risk
- Policy ENV 9: Pollution

East Cambridgeshire District Council have also produced a number of SPDs which are also relevant:

Design Guide SPD (adopted March 2012)

The Design Guide SPD is intended to set out the requirements and aspirations for development within East Cambridgeshire. Developers would need to consider a number of development principles including foul and surface drainage methods.

Developer Contributions SPD (adopted March 2013)

This SPD sets out the Council's approach to seeking developer contributions for infrastructure or environmental improvements required as a result of new development. It is aimed at developers, agents and the general public, and seeks to provide people with a better understanding of when planning contributions will be sought and how they will be used.

East Cambridgeshire District Council may seek planning obligations for certain types of infrastructure and benefits, including flood defence work and SuDS. Financial contributions through planning obligations may be sought towards the maintenance and/or monitoring of SuDS

A.4 Fenland District Council

The 'Fenland Local Plan' (adopted 8 May 2014) contains the policies for the growth and regeneration of Fenland up to 2031. The policies that are of relevance are as follows:

- Policy LP14 – Responding to Climate Change and Managing the Risk of Flooding in Fenland
- Policy LP16 - Delivering and Protecting High Quality Environments across the District

Fenland District Council has also produced two SPDs in support of their adopted Local Plan, with one of the SPDs directly relevant in the context of this SPD.

Delivering and Protecting High Quality Environments in Fenland SPD (adopted July 2014) The Delivering and Protecting High Quality Environments in Fenland SPD has been prepared to provide further guidance on a number of policies in the Fenland Local Plan 2014, in particular Policy LP16, 'Delivering and Protecting High Quality Environments across the District'. The following policies in the SPD are of relevance:

- Policy DM6 – Mitigating Against Harmful Effects
- Policy DM7 – Land Contamination
- Policy DM8 – Riverside Settings

Resource and Renewable Energy SPD (adopted July 2014)

This SPD sets out in detail Fenland District Council's policies in respect of resource use and renewable energy, in order to suitably expand on Part (A) of Policy LP14 in the Fenland Local Plan 2014.

A.5 Huntingdonshire District Council

Huntingdonshire's 'Core Strategy' (adopted September 2009) sets out the Council's strategy for sustainable growth over the plan period up to 2026. The following policies within the draft Local Plan are relevant to this SPD.

- CS 1: Sustainable Development in Huntingdonshire
- CS 10: Contributions to Infrastructure Requirements

The Council is preparing a new Local Plan 'Huntingdonshire's Local Plan 2036' which is intended to replace the Core Strategy once it has been adopted. In line with the NPPF (paragraph 216) policies contained in the emerging Local Plan may be considered to have weight once the plan has been subject to representations at the 'Publication' stage, also known as 'Proposed Submission'. Readers should contact Huntingdonshire District Council for up to date information about the emerging Local Plan and how this SPD supports draft policies.

A.6 South Cambridgeshire District Council

The 'South Cambridgeshire Development Control Policies Development Plan Document' (DPD) (adopted in July 2007) guides decisions on planning applications within South Cambridgeshire and sets out the Council's planning policies on a wide range of topics, including housing, jobs, services and facilities, travel, the natural environment and the Green Belt. The following planning policies are particularly relevant to this SPD:

- Policy DP/1: Sustainable Development
- Policy DP/4: Infrastructure and New Development
- Policy NE/6: Biodiversity
- Policy NE/8: Groundwater
- Policy NE/9: Water and Drainage Infrastructure
- Policy NE/10: Foul Drainage – Alternative Drainage Systems
- Policy NE/11: Flood Risk
- Policy NE/12: Water Conservation

South Cambridgeshire District Council is preparing a new Local Plan which once adopted will replace the Development Control Policies DPD. The 'South Cambridgeshire Local Plan'(submitted in March 2014) sets out how South Cambridgeshire District Council will deliver the levels of employment and housing development that should be provided over the plan period to 2031. The following planning policies are particularly relevant to this SPD:

- Policy CC/1: Mitigation and Adaptation to Climate Change
- Policy CC/7: Water Quality
- Policy CC/8: Sustainable Drainage Systems
- Policy CC/9: Managing Flood Risk
- Policy HO/1: Design Principles
- Policy NH/4: Biodiversity
- Policy NH/6: Green Infrastructure
- Policy SC/12: Contaminated Land
- Policy TI/8: Infrastructure and New Developments

Appendix B Applicant checklists

B.1 Drainage checklist

Development:	
Location:	
Date:	
LPA contact:	
EA contact:	
IDB contact:	
LLFA contact:	
General Notes:	

Recommended actions	Notes	Tick
Managing the risk of flooding (see Chapter 4)		
Establish if your development is at risk of tidal, river flooding or other forms of flooding. Check the flood maps on the EAs website, and the LPAs SFRAs and SWMPs		
Make sure the location of your development meets the Sequential Test (NPPG). Only where there is no other choice, carry out and meet the Exception Test.		
Assess what information is required to be included within your FRA, if one is required. See FRA checklist below for further details.		
Managing surface water (see Chapter 6)		
Before you plan your site, consider how you can manage the rate of surface water run-off so that it is similar to the conditions before the development. Also consider the effect this run-off will have on any receiving watercourse.		
Demonstrate in your FRA that you will deal with surface water by installing the best combination of SuDS techniques for your site (see FRA requirements below).		
Use CIRIA guidance to inform your choice of SUDS design for the development.		

Recommended actions	Notes	Tick
Where infiltration techniques are not possible, or where space is limited, you can still use features such as green roofs to reduce the rate or total amount of run-off.		
Speak to the LLFA about the surface water drainage proposals for your site. They can tell you what consents you will need, which types of SuDS are unsuitable and whether you will have to take special precautions to prevent pollution or reduce infiltration.		
Demonstrate in your FRA that you will deal with surface water by installing the best combination of SuDS techniques for your site.		
Ensure you have an adequate management and maintenance system in place.		
Water Resources (see Chapter 6)		
Design your development to at least meet the minimum level of Building Regulations or Local Planning policies related to water conservation where appropriate.		
Consider water and energy-efficient appliances and fittings in your development such as 'A-rated' washing machines and low or dual-flush toilets.		
If your development is large, consider leak-detection, rainwater-harvesting or even rainwater re-use systems. Information about their management and maintenance should be provided.		
Pollution Prevention (see Chapter 7)		
Talk to the local sewerage company to ensure: • there is sufficient sewage treatment capacity for the lifetime of your development; • there are arrangements for sewage discharges to foul sewer; • what consents you will need.		
Please also check with the Local Planning Authority as to their full Local Validation requirements.		

