Appendix 1

Cambridgeshire Flood and Water Supplementary Planning Document
(May 2015)

DRAFT

Contents

Note to the reader:

This Supplementary Planning Document has been prepared in line with the requirements as set out within the Town and Country Planning (Local Planning) (England) regulations, the National Planning Policy Framework, and the National Planning Practice Guidance.

The SPD will be subject to public consultation for a period of six weeks. The consultation for this SPD will run from:

9am on 4 September 2015 to 5 pm on 16 October 2015

Information on how to respond to the consultation is provided separately.

The final version of the SPD will be considered and approved by Members, in each of the Local Planning Authorities within Cambridgeshire (including the County Council). Any changes made to the SPD will reflect some or all of the following:

- **Comments received on this draft SPD during the public consultation;**
- **Any amendments to relevant policies within any proposed or adopted local plans; and**
- **Any government policy changes.**

Once adopted by the relevant Local Planning Authorities, the Flood and Water SPD will be a material consideration in the determination of relevant planning applications. It should be noted that the Local Planning Authorities are likely to adopt the SPD at different times depending on the progress of their Local Plans and adoption processes.

A Sustainability Appraisal and Habitats Regulations Assessment Screening report has been carried out. These documents will be available to view during the public consultation.

An Equalities Impact Assessment has also been undertaken and will be made available during the public consultation.

1 Introduction

1.1 Background

1.1.1 This Supplementary Planning Document (SPD) forms part of each of the Cambridgeshire Local Planning Authority's suite of planning documents. This SPD has been developed by Cambridgeshire County Council (as Lead Local Flood Authority) in conjunction with Local Planning Authorities (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 1. This section summarises the main issues addressed by the SPD. This SPD supplements policies found in:

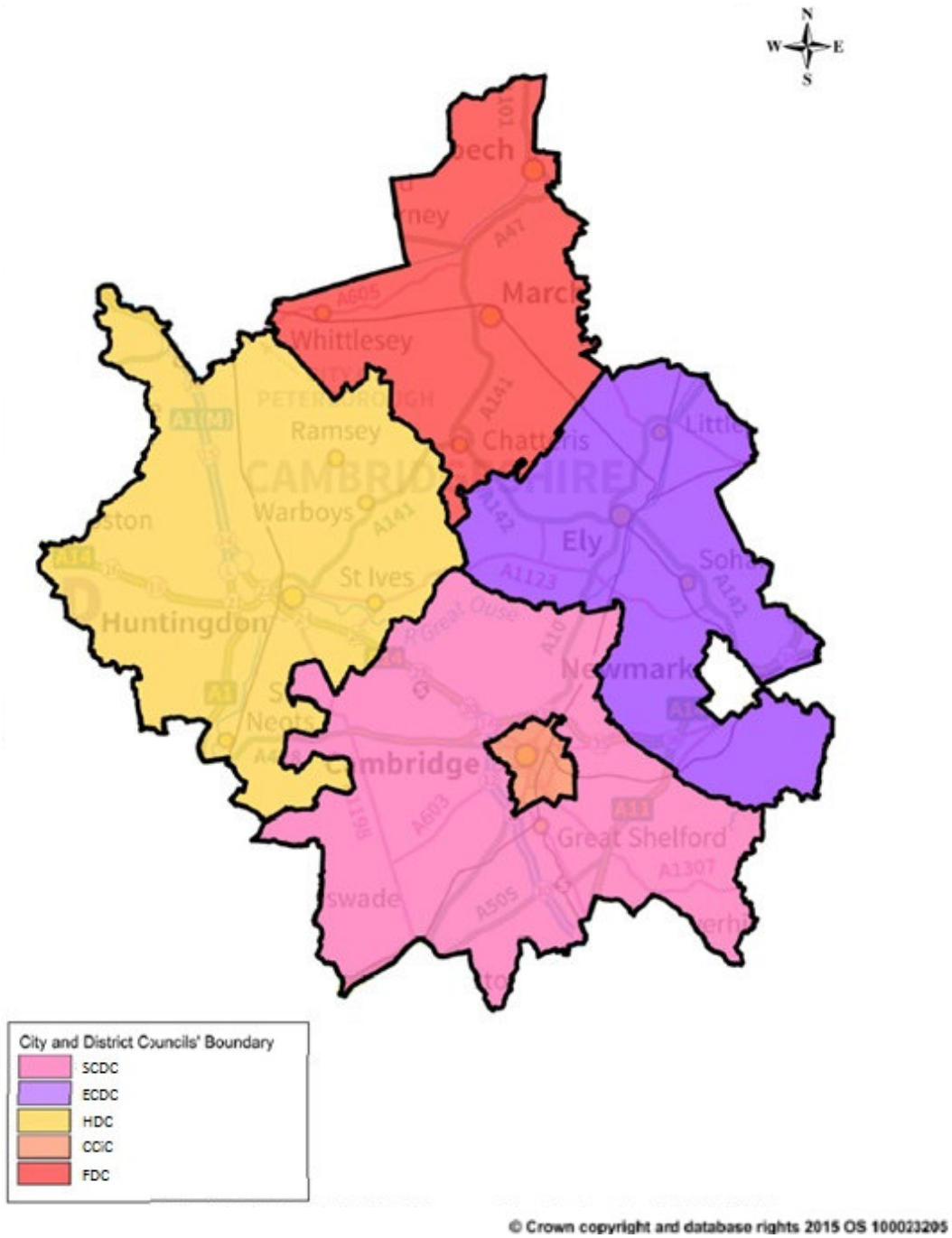
- The Cambridgeshire and Peterborough Minerals and Waste Development Plan
- The Cambridge Local Plan
- The East Cambridgeshire Local Plan
- The Fenland Local Plan
- The Huntingdonshire Core Strategy 2009 and emerging Local Plan
- The South Cambridgeshire Local Plan

1.1.2 This draft SPD is currently a consultation document and following on from the consultation and consideration of representations, the SPD will be adopted by each of the Local Planning Authorities within Cambridgeshire (as listed below). The area that each council covers is highlighted in Figure 1.1.

- Cambridge City Council (CCiC)
- Cambridgeshire County Council (CCC)
- East Cambridgeshire District Council (ECDC)
- Fenland District Council (FDC)
- Huntingdonshire District Council (HDC)
- South Cambridgeshire District Council (SCDC)

1.1.3 When adopted, this document will be 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.

Figure 1.1. Map of City and District Councils boundary area



Why guidance is needed

1.1.4 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 and Drainage strategies (incorporating the approach to surface water drainage)

1.1.5 A significant amount of new developments 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 climate change.

1.1.6 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 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 with Water Management Authorities
Within Chapter 3 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 to Developments and Site Selection
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 (SuDS)
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 water environments must also be protected and improved with regards to water quality, water habitats, geomorphology and biodiversity. Chapter 7 of this document discusses this in more detail.

1.2 How to use this Supplementary Planning Document

1.2.1 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, making recommendations to committees and drawing up S106 obligations that include contributions for Sustainable Drainage Systems (SuDS)

- other interested parties (e.g. Local Members) who wish to better understand the interaction between development, flooding and drainage issues

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 3.

1.2.2 This SPD is set within the context of a water and flood risk management hierarchy (Figure 1.2) 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.

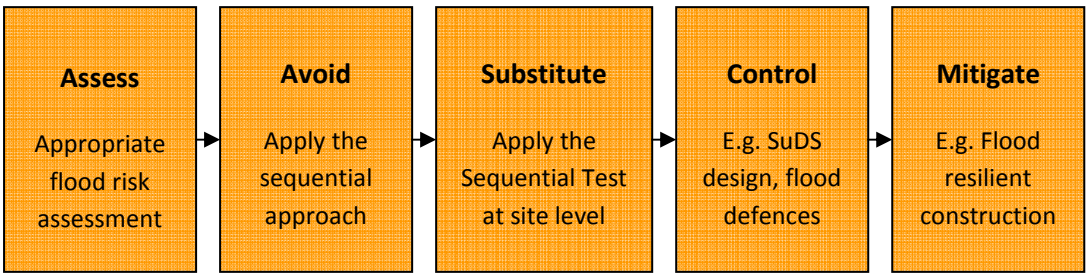


Figure 1.2. The Flood Risk Management Hierarchy

1.2.3 The SPD addresses all the flood and water issues associated with developments within the Cambridgeshire context. 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.

1.2.4 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 and National Planning Practice Guidance) 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 Further details on the WFD can be found under Chapter 7 (Water Environment).

The Floods Directive

2.2.3 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.

2.3 National context

Flood and Water Management Act 2010

2.3.1 The Flood and Water Management Act (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 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 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 applications decisions should ensure that flood risk is not increased and that 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;
- 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 (NPPG) 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.

2.4 Local context

The Environment Agency and Catchment Flood 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 the 'gov.uk' Catchment Flood Management Plan web pages. In addition, the EA have developed an Anglian District River Basin Management Plan (ARBMP) this document identifies the state of, and pressures on, the water environment. The CFMPs and the ARBMP 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

2.4.2 The Local Flood Risk Management Strategy has been developed with members of the Cambridgeshire Flood Risk Management Partnership, for the years 2013 – 2015. The partnership is made up of representatives from Cambridgeshire County Council, city and district councils, the EA,

Anglian Water Services Ltd, Cambridgeshire's Internal Drainage Boards 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

2.4.3 A Strategic Flood Risk Assessment (SFRA) provides the essential information on flood risk, allowing local planning authorities 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 requi4erd 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.