B.2 Flood risk assessment checklist

FRA requirements	Notes	Tick
1. Development Description and Location		
a. What type of development is proposed (e.g., new development, an extension to existing development, a change of use etc.) and where will it be located.		
b. What is its flood risk vulnerability classification?		
c. Is the proposed development consistent with the Local Plan for the area? (Seek advice from the LPA if you are unsure about this).		
d. What evidence can be provided that the Sequential Test and where necessary the Exception Test has/have been applied in the selection of this site for this development type?		
e. Will your proposal increase overall the number of occupants and/or users of the building/land, or the nature or times of occupation or use, such that it may affect the degree of flood risk to these people? (Particularly relevant to minor developments (alterations and extensions) and changes of use).		
2. Definition of the Flood Hazard		
a. What sources of flooding could affect the site?		
b. For each identified source in box 2a above, can you describe how flooding would occur, with reference to any historic records where these are available?		
c. What are the existing surface water drainage arrangements for the site?		
3. Probability		
a. Which Flood Zone is the site within? (As a first step, check the Flood Map for Planning (Rivers and Sea) on the EA's website).		
b. If there is a SFRA covering this site (check with the LPA), does this show the same or a different Flood Zone compared with the EAs flood map? (If different you should seek advice from the LPA and, if necessary, the EA).		
c. What is the probability of the site flooding, taking account of the maps of flood risk from rivers and the sea and from surface water, on the EA's website, and the SFRA, and of any further flood risk information for the site?		
d. If known, what (approximately) are the existing rates and volumes of surface water run-off generated by the site?		

FRA requirements	Notes	Tick
4. Climate Change		
How is flood risk at the site likely to be affected by climate change? (The LPAs SFRA should have taken this into account). Further information on climate change and development and flood risk is available on the EAs website.		
5. Detailed Development Proposals		
Where appropriate, are you able to demonstrate how land uses most sensitive to flood damage have been placed in areas within the site that are at least risk of flooding (including providing details of the development layout)?		
6. Flood Risk Management Measures		
How will the site/building be protected from flooding, including the potential impacts of climate change, over the development's lifetime?		
7. Off-site Impacts		
a. How will you ensure that your proposed development and the measures to protect your site from flooding will not increase flood risk elsewhere?		
b. How will you prevent run-off from the completed development causing an impact elsewhere?		
c. Are there any opportunities offered by the development to reduce flood risk elsewhere?		
8. Residual Risks		
a. What flood-related risks will remain after you have implemented the measures to protect the site from flooding?		
b. How, and by whom, will these risks be managed over the lifetime of the development? (e.g., flood warning and evacuation procedures).		

Notes:

1. *A site-specific flood risk assessment (FRA) is required for proposals of 1 hectare or greater in Flood Zone 1; all proposals for new development (including minor development and change of use) in Flood Zones 2 and 3, or in an area within Flood Zone 1 which has critical drainage problems (as notified to the LPA by the EA); and where proposed development or a change of use to a more vulnerable class may be subject to other sources of flooding (NPPF, Footnote 20).*
2. *A step by step guide on how to complete a FRA in support of a planning application is set out in Chapter 4.*
3. *The checklist is taken from the National Planning Practice Guidance (NPPG) on Flood Risk and Coastal Change – Site-Specific Flood Risk Assessment: Checklist.*

Appendix C Internal drainage boards

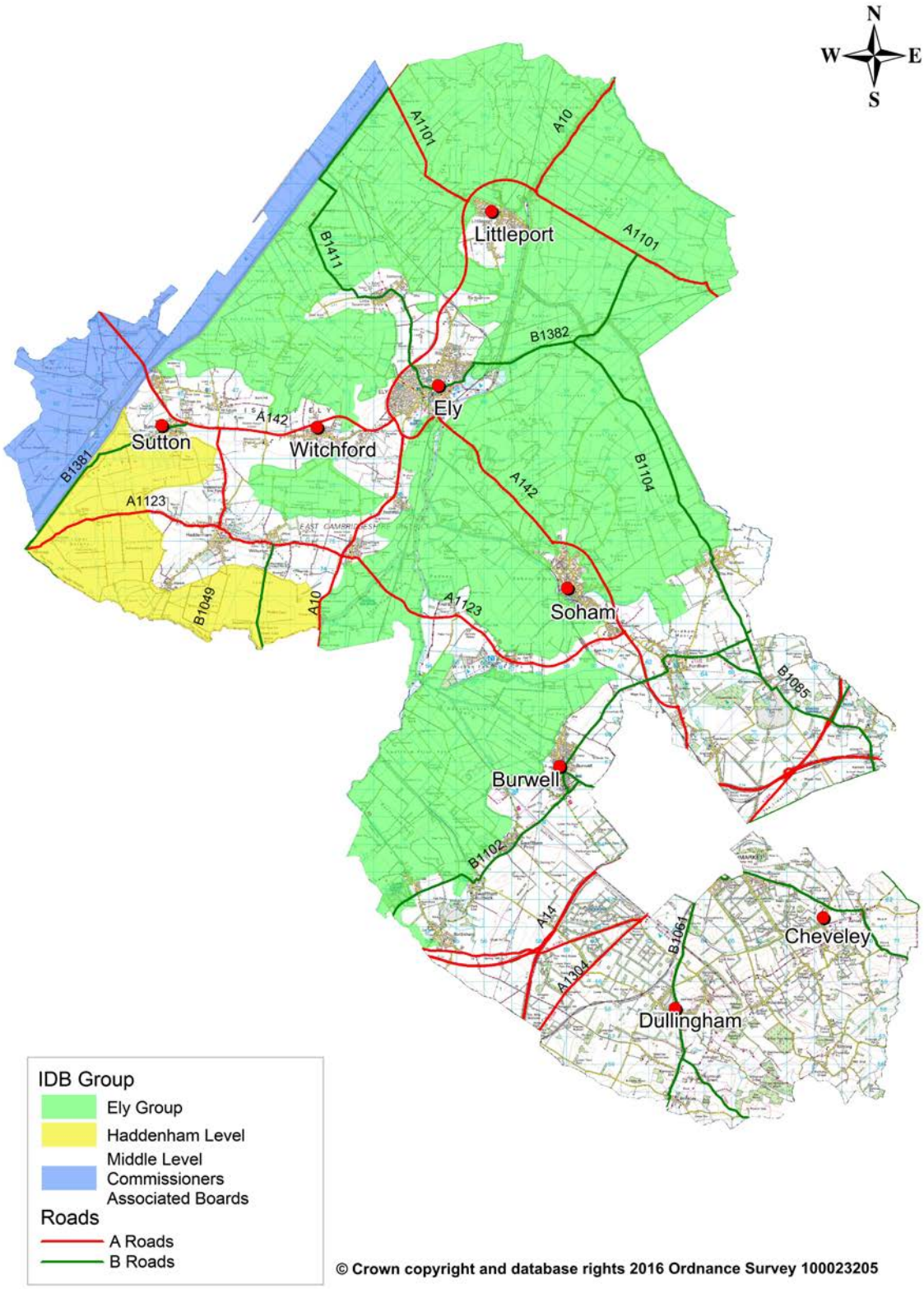
Further details relating to the Internal Drainage Boards and their roles and functions can be found at Chapter 3 and Table 3.2.

IDBs	Applicable to the relevant district council area
North Level Drainage Board	Fenland District Council
Kings Lynn IDB	Fenland District Council
Ramsey IDB[1]	Huntingdonshire District Council
Whittlesey Consortium of IDBs[1]: • Drysides • Feldale IDB • Holmewood and District IDB • Woodwalton Drainage Commissioners • Whittlesey IDB	Huntingdonshire District Council Fenland District Council
Bedford Group of IDBs (in Cambridgeshire): • Alconbury and Ellington IDB • Bedfordshire and River Ivel IDB	Huntingdonshire District Council
IDBs that have been agreed to be represented by Ely Group: • Burnt Fen IDB • Cawdle Fen • Littleport and Downham • Middle Fen and Mere • Old West • Padnal and Waterden • Swaffham • Waterbeach Level	East Cambridgeshire District Council South Cambridgeshire District Council
IDBs presently managed by the Middle Level Commissioners: • Benwick IDB • Bluntisham IDB • Conington and Holme IDB • Churchfield and Plawfield IDB • Curf and Wimblington Combined IDB • Euximoor IDB • Haddenham Level • Hundred Foot Washes IDB • Hundred of Wisbech IDB • Manea and Welney District Drainage Commissioners • March and Whittlesey IDB • March East IDB • March and Whittlesey IDB • March Fifth District Drainage Commissioners • March Sixth District Drainage Commissioners	Fenland District Council East Cambridgeshire District Council South Cambridgeshire District Council Huntingdonshire District Council

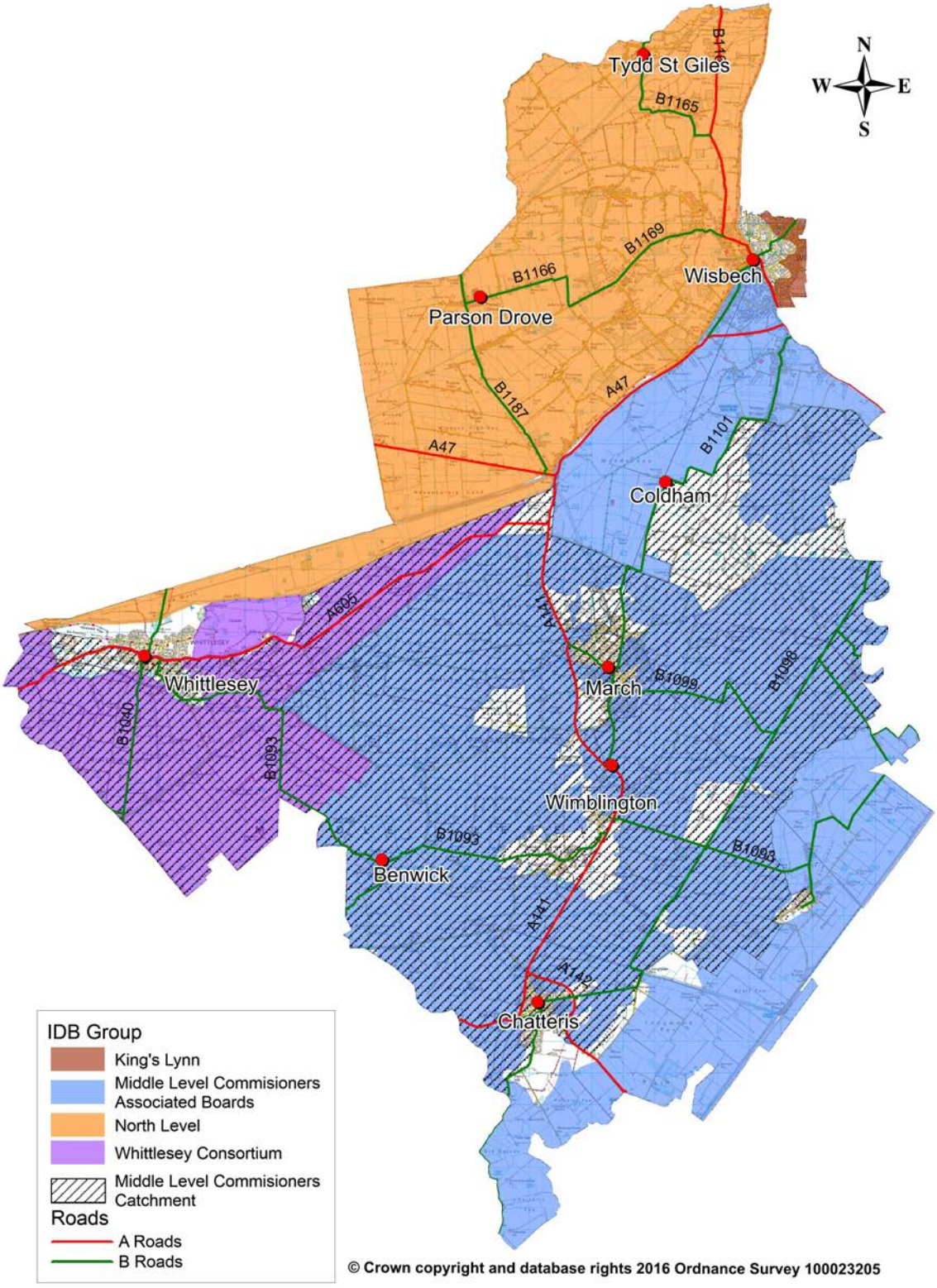
IDBs	Applicable to the relevant district council area
• March Third District Drainage Commissioners • Middle Level Commissioners • Needham and Laddus IDB • Nightlayers IDB • Nordelph IDB • Over and Willingham • Ramsey First (Hollow) IDB • Ramsey Fourth (Middlemoor) IDB • Ramsey Upwood & Great Raveley IDB • Ransonmoor District Drainage Commissioners • Sawtry IDB • Sutton and Mepal IDB • Swavesey IDB • Upwell IDB • Waldersey IDB • Warboys Somersham and Pidley IDB • White Fen District Drainage Commissioners	