Cambridgeshire Surface Water Management Plans

2.4.4 The Surface Water Management Plan (SWMP) outlines 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

2.4.5 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, with relevant policies on water and flood risk issues (Appendix 1). Local Plans are produced by LPAs and the relevant LPAs and their adopted (including draft) Local Plans are listed within Appendix 1.

Landscape and flood characteristics in Cambridgeshire

2.4.6 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.

2.4.7 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.

2.4.8 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

Chapter 3 provides specific details in relation to the key water management authorities that may need to be consulted by the applicant 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 (WMA) 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 (NPPG) lists the statutory consultees to the planning process. In Cambridgeshire, the local water and sewerage companies (Anglian Water and Cambridge Water) and the Internal Drainage Boards (IDBs) are also key authorities within Cambridgeshire, with equivalent importance as the statutory consultees. Table 3.2 lists all the key WMA that applicants may need to contact during the planning application process. The LPA will consult some of the WMAs as part of the application process. The WMAs are highlighted in Table 3.2. It is important that those proposing new developments actively engage with the relevant authorities.

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 LPAs 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 (PPA) 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.

3.2.4 It is recommended that applicants with large development sites[1] consult with the relevant WMAs prior to the pre-application stage.

Environment Agency

[1] E.g. sites with masterplans, however advice should always be sought from the relevant LPA.

3.2.5 The Environment Agency (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 manages flood risk from main rivers, but 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 with the EA can be found in Chapter 4 and also within their consultation guide, which is available on their website.

Internal Drainage Boards

3.2.6 A large proportion of Cambridgeshire is specially managed by Internal Drainage Boards (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.

3.2.7 IDBs are a type of operating authority established in areas of special drainage needs in England and Wales. IDBs have the permissive powers to maintain the flow of water in ordinary watercourses within drainage districts. They have the power to designate, modify and remove structures and features that affect flooding. They are also responsible for other related issues such as flood protection, water level management and irrigation. A list of the IDBs can be found in Appendix 2.

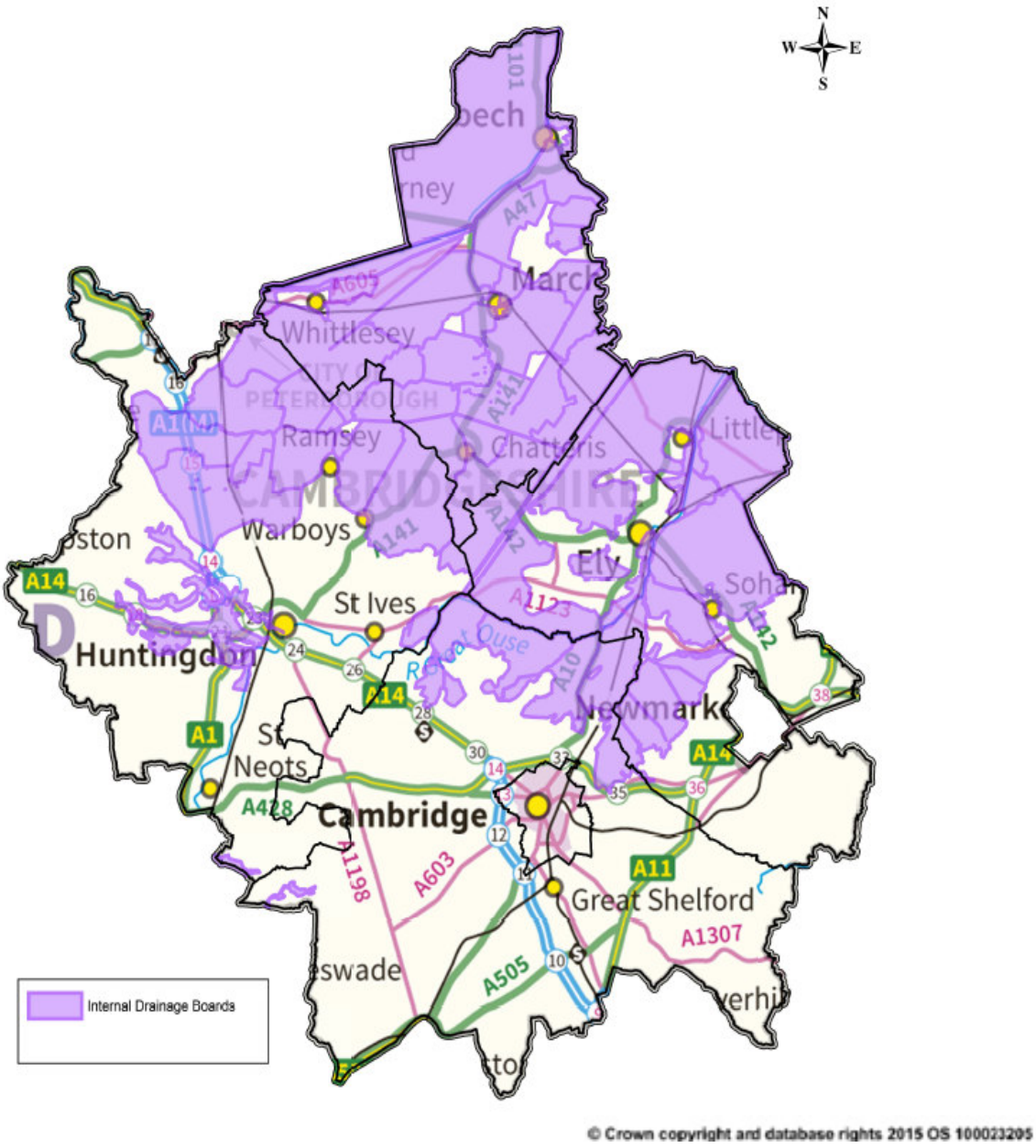
3.2.8 Technically the Middle Level Commissioners (MLC) are not an IDB as they also have navigation duties. For ease of reference within this document the MLC have agreed that the term IDB can be used broadly throughout this document to refer to all of the relevant IDBs under its jurisdiction.

3.2.9 IDBs may have rateable and non-rateable areas within their catchments; this can alter the IDBs' powers, function and duties within the area. It is recommended that applicants contact the relevant IDB to clarify which area a proposed development falls into, and if there is an associated charge.

3.2.10 There are 49 IDBs within Cambridgeshire, Figure 3.1 highlights the area of Cambridgeshire that is covered by IDBs and the areas of high land. 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 and Middle Level Commissioners. The names of the IDB groups covering each district are stated in Appendix 2a.

3.2.11 Appendices 2b – e show the IDB groups for the relevant city and district councils. Detailed information on IDBs' boundaries can be found on their designated websites.

Figure 3.1 – Map of IDBs within Cambridgeshire



Water and wastewater providers

3.2.12 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. It is a statutory requirement to gain consent from Cambridge Water if you are intending to install water systems or make an alteration to existing connections, prior to the commencement of work. Similarly, this advice applies to Anglian Water as it covers water supply outside these areas in Cambridgeshire. Figure 3.2 highlights the water service areas covered by Anglian Water and Cambridge Water.

3.2.13 Anglian Water is also the sewage undertaker in Cambridgeshire and has the responsibility to maintain foul, surface and combined public sewers so that it can effectively drain the area. When flows are proposed to enter public sewers, Anglian Water needs to ensure that the public system has

the capacity to accept these flows. This is assessed when an applicant applies for a sewer connection. Information about Anglian Water's development service is available on their website.

Figure 3.2 - Cambridge Water and Anglian Water coverage

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

Cambridgeshire County Council

3.2.14 One of its key priorities as the LLFA is to manage the risk of flooding from groundwater, surface water and ordinary watercourses.

3.2.15 The County Council also has a strategic leadership role for Risk Management Authorities (RMA). RMAs are defined by the Flood & Water Act 2010 as they have responsibilities for flood risk management. The RMAs have a duty to carry out flood risk management functions in a manner consistent with national and local strategies. The RMAs in Cambridgeshire are highlighted below in Table 3.1.

Flood Sources	EA	LLFA	City and District Council	Anglian Water	Highway Authority	IDB
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	/					

Table 3.1 Relevant flood Risk Management Authorities that will take the lead in managing the risk from various local sources of flooding.

3.2.16 The LLFA also has particular duties to maintain the flow of water in ordinary watercourses that fall outside of an IDB's boundary. The LLFA can delegate the responsibility to the relevant local authority. In such cases it will still remain the role of the LLFA to ensure that its functions are performing correctly.

3.2.17 The County Council 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.

3.2.18 In addition, the County Council 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 3.2.19 – 3.2.21).

City and District Councils

3.2.19 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 in the majority of instances.

3.2.20 The LPA may consult the relevant WMA as part of their planning application assessment. It is still however the responsibility of the applicant to ensure that the relevant WMA has been consulted.

3.2.21 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.

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.	✓	✓	✓	✓	✓	✓
Highways Agency	When the quality and capacity of the Highways Agency (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.	✓	✓	✓	✓	✓	✓

		CCC	CCiC	ECDC	FDC	HDC	SCDC
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.	✓	✓	✓	✓	✓	✓
Anglian Water	Where connection to surface water sewers is required or where the flow to public sewerage system may be affected.	✓	✓	✓	✓	✓	✓
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 2)	✓	-	-	✓	-	-
Haddenham Level Drainage Commissioners		✓	-	✓	-	-	✓
Ramsey IDB		✓	-	-	-	✓	-
Whittlesey Consortium of IDBs		✓	-	-	✓	✓	-
Bedford Group of IDBs		✓	-	-	-	✓	-
Ely Group of IDBS		✓	-	✓	-	-	✓
IDBs represented by Middle Level Commissioners		✓	-	✓	✓	✓	✓

Table 3.2 Simplified table of key water management authorities that may need to be consulted during the planning application process on flood and water matters

4. Guidance on managing flood risk to developments and site selection

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 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

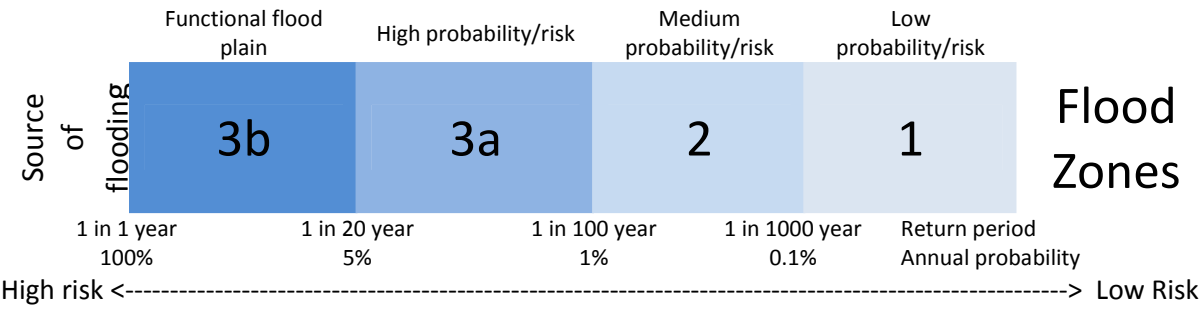
4.1.2 Flood risk is categorised by the likelihood of flooding. If flooding is likely to occur on a regular basis then the risk is categorised as being 'high'. If flooding is less likely to occur then the risk is categorised as being 'low'.

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

- As a percentage chance of flooding each year. For example, 1% chance of flooding each year or 5% chance of flooding each year.
- As a 'return period'. This is an expression of how often that type of flood event is likely to happen or 'return'. For example, a 1 in 100 year flood is an extreme flood that is only expected on average to happen once every one hundred years whereas a 1 in 5 year flood is a smaller flood that on average is only expected to happen once every five years.

4.1.4 There is a move away from using return periods as an expression of flood risk as this approach does not accurately express the risk of flooding as there is a chance each year of a 1 in 100 year flood happening (a 1% chance) and just because one has happened recently does not mean it will not happen again for another 100 years. 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:



4.1.6 Maps showing Flood Zones are available on the Environment Agency's website. The Flood Zones refer to the probability of river and sea flooding, ignoring the presence of defences. Below is a table of the Flood Zones and their definitions taken from the NPPG.

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. Local planning authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency. (Not separately distinguished from Zone 3a on the Flood Map)

Table 4.1 Flood Zone and Flood Risk Tables
(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 sustainable in the long run, 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.

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 at section 4.4.

4.2 Flood risk and planning

The approach to flood risk in planning

The general approach (i.e. the sequential approach) 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.

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 National Planning Practice Guidance (NPPG).

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

4.2.1 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 section 4.5 below). Table 4.2 (within section 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

4.2.2 Local Planning Authorities are required to prepare Strategic Flood Risk Assessments (SFRAs) when preparing a Local Plan. These assess the risk to the area from flooding from all sources, now and in the future, taking account of the impacts of climate change. They are based on all available flood risk information at the time of preparation. SFRAs should be used by developers to inform site selection (see step 1 below) and provide high level information for the SFRAs (see step 4 below).

4.3 Site suitability and flood risk considerations for planning applications

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 flood risk 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.

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).

4.3.1 The following sets out the steps (steps 1 – 7) that should be taken when determining if a site is suitable for development when considering flood risk and also the considerations for making a planning application. The steps are briefly described as follows:

- **Step 1** - consider allocations within the relevant local/development plan, including information contained within associated SFRAs,
- **Step 2** - consider flood risk (e.g. flood zones and sources of flood risk),
- **Step 3** - Undertake pre-application consultation with the relevant LPA and appropriate water management authorities,
- **Step 4** - undertaking a Site Specific flood Risk Assessment,
- **Step 5** - undertake further pre-application discussions with the relevant authorities once Flood Risk Assessment has been completed,
- **Step 6** - prepare a Surface Water Drainage Strategy ensuring its consistent with the Flood Risk Assessment, and
- **Step 7** - submit the planning application.

4.3.2 All requirements are consistent with the NPPF and NPPG, with local requirements explained further. Reference should also be made to the developer checklist provided at Appendix 3, which should be submitted with planning applications alongside other relevant up to date available 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

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) remains unchanged?

Developers 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.

If yes go to Step 3. The sequential and exception tests do not need to be completed.
If no proceed to Step 2.

4.3.3 If the site has been specifically allocated in the relevant local plan/development plan for the same land use type 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. However there are situations where there may have been a material change in the flood zoning of the site since the adoption of the relevant part of the local plan/development plan (the Environment Agency refines flood zones on a regular basis). The site must therefore also pass part b) within Step 1. For example, the site may have changed, in whole or part, from one flood zone to another. If this has occurred, and the site has moved to a higher risk zone (e.g. from Flood Zone 1 to Flood Zone 2), it will be necessary to demonstrate that the proposed development passes the Sequential Test.

Step 2

Is the site:
a) In Flood Zone 2 or 3?
b) In Flood Zone 1 and in an area that has been identified in the relevant SFRA for the area, or any updated available information, as having flooding issues now or in the future (for example, through the impact 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 of the sequential test explained below for details)?

If yes to any of the above questions, the Sequential Test is required to be undertaken by the developer and the results submitted to the LPA for assessment.

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, as explained in paragraph 4.3.2); or
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).

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 How **applicants** should undertake the Sequential Test for assessment by the LPA is set out below. 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 it with 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 both 'deliverable' and 'developable' as defined by the NPPF.

These will be identified from a number of sources depending on the sizes of the site including:

- Local Plan documents;
- 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 of comparable size in that it can accommodate the requirements of the proposed development;
- The site is not safeguarded in the relevant Local Plan for another use;
- It does not conflict with any other criteria or policies in the relevant local plan.

Sites are not considered to be reasonably available if they fail to meet any of the above requirements or already have planning permission for a development that is likely to be implemented.

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 Environment Agency's Flood Zone Maps for Planning (River and Seas);
- The Flood Map for Surface Water (Environment Agency);
- 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 (specific to Fenland District Council);
- Any other source of locally known flood risk to the flood risk management authorities; 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 that have a lower flood risk?

Or is there a constraint on delivery of that site? This could include:

- Local Plan status
- Capacity
- Availability
- Policy restrictions
- Physical problems or limitations
- Potential impacts of the development
- Future environmental conditions that would be experienced by the inhabitants of the development

The presence of existing defences should not be taken into consideration when undertaking the Sequential Test to steer development within Flood Zone 1. 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 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 undertake a site specific flood risk assessment (FRA).

4.5 The Exception Test

4.5.1 As explained within paragraph 102 of the NPPF, the Exception Test is for sites where completing the Sequential Test has found no reasonably available alternative sites and the site of the proposed development is in Flood Zones 2 and 3.

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

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.

Table 4.2 Flood risk vulnerability and flood zone compatibility
(*source: Table 2: Flood Risk Vulnerability Classification, National Planning Practice Guidance*)

4.5.3 Using the tables above and below, 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.

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	✓	✘	Exception Test	✓

	required			required	
Zone 3b 'functional flood plain'	Exception Test required	✓	✗	✗	✗
Key: ✓= Development may be appropriate ✗=Development should not be permitted					

Table 4.3 Flood risk vulnerability and flood zone compatibility
(*Source: Table 3: Flood risk vulnerability and flood zone 'compatibility, National Planning Practice Guidance*)

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 year) 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 year) in some locations. This will be defined in the SFRA for the area.

4.5.5 However, table 4.3 cannot 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 ✓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.

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

(Source: Paragraph 102, National Planning Policy Framework)

4.5.7 It will be **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 cultural heritage

- Climate change mitigation and renewable energy
- Flood Risk and climate change adaptation
- Pollution
- Healthy, inclusive and accessible communities
- Economic activity
- Transport

4.5.9 Any development undertaking the Exception Test should demonstrate the sustainability issue that the proposals are seeking to address. The general provision of housing by itself would not normally be considered a wider sustainability benefit to the community which would outweigh flood risk. However, the provision of affordable housing might be appropriate if a specific identified need can be established in the settlement or other area of search for the proposed development.