1. The MLC provide planning services for Ramsey IDB and the Whittlesey Consortium of IDBs.

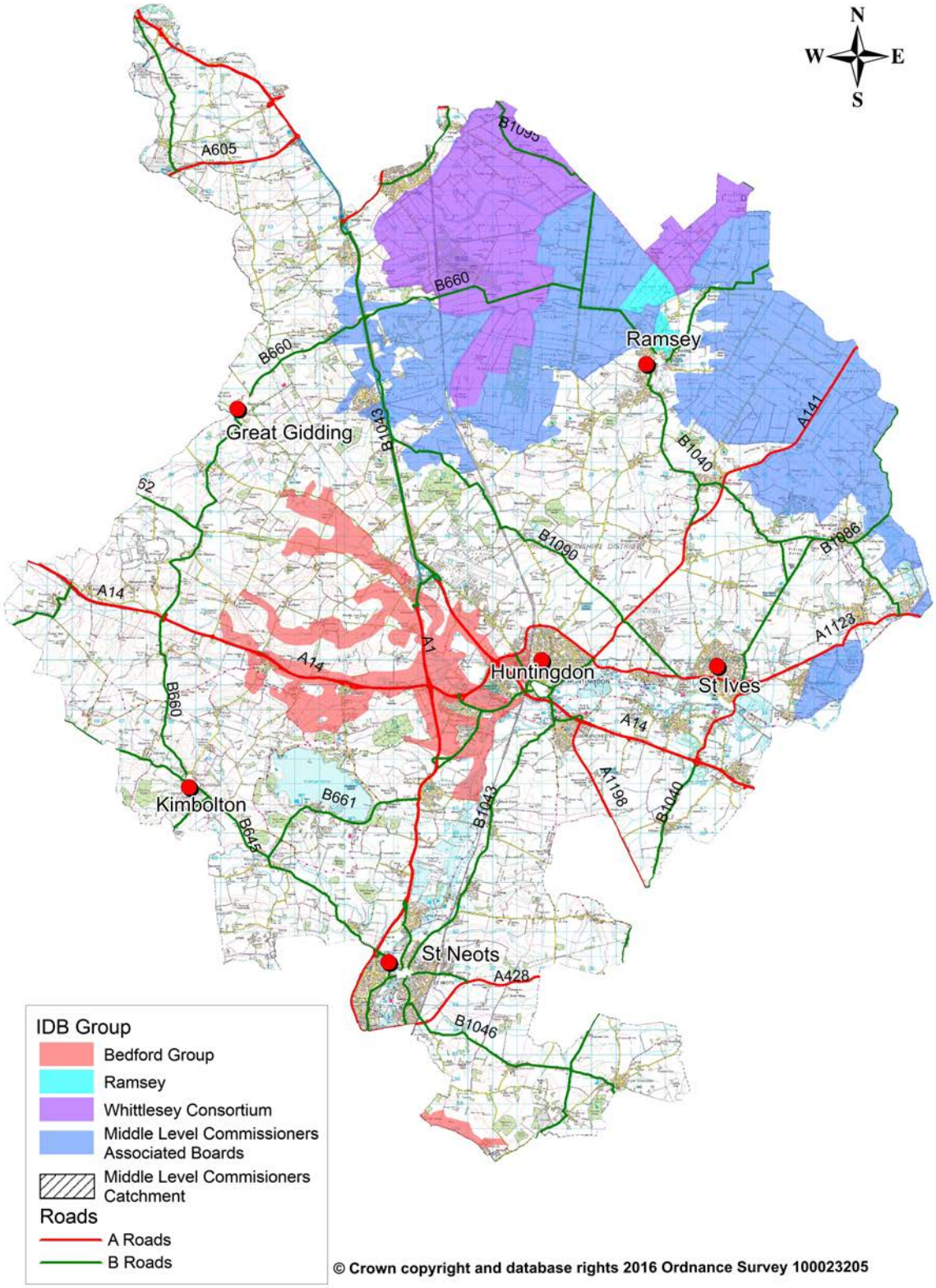
Map C.1 : IDBs within East Cambridgeshire District Council (ECDC) Area



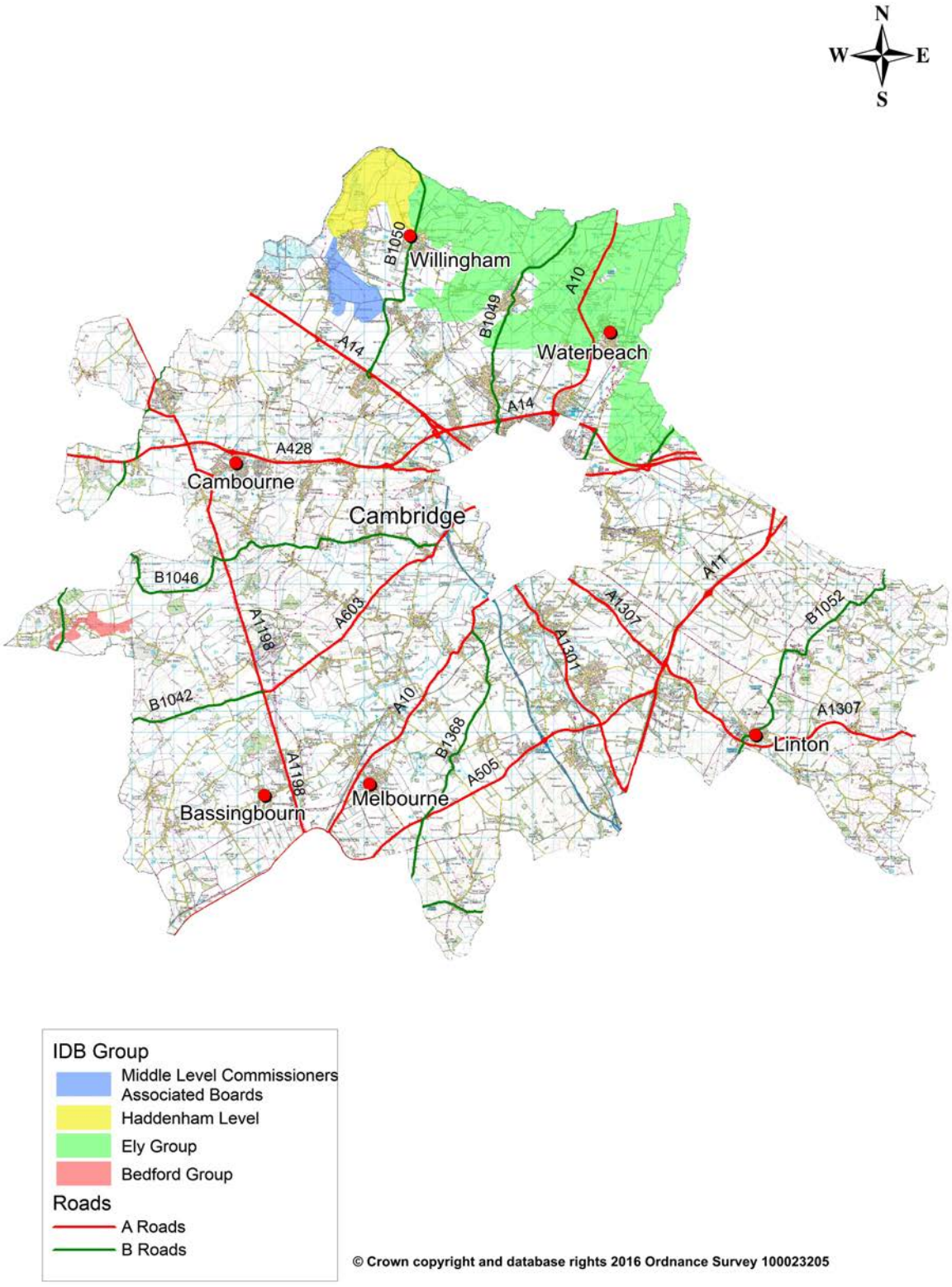
Map C.2 : IDBs within Fenland District Council (FDC) Area



Map C.3 : IDBs within Huntingdonshire District Council (HDC) Area



Map C.4 : IDBs within South Cambridgeshire District Council (SCDC) Area



Appendix D Building materials guidance

Table D.1

A) Foundations
Water exclusion strategy: • Concrete blocks used in foundations should be sealed with an impermeable material or encased in concrete to prevent water movement from the ground to the wall construction. Water entry strategy: • Provide durable materials that will not be affected by water and use construction methods and materials that promote easy draining and drying.

B) Floors
Ground floors can be influenced by two different conditions: • Water entry from the ground which can cause uplift pressures and will require structural checks if a water exclusion strategy is proposed; • Exposure to standing water. Water exclusion and entry strategy: • Materials that retain their structural integrity post flood event or easily replaced materials should be specified along with an engineering report confirming structural integrity for depths anticipated; • Construction should allow for cleaning and drainage; • Concrete ground supported floors are preferable to suspended floors where ground conditions allow; • Suspended floors may require cleaning out of the sub-floor space post flooding so access and falls should be provided; • Suspended steel floors would require anti-corrosion protection; • Suspended timber floors are not recommended; • Insulation should be of the closed cell type, generally insulation placed above the floor slab minimises the effect of flood water but may float if a low mass floor cover and screed is specified; • Floor finishes should generally be ceramic or concrete based floor tiles and sand/cement screed. Water resistant grout and a cement based adhesive/bedding is preferred; • Skirting boards should not be timber but either ceramic tiles or plastic; • If the flooding risk is up to a 1 in 5 year event a floor sump should be specified; • Under floor services should avoid using ferrous materials.