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 a park, community centre, cycle ways/ footways or other infrastructure which allow the community to function in a sustainable way.

Step 3

Undertake pre-application consultation with the relevant LPA and appropriate water management authorities.

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 water management authorities. Chapter 3 provides more details on this.

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.

Meaningful pre-application discussions with water management authorities such as the Environment Agency, Cambridgeshire County Council as the Lead Local Flood Authority, IDBs and Anglian Water 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 sustainable drainage components used?
d) How the site can meet national and local sustainable drainage standards?
e) Is a site specific flood risk assessment required? If so, what is the scope of an appropriate site specific flood risk assessment?
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 water management authority;
h) Obtain any relevant data needed in order to prepare the site specific flood risk assessment

and drainage strategy.

4.6 Site specific flood risk assessments (FRAs)

Step 4

A 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 Environment Agency); 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) (see section 4.6.1 for more information);
2) Where the site is intended to discharge to the catchment or assets of a water management authority which requires a site specific flood risk assessment;
3) Where the site's drainage system meets the criteria of the Middle Level Commissioners (as listed in section 4.6.3);
4) 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.

4.6.1 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 Environment Agency'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 sometimes 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). Advice should be sought from the Environment Agency if further explanation is required on this point.

4.6.2 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. The areas that are served by an IDB may require permission through byelaws under the Land Drainage Act 1991[2]. This is in addition to, and separate from, planning permission and has a separate approval process. However, FRAs for planning

[2] Land Drainage Act 1991 stipulates the relevant drainage districts powers and duties.

applications 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.

4.6.3 A development proposal meeting the following criteria is required to submit a FRA to the Middle Level Commissioners:

- development being either within or adjacent to a drain/watercourse, and/or other flood defence structure within the area of an IDB overseen by Middle Level Commissioners;
- development being within the channel of any ordinary watercourse within the Middle Level Commissioner's area;
- where a direct discharge of surface water or treated effluent is proposed into the Middle Level Commissioners' catchment;
- for any development proposal affecting more than one watercourse in the Middle Level Commissioner's area and having possible strategic implications);
- in an area of known actual flood risk within the Middle Level Commissioner's area;
- development being within the maintenance access strips provided under the Middle Level Commissioners' Byelaws;
- any other application that, in the opinion of the Middle Level Commissioners' Chief Engineer, has material drainage implications.

4.6.4 It must be demonstrated using an FRA that there is a viable scheme which meets the Middle Level Commissioners requirements. The above criteria are also likely to be applicable to other IDBs within the Cambridgeshire catchment.

4.7 Contents of a FRA

4.7.1 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 flood risk assessment, as early as possible in preparing the development proposal.

4.7.2 The box below sets out the requirements of a FRA, with the FRA checklist in Appendix 3 detailing what information should be contained within it.

FRAs should:

a) 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;
b) **be proportionate** to the risk and appropriate to the scale, nature and location of the development;
c) 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;
d) take the impacts of **climate change** into account;
e) 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;
f) 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;
g) 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;
h) 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 (Cambridgeshire County Council), the Environment Agency and the LPA;
i) identify relevant **flood risk reduction measures** for all sources of flood risk;
j) 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;
k) 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;
l) be supported by appropriate **evidence data** and information, including historical information on previous events.

4.7.3 It should be noted that even if the proposed development passes the Sequential and Exception Tests, there may be other material planning considerations that would mean that the proposed development would be inappropriate. Likewise, if it is not possible to design a new development which is safe and which does not increase flood risk elsewhere, then it is unlikely that development will be permitted. Therefore discussions with the LPA and other water management authorities are encouraged before a planning application is made.

Step 5

a) Undertake further pre-application discussions with the local planning authority and the water management authorities relating to the contents of the FRA and initial surface water drainage proposals.

b) The aim of continued consultation throughout the pre-application process will ensure that the water management proposals that are finally submitted to the LPA are acceptable to all parties.

4.8 Preparation of a surface water drainage strategy

4.8.1 A surface water drainage strategy contains the proposals for the surface water drainage of the development. Initial proposals that are sufficient to demonstrate a scheme can be delivered that will adequately drain the development proposed whilst not increasing flood risk elsewhere and are in accordance with the requirements of relevant water management authorities should be included within the site specific flood risk assessment.

4.8.2 If an outline application is to be submitted for a major development then a conceptual 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 conceptual surface water drainage strategy.

Step 6

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 water management sub-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

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 7** to support this process.

Step 7

Submit the 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 flood risk assessment, and a surface water drainage strategy, can be submitted. This will be formally reviewed by the LPA in consultation with the relevant water management authorities as outlined in **Chapter 3**. All relevant authorities and consultee comments are taken into consideration in the determination of the planning application.

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). Water management authorities 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 Step 4 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 and the relevant IDB (if applicable).

5.1.4 Breach modelling may be appropriate for certain areas of Cambridgeshire. There are two types of breach modelling:

- **Instantaneous breach:** the maximum extent of one or more breaches. This information is required by the Environment Agency 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 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 Environment Agency should be contacted to find out if any more recent data is available for this or other defended locations.

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 (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 flood risk assessment, the sensitivity ranges in the table below provide an appropriate precautionary response to the uncertainty about climate change impacts on rainfall intensities, and river flow.

Parameter	1990 to 2025	2025 to 2055	2055 to 2085	2085 to 2115
Peak rainfall intensity	+5%	+10%	+20%	+30%
Peak River Flow	+10%	+20%		

Table 5.1: Recommended national precautionary sensitivity ranges for peak rainfall intensities and peak river flows[3]

Notes to table 5.1:

a. For deriving peak rainfall, for example, (i) between 2025 and 2055 multiply the rainfall measurement (in mm per hour) by 10 per cent and (ii) between 2055 and 2085 multiply the rainfall measurement by 20%. So, if there is a 10mm per hour event, for the 2025 to 2055 period this would equate to 11mm per hour; and for the 2055 to 2085 period, this would equate to 12mm per hour. Other parameters in table 5.1 are treated similarly.

b. 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.

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 design calculations.

5.1.9 The Environment Agency has produced a sensitivity test for the development of flood maps by using the 20% allowance for peak flows between 2025 to 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 depth of flooding under the same allowance will 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 4.2) in future could be re-classified as lying within a higher risk zone (for example, for Flood Zone 3a see Table 4.2), which could have implications for the type of development being proposed. It is therefore important that applicants refer to the current flood map[4] and the LPA's SFRA when preparing and considering proposals.

[3] Source: *(Source:* Department for Environment, Food and Rural Affairs FCDPAG3 Economic Appraisal Supplementary Note to Operating Authorities – Climate Change Impacts, October 2006)

[4] Environment Agency Flood Map for Planning (Rivers and Sea)

Site layout

5.1.10 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 SuDS (see Chapter 6). 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).

5.1.11 The inclusion of good quality green infrastructure 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.

5.1.12 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 can 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.

5.1.13 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 paragraph 5.2.9 on flood resilience).

5.1.14 The following three examples are of developments that integrate flood risk management into the development master plan. All of these measures may not be appropriate in all locations and further details of each development, including costing can be found in the LifE Project – Long-term Initiatives for Flood-risk Environments publication EP98[5].

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[5] Long-term Initiatives for Flood-risk Environments publication EP98IHS BRE Press. http://www.baca.uk.com

Figure 5.1 - Upper river catchment development ©BACA Architects

For 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.

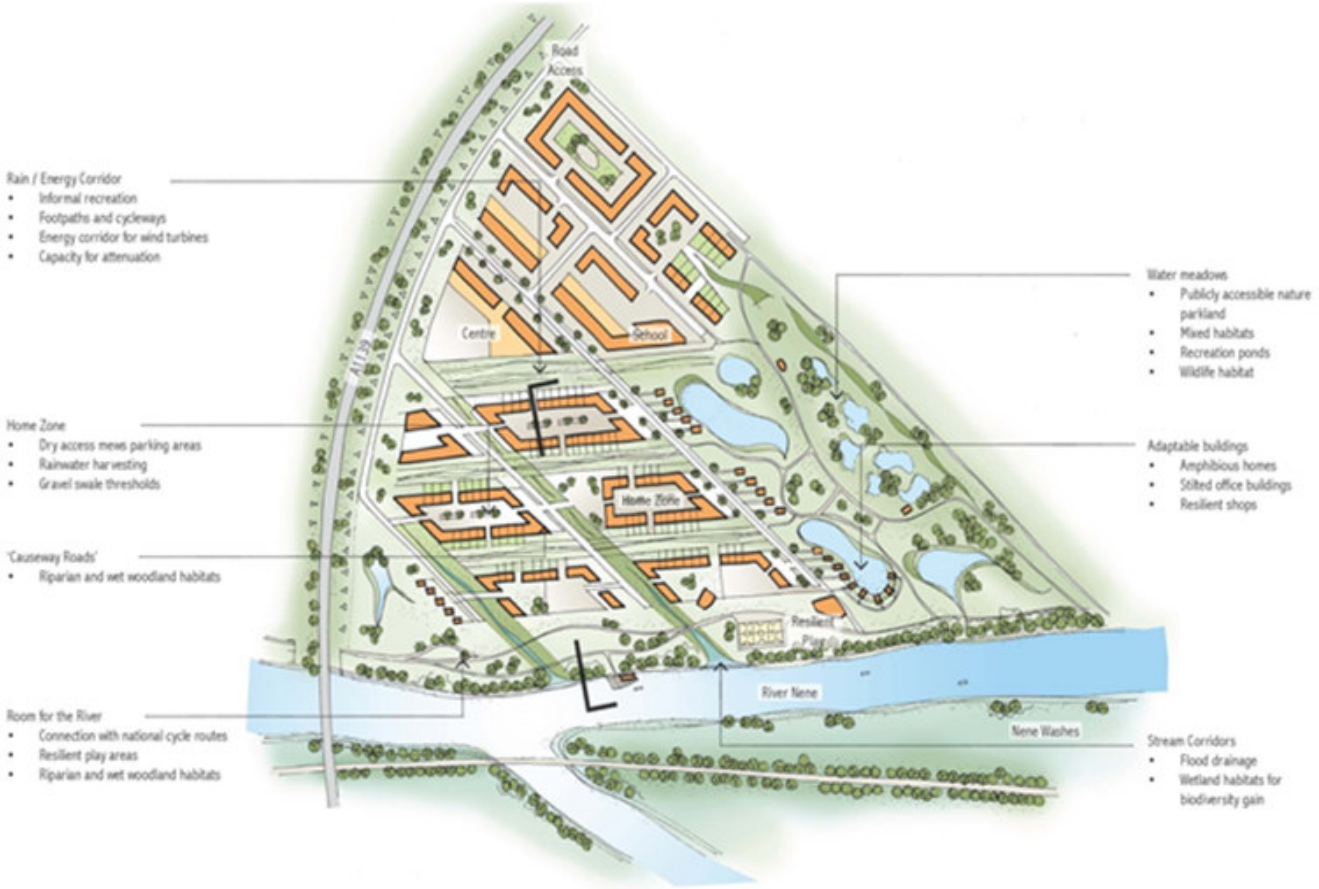


Figure 5.2 - Middle river catchment development ©BACA Architects

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.

river.

Figure 5.2 - Middle river catchment development ©BACA Architects

Figure 5.3 - Lower river catchment development ©BACA Architects

In Figure 5.3 the main objective was 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.

5.1.15 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.

5.1.16 The use of sustainable drainage systems 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 are (see section 6.4).

Raising floor levels

5.1.17 Where it is not possible to avoid flood risk or minimise it through site layout, raising floor levels above the predicted flood level with an allowance for the life time of the development (climate change allowance) 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 exit 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.

5.1.18 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.

5.1.19 Raising floor levels can have an adverse impact on the street scene as building and feature heights will increase and there may be implications for access ramps for wheelchairs. It 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/screens.

5.1.20 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. It is important that the design will ensure that safe access and escape will always be available and this will be an essential part of the ongoing maintenance and legal agreements for the development.

5.1.21 An alternative could include the placing of parking (see paragraph 5.1.16) 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.

5.1.22 Single storey residential development is 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 in 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

Wisbech or other areas of extensive floodplain (as agreed by the relevant LPA in advance), 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 openable roof light windows or similar.

5.1.23 Change of use from commercial to residential that results in proposed ground floor flats in Flood Zone 3 is not acceptable even with the use of flood proofing measures to mitigate the flood risk. Sleeping accommodation on the ground floor that relies on flood warnings and the implementation of flood proofing measures is hazardous.

5.1.24 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. This is generally only applicable on smaller development sites or for a small portion of the developable site area.

5.1.25 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 Environment Agency 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.

5.1.26 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 (especially to life). Consultation should be undertaken with flood risk authorities (for example the EA or LLFA) to determine what type of flood compensation or other mitigating actions would be appropriate.

New flood defences

5.1.27 The construction of new flood risk defences to enable development to take place needs to be very carefully considered with the LPA, the Environment Agency and the relevant IDB. New defences create new residual risks that can take significant investment to fully understand and plan. Water management authorities 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 Environment Agency to adopt flood defences directly.

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 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.

5.2.6 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.

5.2.7 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.

Photo 5.1 - Reinforced concrete flood resistant wall faced with local stone © Robin Stott

5.2.8 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.

5.2.9 There are two main strategies for flood resilience:

- 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 0.3m). 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).

5.2.10 The following general advice has been taken from Improving the Flood Performance of New Buildings (CLG, 2007) and further details can be found within that document.

Building materials

5.2.11 The main principle of flood resilience is to use materials that are compatible with coming into contact with floodwater. In Table 5.4 below various building materials have been tested to understand their resilience characteristics. The use of external materials will need to be considered alongside other planning requirements such as visual amenity and heritage factors.

Material	Resilience characteristics*		
	Water penetration	Drying ability	Retention of pre-flood dimensions, integrity
Bricks			
Engineering bricks (Classes A and B)	Good	Good	Good
Facing bricks (pressed)	Medium	Medium	Good
Facing bricks (handmade)	Poor	Poor	Poor
Blocks			
Concrete (3.5N, 7N)	Poor	Medium	Good
Aircrete	Medium	Poor	Good
Cavity insulation			
Mineral fibre	Poor	Poor	Poor
Blown-in expanded mica	Poor	Poor	Poor
Rigid PU foam	Medium	Medium	Good
Timber Board			
OSB2, 11mm thick	Medium	Poor	Poor
OSB3, 18mm thick	Medium	Poor	Poor
Gypsum plasterboard			

Gypsum plasterboard, 9mm thick	Poor	Not Assessed	Poor
Mortars			
Below d.p.c. 1:3 (cement:sand)	Good	Good	Good
Above d.p.c. 1:6 (cement:sand)	Good	Good	Good
Renders/Plasters			
Cement render - external	Good	Good	Good
Cement/lime render - external	Good	Good	Good
Lime plaster (young)	Poor	Not Assessed	Poor
* Resilience characteristics are related to the testing carried out and exclude aspects such as ability to withstand freeze/thaw cycles, cleanability and mould growth			

Table 5.4 - Flood resilience characteristics of building materials, taken from Flood Resilient Construction (CLG, 2007)

Building components and flood resilience

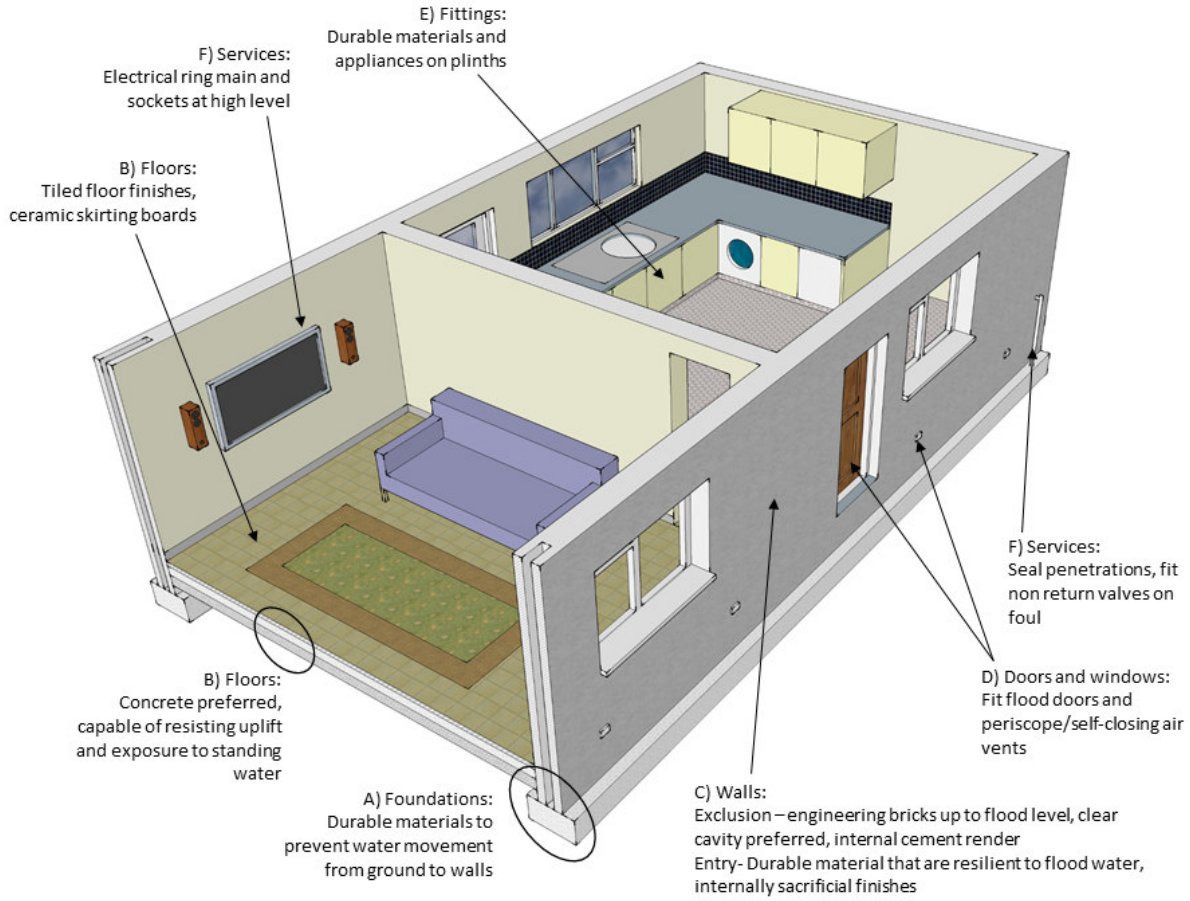


Figure 5.5 - Flood resilient measures

5.2.12 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 4.