C) Walls
Refer to Figure 5.4 for guidance on appropriate building materials to be specified. **Water exclusion strategy** for depths of water up to 0.3m or where structurally designed, up to 0.6m. Masonry walls: • Joints should be fully filled and bricks should be laid frog upwards; • Perforated bricks should not be used;

C) Walls

- Where possible use engineering bricks up to flood level plus one brick course for freeboard;
- Blocks and dense facing bricks have improved performance when covered with render;
- Do not use highly porous bricks such as handmade bricks;
- For a water exclusion strategy where leakage is expected to be minimal aircrete blocks are recommended but may retain moisture longer than concrete blocks and provide less restraint to uplift forces on flood slabs/edges;
- Solid masonry walls are a good option but will need to have suitable wall insulation to comply with the latest building regulations;
- Clear cavity walls are preferable if sufficient insulation cannot be provided elsewhere.

Timber Frame walls:

- Timber frame walls are not recommended.

Reinforced concrete wall/flood:

- Should be considered where the risk of frequent flooding is high.

External render:

- Effective barriers should be used with blocks or bricks up to predicted flood level plus one brick course for freeboard, to prevent thermal bridge may require additional insulation on inner skin of wall or external insulation;
- External renders with lime content can induce faster surface drying.

Insulation:

- External insulation is better than cavity insulation as it is easily replaced;
- Cavity insulation should be a rigid closed cell type.

Internal linings:

- Internal cement renders (with good bond) are effective at reducing leakage and assist rapid drying;
- Avoid gypsum plasterboard;
- Internal lime plaster/render can be a good solution once full strength has been gained (6 months approximately).

Water entry strategy

Masonry walls:

- Use good quality facing bricks for the external face of cavity walls;
- Do not use highly porous bricks such as handmade bricks;
- For a water entry strategy where water is expected to enter the building concrete blocks are recommended;
- Clear cavity walls are preferable if sufficient insulation cannot be provided elsewhere.

Timber Frame walls:

- Timber frame walls are not recommended.

External render:

C) Walls

- Should not be used as it is a barrier to water penetration and may induce excessive differences with flood water depths internally and externally.

Insulation:

- External insulation is better than cavity insulation as it is easily replaced;
- Cavity insulation should be a rigid closed cell type.

Internal linings:

- Avoid internal cement renders as these can prevent drying;
- Use standard gypsum plasterboard up to the predicted flood level plus a freeboard of 100mm as a sacrificial material;
- Internal lime plaster/render can be a good solution once full strength has been gained (6 months approximately).

D) Doors and windows

Doors:

- Thresholds should be raised as high as possible whilst still complying with level access requirements;
- External PVC doors are preferable. Where an external wooden door is used, all efforts should be made to ensure a good fit and seal to the frames;
- For a flood exclusion strategy the use of flood doors should be specified. This type of door seals and protects from flooding once closed;
- Hollow core timber internal doors should not be used in high flood risk areas;
- Butt hinges can aid in the removal and storage of doors in dry areas;

Windows and patio doors:

- Should employ similar measures to doors. Special care should be taken to ensure adequate sealing of any window/door sills to the fabric of the property.

Air vents:

- There are two types of air vents that could be specified, either a periscope air vent which has a higher external opening than internal opening or a self-closing air vent by means of an internal floatation mechanism. Periscope air vents are generally preferable as there are no moving parts reducing the maintenance requirements.

E) Fittings

- The main principle is to use durable fittings that can be easily cleaned e.g. the use of plastic or stainless steel for kitchen units;
- Domestic appliances such as fridges and ovens on plinths as high as practicable above the floor.

F) Services

- All service penetrations should be sealed with expanding foam or similar closed cell material;
- Where applicable pipework should use closed cell insulation below the predicted flood level;

F) Services

- Non-return valves are recommended to prevent back flow of diluted sewage in situations where there is an identified risk of foul sewer surcharging. There is an ongoing maintenance requirement for these valves. Downstairs bathrooms and sinks are often conduits during flood conditions and careful consideration needs to be given to these;
- Water, electricity and gas meters should be located above the predicted flood level where possible;
- Electric ring mains should be installed at first floor level which drops towards the ground floor where ground floor sockets should be installed at a high level;
- Heating boiler units should be installed above the predicted flood level and preferably on the first floor. Underfloor heating should be avoided on ground floors. Conventional heating pipes are unlikely to be significantly affected by flood water;
- Communication wiring for telephone, TV and internet and other services should be protected by suitable insulation in the distribution ducts to prevent damage;
- Septic tanks are required in some rural parts of Cambridgeshire. Recommended criteria for the design and installation of these systems are given in BS 6297. The septic tank should be appropriate for the ground conditions locally and take into account flood levels.

Appendix E Pre-application checklist

Requirements	Details (or reference documentation)	Agreed?
(a) Any planning and environmental objectives for the site that should influence the surface water drainage strategy. These objectives can be put forward by the developer, LPA or relevant water management authorities and should be agreed by all parties.		
(b) The likely environmental or technical constraints to SuDS design for the site. These should be agreed by all parties.		
(c) The requirements of the local adoption or ongoing maintenance arrangements. The LPA have the overriding decision on the appropriateness of the adoption arrangements.		
(d) The suite of design criteria to be applied to the SuDS scheme (taking account of (a) to (c)).		
(e) Evidence that the initial development design proposals have considered the integration and linkage of the surface water management with street layouts, architectural and landscape proposals.		
(f) An assessment of strategic opportunities for the surface water management system to deliver multiple benefits for the site (see Table 5, British Standard 8582). This should be provided by the developer and should include the strategic use of public open space for SuDS.		
(g) The statutory and recommended non-statutory consultees for the site. This should be provided by the LPA.		
(h) The likely land and infrastructure ownership for drainage routes and points of discharge (including sewerage assets).		
(i) An assessment of statutory consultee responsibilities and requirements, including timescales for any likely required approvals/consents.		
(j) Any potential local community impacts, health and safety issues or specific local community concerns/requirements that should be addressed by the detailed design.		
(k) An assessment of cost implications of stakeholder obligations.		
(l) An agreed approach to the design and maintenance of the surface water management for the proposed site.		

Appendix F Surface water drainage pro-forma

Applicants should complete this form and submit it to the LPA, referencing from where in their submission documents this information is taken. The proforma is supported by the DEFRA/ EA guidance on Rainfall Runoff Management. and uses the storage calculator on www.UKsuds.com. The proforma should be considered alongside other supporting SuDS Guidance, but focuses on ensuring flood risk is not made worse elsewhere. This proforma is based upon current industry standard practice.

1. Site details

Site	
Address & post code or LPA reference	
Grid Reference	
Is the existing site developed or Greenfield?	
Total Site Area served by drainage system (excluding open space) (Ha)[1]	

1. The Greenfield runoff off rate from the development which is to be used for assessing the requirements for limiting discharge flow rates and attenuation storage from a site should be calculated for the area that forms the drainage network for the site whatever size of site and type of drainage technique. Please refer to the Rainfall Runoff Management document or CIRIA manual for detail on this.