5.2.13 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.

5.2.14 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.

5.2.15 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.

5.2.16 The areas of Cambridgeshire covered by the Environment Agency's flood warning scheme can be viewed on the Agency'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 Environment Agency's scheme also 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 sustainable drainage systems can be incorporated into the overall design of your proposal. Within Cambridgeshire the aim is to achieve the design and delivery of high quality sustainable drainage that complement the urban and rural landscapes of the county and which:

- **Effectively manage water (both quantity and quality – see also Chapter 7);**
- **Are aesthetically pleasing;**
- **Conserve, accommodate and enhance biodiversity; and**
- **Provide amenity for local residents (ensuring a safe environment – see section 6.7).**

6.1 Introduction

6.1.1 Sustainable Drainage Systems (SuDS) provide an opportunity to re-create natural drainage systems by retaining and managing water on the surface, and integrating water management with urban form to create and enhance the public realm, streets and open spaces that we all value.

6.1.2 SuDS generally replace traditional underground, piped systems that gather runoff using grates or storm water drains. SuDS control flows to prevent deluges during times of high rainfall and reduce the risk of flooding. 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. Residents local to the system can benefit from safe access to water that can enrich their environment. Additionally, developers benefit from this environmental improvement by constructing highly desirable, affordable and saleable commercial and residential properties.

6.1.4 This chapter presents information for designing water sensitive developments. It provides the first stepping stone for any SuDS designer, communicating a landscape background to create a successful system. 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 The SuDS Manual (CIRIA, C697).

6.1.5 Reference is made to SuDS throughout this chapter, rather than surface water drainage as both the NPPF 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.

6.1.6 Organisations such as British Standards, CIRIA 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 LPA and the relevant water management authorities.

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 600 mm 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. Equally, infiltration to re-charge local groundwater supplies is important due to the low rainfall conditions in Cambridgeshire and therefore SuDS should aim to use infiltration wherever it is achievable and acceptable.

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 in the Cambridgeshire area to prevent flooding. However, surface water flooding is also considered a key issue in the county with an estimated 23,100 homes at risk from this type of flooding. As such, SuDS are an important component to reducing surface water runoff and mitigating flood risk. However 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 strategy's 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.

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. Through careful design, SuDS can respect, enhance and connect local habitats and support biodiversity and green infrastructure in Cambridgeshire. This is primarily through the creation of rough grasslands, wetland meadows, aquatic planting and open water. One of the main risks to biodiversity in the area 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.

6.2.7 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

6.2.8 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.

6.2.9 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

6.2.10 Historically, some areas in Cambridgeshire have comprised 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 replace some of this lost landscape and habitats.

6.2.11 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.

6.2.12 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.

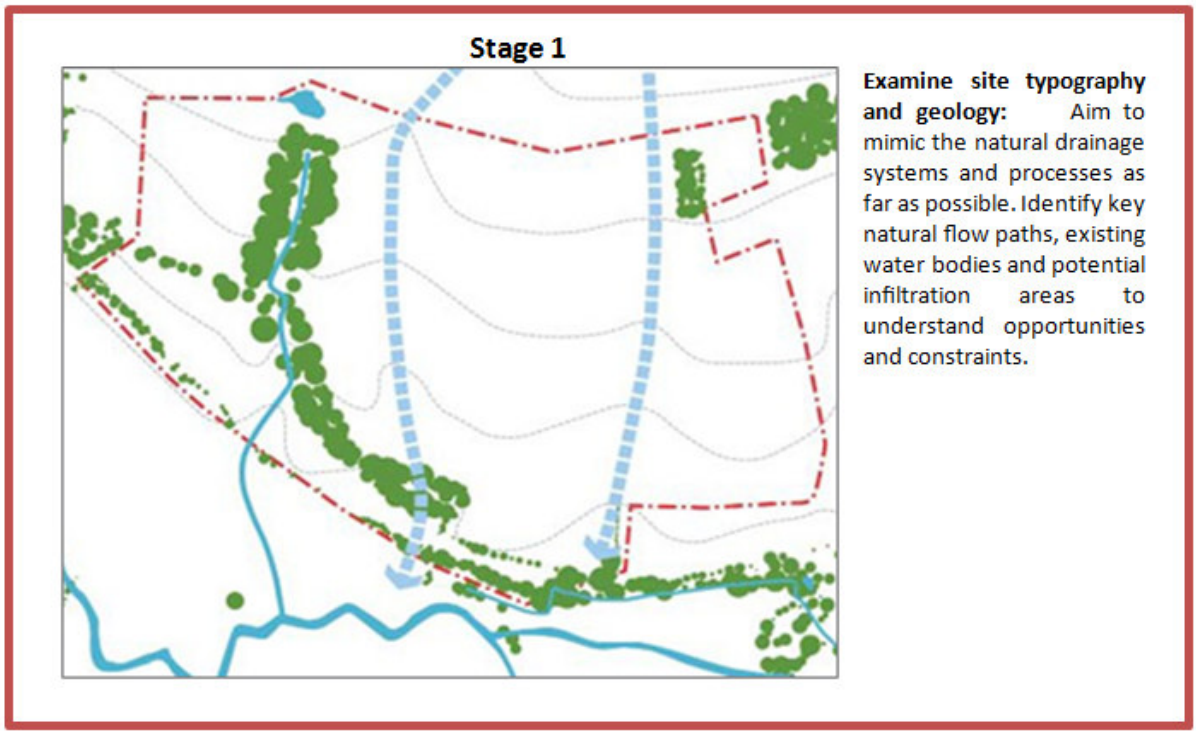
Designing SuDS

6.2.13 Designing SuDS effectively requires the right team with the relevant skills. SuDS in Cambridgeshire should be designed by a competent design team that includes all of the relevant skill sets to create a successful design, often with cost savings where multiple benefits such as improved open spaces and drainage can function in one area.

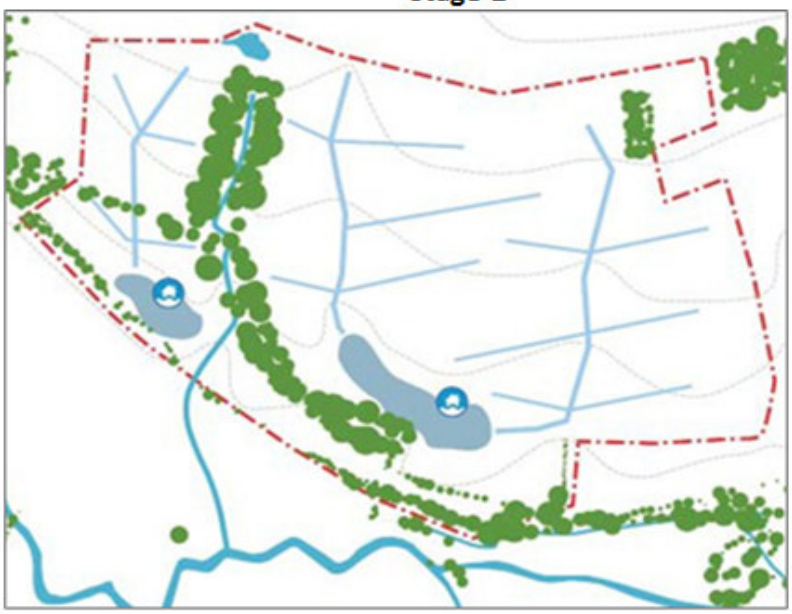
6.3 Cambridgeshire SuDS Design Principles

Plan in SuDS from the start

6.3.1 A SuDS scheme operates best when considered early in the site masterplan or layout plan. 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. Land uses can also be clustered and phased considering SuDS design. This can help ensure an effective network of SuDS features is included to provide suitable attenuation and water treatment. The result is a more effective and efficient plan which will avoid the need for changes at a later stage and prevent costs escalating. The stages in Figure 6.1 show how a design can integrate SuDS spatially through the evolution of a masterplanning exercise. Please refer to the key at the end of Figure 6.1 when viewing the information for each stage.



Stage 2



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.

Stage 3

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. SuDS must be situated outside of flood zones 3a and 3b.

Stage 4

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.

Stage 5

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.