2. Impermeable area

	Existing	Proposed	Difference (Proposed-Existing)	Notes for developers and Local Authorities
Impermeable area (ha)				If proposed > existing, then runoff rates and volumes will be increasing. Section 6 must be filled in. If proposed ≤ existing, then section 6 can be skipped & section 7 filled in.
Drainage Method (infiltration/sewer/watercourse)			N/A	If different from the existing, please fill in section 3. If existing drainage is by infiltration and the proposed is not, discharge volumes may increase. Fill in section 6.

3. Proposing to discharge surface water via

	Yes	No	Evidence that this is possible	Notes for developers and Local Authorities
Infiltration				e.g. soakage tests. Section 6 (infiltration) must be filled in if infiltration is proposed.
To watercourse				e.g. Is there a watercourse nearby?
To surface water sewer				Confirmation from sewer provider that sufficient capacity exists for this connection.
Combination of above				e.g. part infiltration part discharge to sewer or watercourse. Provide evidence above.

4. Peak Discharge Rates[1]

	Existing rates (l/s)	Proposed rates (l/s)	Difference (l/s) (Proposed-Existing)	Notes for developers and Local Authorities
Greenfield QBAR		N/A	N/A	QBAR is approx. 1 in 2 storm event. Provide this if Section 6 (QBAR) is proposed.
1 in 1				Proposed discharge rates (with mitigation) should be no greater than existing rates for all corresponding storm events. e.g. discharging all flow from site at the existing 1 in 100 event increases flood risk during smaller events.
1 in 30				
1 in 100				
1 in 100 + climate change	N/A			To mitigate for climate change the proposed 1 in 100 +CC must be no greater than the existing 1 in 100 runoff rate. If not, flood risk increases under climate change. 30% should be added to the peak rainfall intensity.

1. This is the maximum flow rate at which storm water runoff leaves the site during a particular storm event.

5. Calculate additional volumes for storage[1]

	Existing volume (m^3)	Proposed volume (m^3)	Difference (m^3) (Proposed-Existing)	Notes for developers and Local Authorities
1 in 1				Proposed discharge volumes (without mitigation) should be no greater than existing volumes for all corresponding storm events. Any increase in volume increases flood risk elsewhere. Where volumes are increased section 6 must be filled in.
1 in 30				
1 in 100				
1 in 100 + climate change				To mitigate for climate change the volume discharge from site must be no greater than the existing 1 in 100 storm event. If not, flood risk increases under climate change.

1. The total volume of water leaving the development site. New hard surfaces potentially restrict the amount of storm water that can go to the ground, so this needs to be controlled so not to make flood risk worse to properties downstream.

6. Calculate attenuation storage[1]

		Notes for developers and Local Authorities
Storage Attenuation volume (Flow rate control) required to retain rates as existing (m^3)		Volume of water to attenuate on site if discharging at existing rates. Can't be used where discharge volumes are increasing

1. Attenuation storage is provided to enable the rate of runoff from the site into the receiving watercourse to be limited to an acceptable rate to protect against erosion and flooding downstream. The attenuation storage volume is a function of the degree of development relative to the greenfield discharge rate.

7. How is Storm Water stored on site?(1)

			Notes for developers and Local Authorities
Infiltration	**State the Site's Geology and known Source Protection Zones (SPZ)**		Avoid infiltrating in made ground. Infiltration rates are highly variable and refer to Environment Agency website to identify and source protection zones (SPZ)
	Are infiltration rates suitable?		Infiltration rates should be no lower than $1x10^{-6}$ m/s.
	State the distance between a proposed infiltration device base and the ground water (GW) level		Need 1m (min) between the base of the infiltration device & the water table to protect Groundwater quality & ensure GW doesn't enter infiltration devices. Avoid infiltration where this isn't possible.
	Were infiltration rates obtained by desk study or infiltration test?		Infiltration rates can be estimated from desk studies at most stages of the planning system if a backup attenuation scheme is provided.
	Is the site contaminated? If yes, consider advice from others on whether infiltration can happen.		Water should not be infiltrated through land that is contaminated. The Environment Agency may provide bespoke advice in planning consultations for contaminated sites that should be considered.
In light of the above, is infiltration feasible?	**Yes/No? If the answer is No, please identify how the storm water will be stored prior to release**		If infiltration is not feasible how will the additional volume be stored? The applicant should then consider the following options in the next section.

1. Storage is required for the additional volume from site but also for holding back water to slow down the rate from the site. This is known as attenuation storage and long term storage. The idea is that the additional volume does not get into the watercourses, or if it does it is at an exceptionally low rate. You can either infiltrate the stored water back to ground, or if this isn't possible hold it back with on-site storage. Firstly, can infiltration work on site?

Storage requirements

The developer must confirm that either of the two methods for dealing with the amount of water that needs to be stored on site.

- **Option 1 Simple:**
  Store both the additional volume and attenuation volume in order to make a final discharge from site at QBAR (Mean annual flow rate). This is preferred if no infiltration can be made on site. This very simply satisfies the runoff rates and volume criteria.
- **Option 2 Complex:**
  If some of the additional volume of water can be infiltrated back into the ground, the remainder can be discharged at a very low rate of 2 l/sec/hectare. A combined storage calculation using the partial permissible rate of 2 l/sec/hectare and the attenuation rate used to slow the runoff from site.

		Notes for developers and Local Authorities
Please confirm what option has been chosen and how much storage is required on site.		The developer at this stage should have an idea of the site characteristics and be able to explain what the storage requirements are on site and how it will be achieved.

8. Please confirm

		Notes for developers and Local Authorities
Which SuDS measures have been used?		SuDS can be adapted for most situations even where infiltration isn't feasible e.g. impermeable liners beneath some SUDS devices allows treatment but not infiltration. See CIRIA SUDS Manual C697.
Drainage system can contain in the 1 in 30 storm event without flooding		This a requirement for sewers for adoption & is good practice even where drainage system is not adopted.
Any flooding between the 1 in 30 & 1 in 100 plus climate change storm events will be safely contained on site.		Safely: not causing property flooding or posing a hazard to site users i.e. no deeper than 300mm on roads/footpaths. Flood waters must drain away at section 6 rates. Existing rates can be used where runoff volumes are not increased.
How are rates being restricted (hydrobrake etc)		Hydrobrakes to be used where rates are between 2l/s to 5l/s. Orifices may not work below 5l/s as the pipes may block. Pipes with flows < 2l/s are prone to blockage but this can be overcome with careful product selection and SuDS design.

		Notes for developers and Local Authorities
Please confirm the owners/adopters of the SuDS throughout the development. Please list all the owners.		If these are multiple owners then a drawing illustrating exactly what features will be within each owner's remit must be submitted with this Proforma.
How are the entire SuDS to be maintained?		If the features are to be maintained directly by the owners as stated in answer to the above question please answer yes to this question and submit the relevant maintenance schedule for each feature. If it is to be maintained by others than above please give details of each feature and the maintenance schedule. Clear details of the maintenance proposals of all element of the proposed drainage system must be provided. Poorly maintained drainage can lead to increased flooding problems in the future.

9. Evidence

Pro-forma Section	**Document reference where details quoted above are taken from:**	**Page Number**
2		
3		
4		
5		
6		
7		

The above form should be completed using evidence from the Flood Risk Assessment where applicable, surface water drainage strategy and site plans. It should serve as a summary sheet of the drainage proposals and should clearly show that the proposed rate and volume as a result of development will not be increasing. If there is an increase in rate or volume, the rate or volume section should be completed to set out how the additional rate/volume is being dealt with. This form is completed using factual information from the Flood Risk Assessment and Site Plans and can be used as a summary of the surface water drainage strategy on this site.	
Form completed by:	
Qualification of person responsible for signing off this pro-forma:	
Company:	
On behalf of (Client's details):	
Date:	

Glossary of terms

Awarded watercourse	Watercourses who's maintenance responsibility lies with the relevant local authority.
Aircrete blocks	Often known as aerated concrete blocks combining the reliability and strength of concrete blocks with the advantage of using lightweight blocks on site.
Annual exceedance probability (AEP)	AEP is the probability associated with a return period. Thus an event of return period 50 years has an AEP of 1/T or 0.02 (2%).
Aquatic ecosystems	Ecosystem within a body of water. Communities of organisms that depend on each other and their environment living in aquatic ecosystems. Two main types of aquatic ecosystem are marine ecosystems and freshwater ecosystems.
Base flow	The sustained flow in a channel or drainage system.
Bioretention	A depressed landscaping area that is allowed to collect run-off so it percolates through the soil below the area into an underdrain, thereby promoting pollutant removal.
Carbon sequestration	Process of capturing and long term storage of carbon dioxide from the atmosphere.
Catchment	The area contributing surface water flow to a point on a drainage or river system. Can be divided into sub-catchments.
Catchment Flood Management Plan (CFMP)	Catchment Flood Management Plans (CFMPs) are a large-scale strategic planning framework for the integrated management of flood risks to people and the developed and natural environment in a sustainable manner.
Combined Sewer	A sewer designed to carry foul sewage and surface water runoff in the same pipe.
Conveyance	Movement of water from one location to another.
Evapotranspiration	The process by which the Earth's surface or soil loses moisture by evaporation of water and by uptake and then transpiration from plants.
Exceedance flow	Excess flow that appears on the surface once the conveyance capacity of the drainage system is exceeded.
Exceedance flow route	Design and consideration of above-ground areas that act as pathways permitting water to run safely over land to minimise the adverse effect of flooding on people and property. This is required when the design capacity of the drainage system (SuDS or traditional drainage) has been exceeded.
Filtration	The act of removing sediment or other particles from a fluid by passing it through a filter.
Flood defence	A structure (or system of structures) for the alleviation of flooding from rivers or the sea.
Flood mechanism	A natural or established process by which flooding takes place or is brought about.

Flood risk	The level of flood risk is the product of the frequency or likelihood of the flood events and their potential consequences (such as loss, damage, harm, distress and disruption).
Floodplain	Any area of land over which water flows or is stored during a flood event or would flow but for the presence of flood defences
Fluvial	Landforms created by deposits from processes associated with rivers and streams.
Green infrastructure	Network of green open spaces that help to solve urban and climatic challenges by providing stormwater management, clean water, more biodiversity and healthy soils.
Groundwater	Water that is below the surface of the ground in the saturation zone.
Hardscape	The built environment including paved areas like streets, pavements, structures, walls, street amenities, pools and fountains.
Hydraulic model	A simplified representation of flow within a river system.
Hydromorphology	The subfield of hydrology that deals with the structure and evolution of the Earth's water resources. It also deals with the origins and dynamic morphology of those water resources.
Hydrological model	Estimates the flow in a river arising from a given amount of rainfall falling into the catchment.
Infiltration	The passage of surface water into the ground.
Main river	Main rivers are usually larger streams and rivers, though some of them are smaller watercourses of local significance. The main rivers are marked on an official document called the main river map. Copies of these maps can be located at the local offices of the Environment Agency.
Minor development	For the purposes of assessing flood risk, Minor Development is defined within the NPPG as follows: • **minor non-residential extensions**: industrial/commercial/leisure etc. 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.
Non-potable water	Poor quality water that is not safe enough to be consumed by humans
Ordinary watercourses	All watercourses not designated as Main River or IDB watercourses. The operating authority (local authority or IDB) has permissive powers to maintain them but the responsibility to do so rests with the riparian owner.
Planning performance agreements	A planning performance agreement is a project management tool which sets timescales for actions between the LPA and an applicant.

Glossary of terms

Potable water	Water company/utility/authority drinking water supply.
Probability of occurrence	The probability of a flood event being met or exceeded in any one year. For example, a probability of 1 in 100 corresponds to a 1 per cent or 100:1 chance of an event occurring in any one year.
Residual risk	The remaining risks associated with the location of development and the mitigation actions needed to be taken after the sequential approach has been applied.
Raingarden	Planted depression that allows rainwater runoff from impervious urban areas like rooks, driveways, walkways, parking lots and compacted lawn areas to be absorbed.
Riparian owners	Landowners who have rights and responsibilities to maintain the flow of water in a channel.
Septic tank	Small scale sewage treatment system common in areas with no connection to main sewage pipes.
Sewage treatment work (STW)	Process of removing contaminants from wastewater including household sewage and runoff.
Standard of protection	The flood event return period above which significant damage and possible failure of the flood defences could occur.
Sustainable drainage systems **(SuDS)**	Sustainable Drainage Systems; an approach to surface water management that combines a sequence of management practices and control structures designed to drain surface water into a more sustainable fashion than some conventional techniques
Surface water flooding	Surface water flooding is the flooding that occurs from excess water that runs off across the surface of the land and does not come from a watercourse.
Swales	A shallow vegetated channel designed to conduct and retain water, but may also permit infiltration. The vegetation filters particulate matter.
Waste water treatment works (WwTW)	Installation to treat and make less toxic domestic and/or industrial effluent.

Acronyms

CCC	Cambridgeshire County Council
CCiC	Cambridge City Council
CSO	Combined Sewer Outfall
BAP	Biodiversity Action Plan
EA	Environment Agency
ECDC	East Cambridgeshire District Council
FDC	Fenland District Council
FRA	Flood Risk Assessment
HDC	Huntingdonshire District Council
IDB	Internal Drainage Boards
LLFA	Lead Local Flood Authority
LPA	Local Planning Authorities
NPPF	National Planning Policy Framework
PPA	Planning Performance Agreements
PPG	Planning Practice Guidance
RMA	Risk Management Authority
RSPB	Royal Society for the Protection of Birds
SCDC	South Cambridgeshire District Council
SFRA	Strategic Flood Risk Assessment
SPD	Supplementary Planning Document
SPZ	Source Protection Zones
SSSI	Site of Special Scientific Interest
STW	Sewage Treatment Works
SWMP	Surface Water Management Plan
SuDS	Sustainable Drainage System
WCS	Water Cycle Study
WFD	Water Framework Directive
WwTW	Waste Water Treatment Works
WRZ	Water Resource Zone

Cambridge & South Cambridgeshire Updates To the Cambridgeshire Flood and Water Supplementary Planning Document (SPD)

GREATER CAMBRIDGE SHARED PLANNING

Introduction

The Cambridgeshire Flood and Water (CPFW) SPD has been produced by Cambridgeshire County Council in conjunction with Cambridge City Council, South Cambridgeshire District Council and three other local planning authorities in Cambridgeshire, in their role as Lead Local Flood Authority. A county wide SPD has been produced to ensure that Cambridgeshire has a consistent, locally appropriate approach to flood risk and water management. The SPD will support a number of South Cambridgeshire and Cambridge City Council Local Plan policies related to climate change, water quality, sustainable drainage systems, design principles, biodiversity, green infrastructure and land contamination.