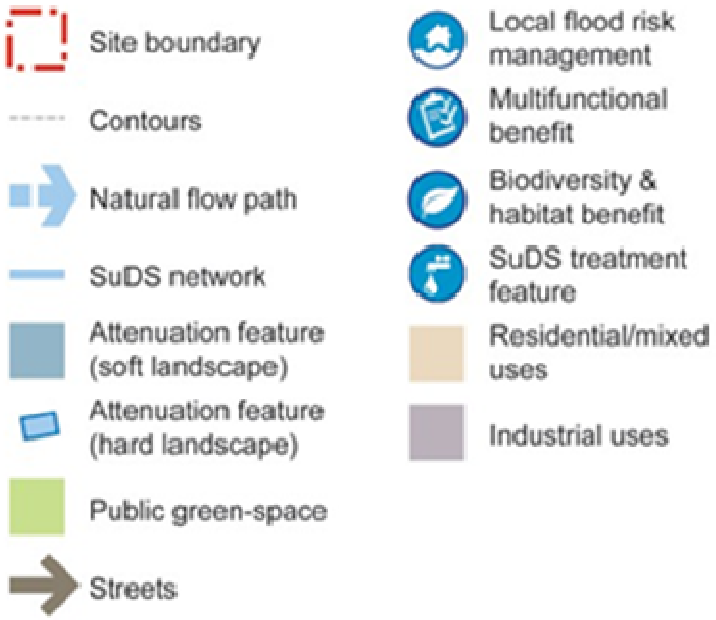


Figure 6.1 – Integrating SuDS spatially across a site (courtesy of CIRIA)

Mimic natural drainage

6.3.2 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 movements 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.

6.3.3 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. For example the IDB may stipulate its rates of discharge for developments within its areas and the lead local flood authority or local planning authority may stipulate an acceptable discharge rate outside of these areas.

6.3.4 Brownfield or previously developed 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 from the development. Note that in some parts of Cambridgeshire there is specific policy requirements related to acceptable runoff rates for brownfield sites set out in Local Plans.

6.3.5 Figure 6.2 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.

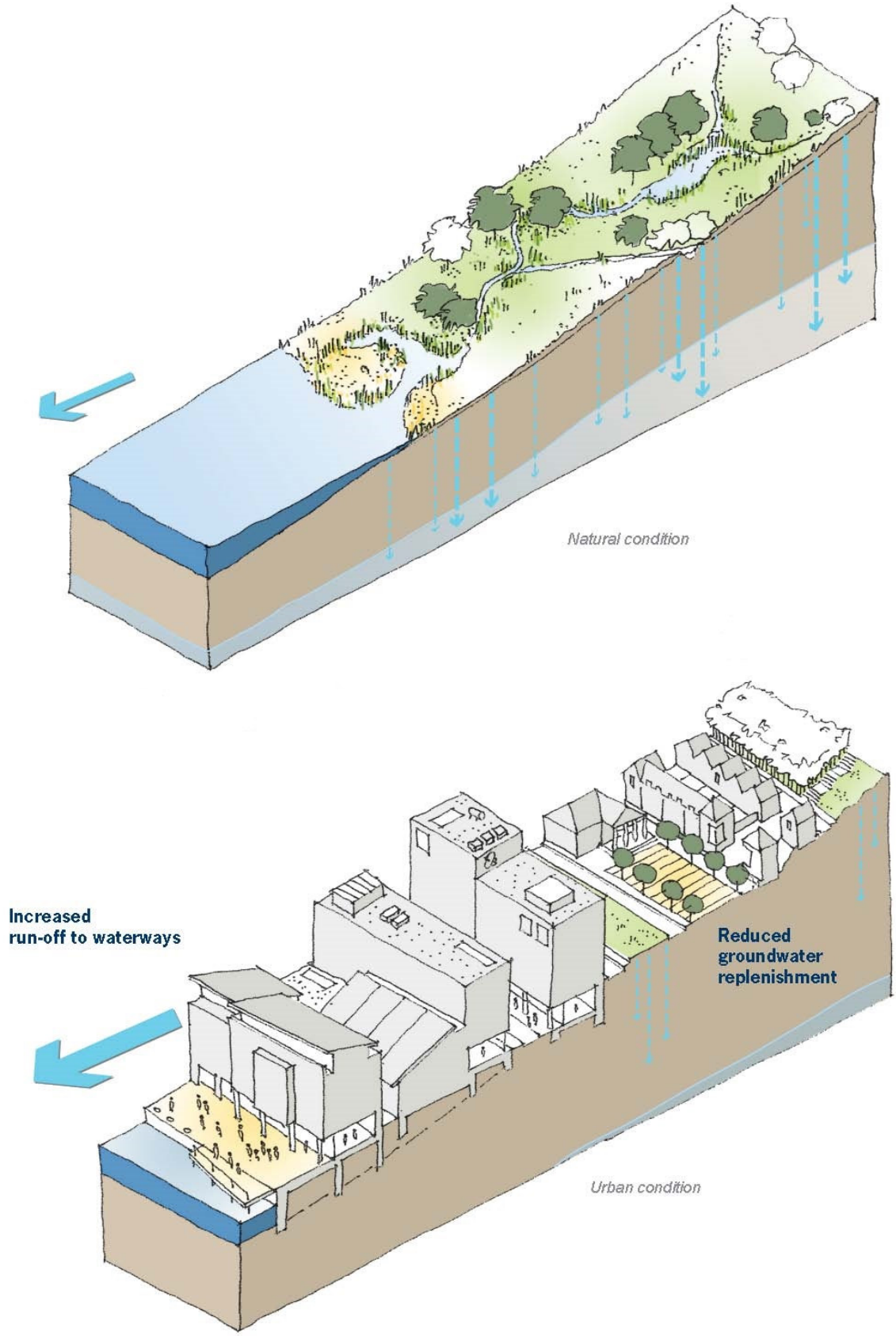


Figure 6.2: Difference between natural landscape and urban drainage (courtesy of CIRIA)

SuDS management train

6.3.6 SuDS should not be thought of as individual features, but as an interconnected network of surface water management initiatives. The SuDS 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, and green roofs. Once surface water runoff from a site has been minimised, site control initiatives, which collect and treat water for a collection of properties should be considered. Site-wide SuDS may include swales, ponds and wetlands, which work to slow the conveyance of water off the site and provide secondary stages of treatment. Regional controls are larger in scale and may be implemented in large sites, or by third parties as part of catchment wide initiatives, and may include retention ponds, wetlands and infiltration basins. Figure 6.3 below portrays this management train.

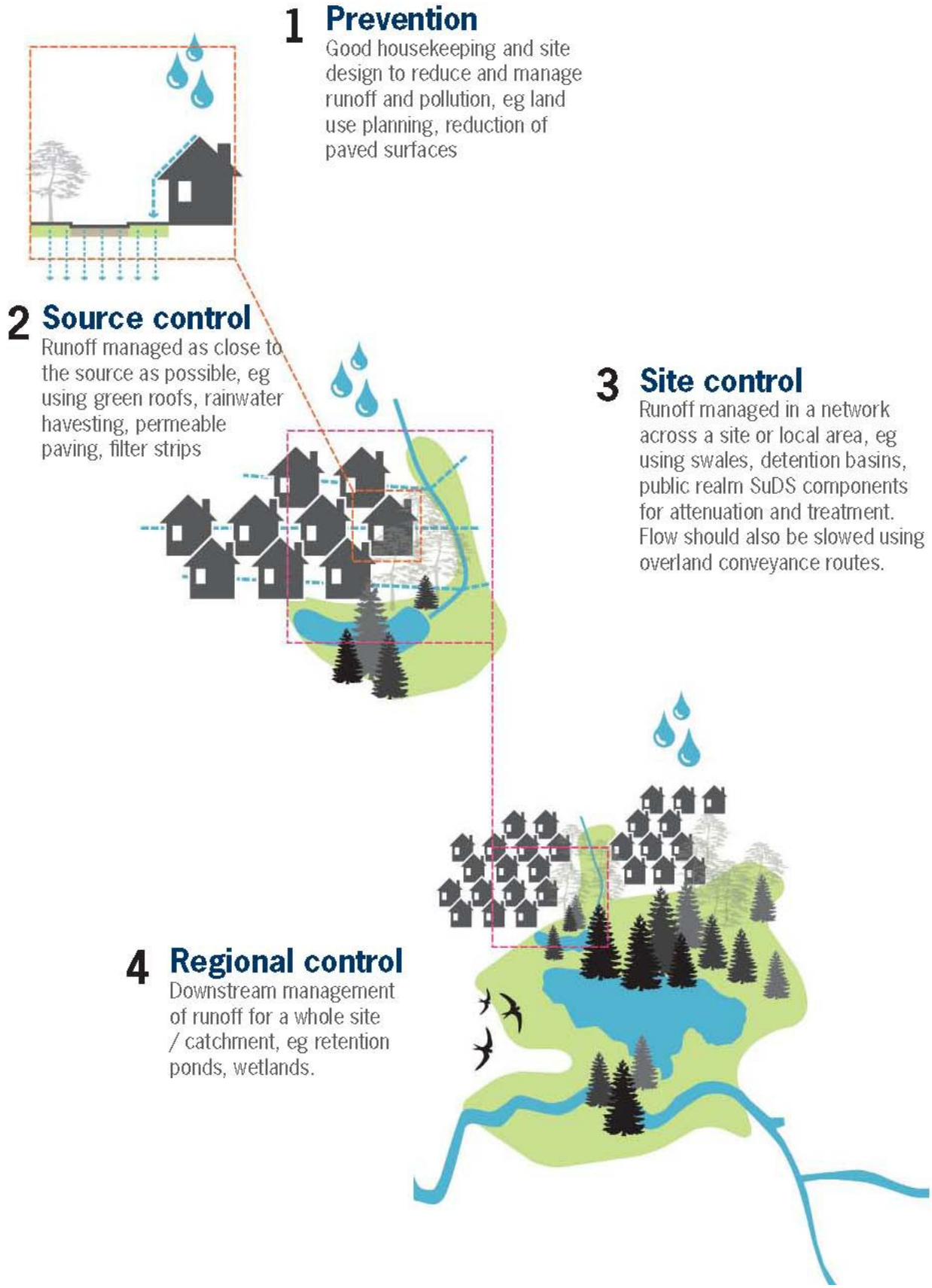


Figure 6.3 - SuDS Management Train (courtesy of CIRIA)

Water reuse first

6.3.7 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. Rainwater can be directly collected from the roof and 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 the rain garden shown in Figure 6.4, before storing it for surrounding buildings or irrigation systems to reuse. Existing and emerging Local Plans provide planning policies in relation to this.