Following the adoption of the South Cambridgeshire and Cambridge Local Plans in September and October 2018, respectively, the CPFW document was re-adopted by South Cambridgeshire District Council on 7 November 2018 and adopted by Cambridge City Council on 12 December 2018. Both were adopted as a Supplementary Planning Document (SPD).

Agreed Amendments to the SPD for South Cambridgeshire and Cambridge

Following the adoption of both Local Plans, it has been necessary to make a number of corresponding minor amendments to the Cambridgeshire Flood and Water Supplementary Planning Document (SPD). These changes reflect:

- the now adopted status of these Local Plans;
- the various dates of (re-)adoption of the SPD;
- updates to relevant Local Plan policy titles and numbering referenced in the SPD; and
- amendments relating to the withdrawal of Cambridge's Community Infrastructure Levy Charging Schedule.

The updates have been agreed by both Councils and are listed overleaf.

Section	Amendment	Reason
Note to reader Page 3	Amend to reflect adoption as SPD	Local Plan now adopted.
	~~As the emerging Cambridge Local Plan is still at the examination stage, this document will be carried forward for adoption as an SPD at the same time as the Local Plan, as agreed at Development Plan Scrutiny Sub Committee on 6 December 2016. In the interim period, prior to adoption of the SPD, the Cambridgeshire Flood and Water document provides context and guidance as material consideration in the planning process. It does not introduce new policy but rather it elaborates on, and is consistent with Local Plan policies.~~ On 27 September 2018, the South Cambridgeshire Local Plan was adopted and the Adopted Policies Map was agreed for publication. Together the South Cambridgeshire Local Plan (September 2018) and Adopted Policies Map (September 2018) replace the Core Strategy DPD (January 2007), Development Control Policies DPD (July 2007), Site Specific Policies DPD (January 2010), Local Plan 2004 'Saved' Policy CNF6, and Adopted Proposals Map (February 2012). On 18 October 2018, the Cambridge Local Plan was adopted and the Adopted Cambridge Policies Map was agreed for publication. Together the Cambridge Local Plan (October 2018) and Adopted Policies Map (October 2018) replace the Cambridge Local Plan 2006 'Saved' Policies and Adopted Cambridge Proposals Map (October 2009). The Cambridgeshire Flood and Water document was adopted by Cambridge City Council on 12 December 2018 and by South Cambridgeshire District Council on 7 November 2018 as a Supplementary Planning Document. It elaborates on, and is consistent with Local Plan policies in each of these respective Local Plans.	
1.1.1	Update hyperlinks for the Cambridge Local Plan	
	https://www.cambridge.gov.uk/local-plan-2018	
1.1.1	Update hyperlinks for the Cambridge Local Plan	
	https://www.scambs.gov.uk/planning/local-plan-and-neighbourhood-planning/the-adopted-development-plan/south-cambridgeshire-local-plan-2018/	

Section	Amendment	Reason
Appendix A.2	Reference to Policy 27 becomes Policy 28 Reference to Draft Planning Obligations SPD needs to be updated to reflect current position	Amended in Local Plan Related to withdrawal of CIL Charging Schedule
	The ~~'~~Cambridge Local Plan 2018~~2014: Proposed Submission'~~ sets out how Cambridge City Council will meet the development needs of Cambridge to 2031. The key policies that are of relevance are as follows: Policy ~~27~~28: Carbon reduction, community energy networks, sustainable design and construction, and water use Policy 31: Integrated water management and the water cycle Policy 32: Flood risk Policy 33: Contaminated Land The City Council also has a number of SPDs that are of relevance to this Flood & Water SPD, which are as follows: Draft Planning Obligations Strategy Supplementary Planning Document (~~June 2014~~ as amended) ~~This draft SPD has been written to support the emerging Cambridge Local Plan 2014 and the emerging Cambridge Community Infrastructure Levy (CIL), both of which the Council expects to adopt in 2015.~~ Following the adoption of the Cambridge Local Plan 2018, this SPD will be updated to support the Local Plan policies. This SPD supports Policy 85 (Infrastructure delivery, planning obligations and the Community Infrastructure Levy) of Cambridge's draft Local Plan. Strategic improvements to landscape, habitats, access to the countryside and major green infrastructure projects could be funded by CIL. Environmental mitigation measures will be considered on a site by site basis. Depending on the scale of the development there may be circumstances where schemes require mitigation measures to be included in a Section106 Agreement. Matters which could be included in a S.106 Agreement include: - Ecological Mitigation/Remediation - Major contamination issues Open Space & Recreation Strategy (adopted October 2011) This document, which forms part of the technical evidence base for the Local Plan, seeks to ensure that open space supports the development of sustainable communities, and the enhancement of the health and well-being of residents and the biodiversity of the city. The Council is also due to update its Sustainable Design and Construction SPD, which will provide further guidance on policy requirements regarding water conservation measures and water sensitive urban design. The Council has also adopted the Cambridge Sustainable Drainage Design and Adoption Guide, which sets out the Council's requirements for the design of SuDS in public open spaces.	

Section	Amendment	Reason
Appendix A.6	Remove references to 2007 Development Control Policies DPD Reference to Policy HO/1 becomes Policy HQ/1	Factual correction
	~~The 'South Cambridgeshire Development Control Policies Development Plan Document' (DPD) (adopted in July 2007) guides decisions on planning applications within South Cambridgeshire and sets out the Council's planning policies on a wide range of topics, including housing, jobs, services and facilities, travel, the natural environment and the Green Belt. The following planning policies are particularly relevant to this SPD:~~ ~~Policy DP/1: Sustainable Development~~ ~~Policy DP/4: Infrastructure and New Development~~ ~~Policy NE/6: Biodiversity~~ ~~Policy NE/8: Groundwater~~ ~~Policy NE/9: Water and Drainage Infrastructure~~ ~~Policy NE/10: Foul Drainage – Alternative Drainage Systems~~ ~~Policy NE/11: Flood Risk~~ ~~Policy NE/12: Water Conservation~~ ~~South Cambridgeshire District Council is preparing a new Local Plan which once adopted will replace the Development Control Policies DPD. The 'South Cambridgeshire Local Plan'(submitted in March 2014)~~ The South Cambridgeshire Local Plan 2018 sets out how South Cambridgeshire District Council will deliver the levels of employment and housing development that should be provided over the plan period to 2031. The following planning policies are particularly relevant to this SPD: Policy CC/1: Mitigation and Adaptation to Climate Change Policy CC/7: Water Quality Policy CC/8: Sustainable Drainage Systems Policy CC/9: Managing Flood Risk Policy H~~O~~Q/1: Design Principles Policy NH/4: Biodiversity Policy NH/6: Green Infrastructure Policy SC/12: Contaminated Land Policy TI/8: Infrastructure and New Developments	