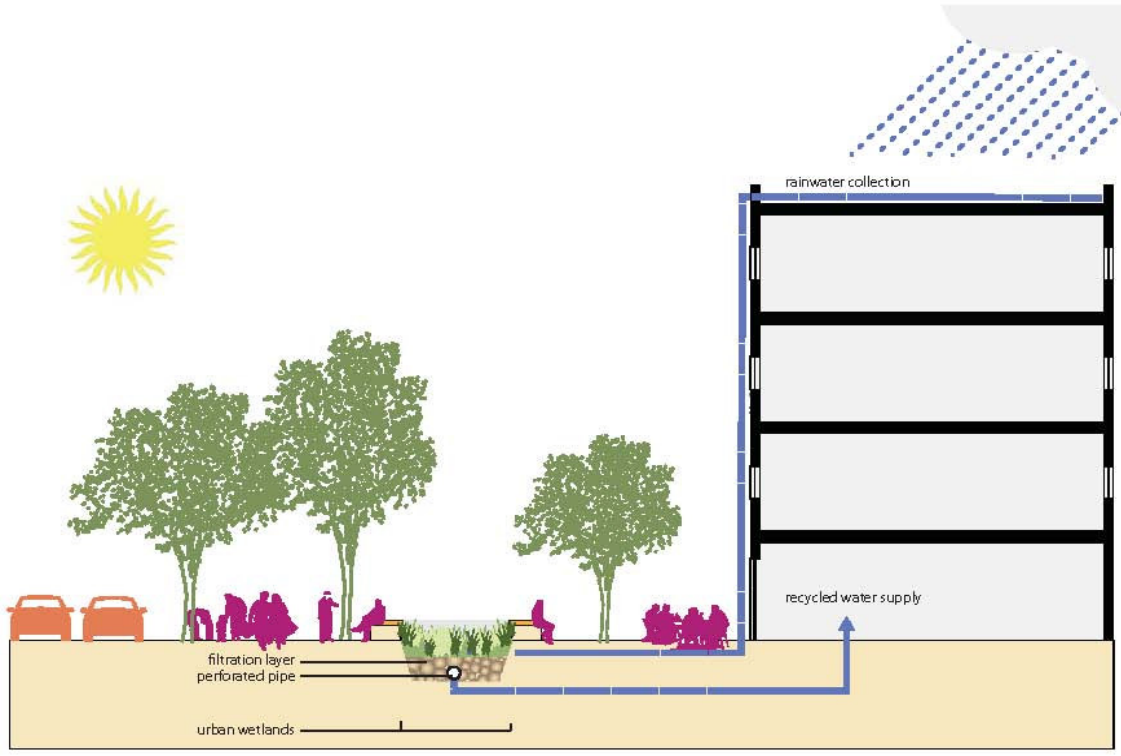


Figure 6.4 - Water reuse in the form of a rain garden (courtesy of CIRIA)

Use infiltration where suitable

6.3.8 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.

6.3.9 When designing SuDS networks on land that has low permeability, SuDS should be selected and designed accordingly. Soakaways and other infiltration methods may not be suitable but there are many other methods that can be used in clay type soils. In these cases, above ground SuDS features, such as swales, ponds, and wetlands should be prioritised. 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.

6.3.10 Ground conditions should not prevent the use of SuDS but should be considered when choosing the system. The British Geological Survey can provide maps and reports to support decisions with regards to the suitability of the subsurface for the installation of SuDS type systems. The suitability for infiltration across an area should be based on:

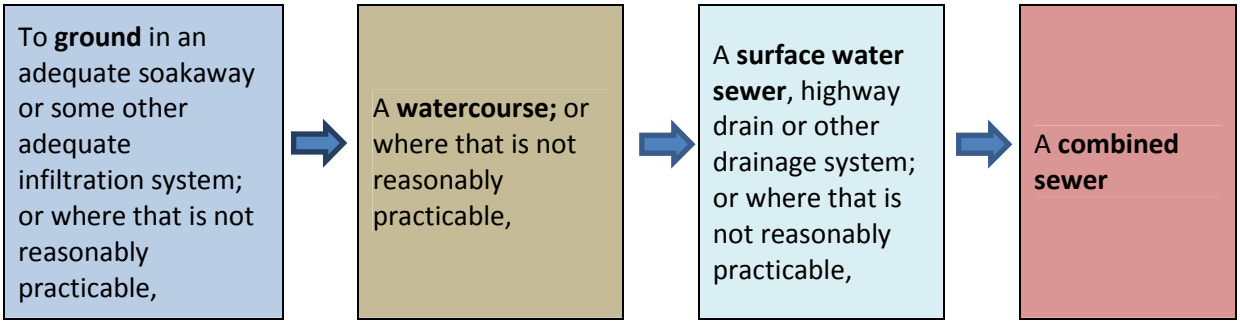
- Existing constraints prior to planning infiltration SuDS;
- Drainage capacity and rate of the ground;
- Potential for ground instability when water is infiltrated;
- Impact on groundwater quality as a result of infiltration;
- Development on contaminated land or source protection zones (vulnerable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

6.3.11 Infiltration should be assessed on-site using infiltration tests that follow the detailed SuDS design principles covered in BRE365 procedure. Source Protection Zones (SPZ) should be taken into account when considering infiltration and 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 SPD.

6.3.12 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 where 1.0m below ground level would be the best achievable depth. Deeper ('deep bore') soakaways pose a serious pollution risk and are not acceptable, and it is expected they will become contrary to the EU Water Framework Directive.

6.3.13 Whilst infiltration should always be considered first it is recognised that this may not be possible in all areas. It is a Building Regulations and NPPG requirement that the following discharge hierarchy is used when considering proposals:

Rainwater shall discharge to the following, listed in order of priority



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).

Keep surface water on the surface

6.3.14 Design and layout should seek to manage and convey surface water above-ground as much as possible, avoiding the use of underground piping. 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

6.3.15 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. A 'water sensitive' urban design approach to urban planning and design that incorporates SuDS within the overall vision for the site will lead to better solutions. It can assist with regeneration initiatives, improvement of the public realm, overland conveyance, and can even be used in public art. SuDS treatment and attenuation features, such as bioretention, ponds, and wetlands can be integrated into the public realm and open spaces to enrich the area with green infrastructure. Hardscape SuDS features and source control can also be creatively designed to enhance courtyards, public squares and property surrounds. SuDS can be purely aesthetic or interactive in nature. Interactive SuDS should include at least one stage of natural pre-treatment upstream before coming into human contact, such as in the case of water play areas.

Landscape-led approach

6.3.16 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. 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.

Recognising and conserving the significance of Cambridgeshire's historic and archaeological environment

6.3.17 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.

6.3.18 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.

Enhance biodiversity

6.3.19 While SuDS are implemented primarily for water treatment and management, they also provide opportunities to improve and protect by incorporating planting and surface water. In that spirit, every effort should be made to create new habitats that enhance nature conservation and amenity space. There are several Biodiversity Action Plan species and habitats[6] 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

[6] Updates to Biodiversity Action Plans can be found here: www.cpbiodiversity.org.uk

for the more sensitive wildlife species. 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.

Minimise embodied carbon in SuDS

6.3.20 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

6.3.21 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 easy maintenance and access

6.3.22 When designing SuDS it is crucial to consider throughout the process how features will be maintained and accessed, who is ultimately responsible, 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 Regulations from the outset to ensure that access is provided for maintenance and that health and safety measures are adhered to.

6.3.23 Consideration should also be given to access to, and maintenance of, existing infrastructure which includes existing watercourses. Many IDBs, Local Authorities and the Environment Agency have requirements for maintenance strips adjacent to a watercourse and should be contacted for exact requirements in their area.

Design SuDS for brownfield sites

6.3.24 Previously developed land (brownfield sites) should not be seen as a barrier to using SuDS. 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

6.3.25 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 SuDS feature may fill up with river flood water when the area floods and will 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. SuDS should not be included in areas where water regularly flows or is stored.

Design open spaces to incorporate SuDS

6.3.26 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 recreational and open spaces, whether green or paved spaces will be essential for well-designed developments. Open spaces can provide space for SuDS features to be included 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 6.5). 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.

6.3.27 Areas of SuDS within open spaces 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.

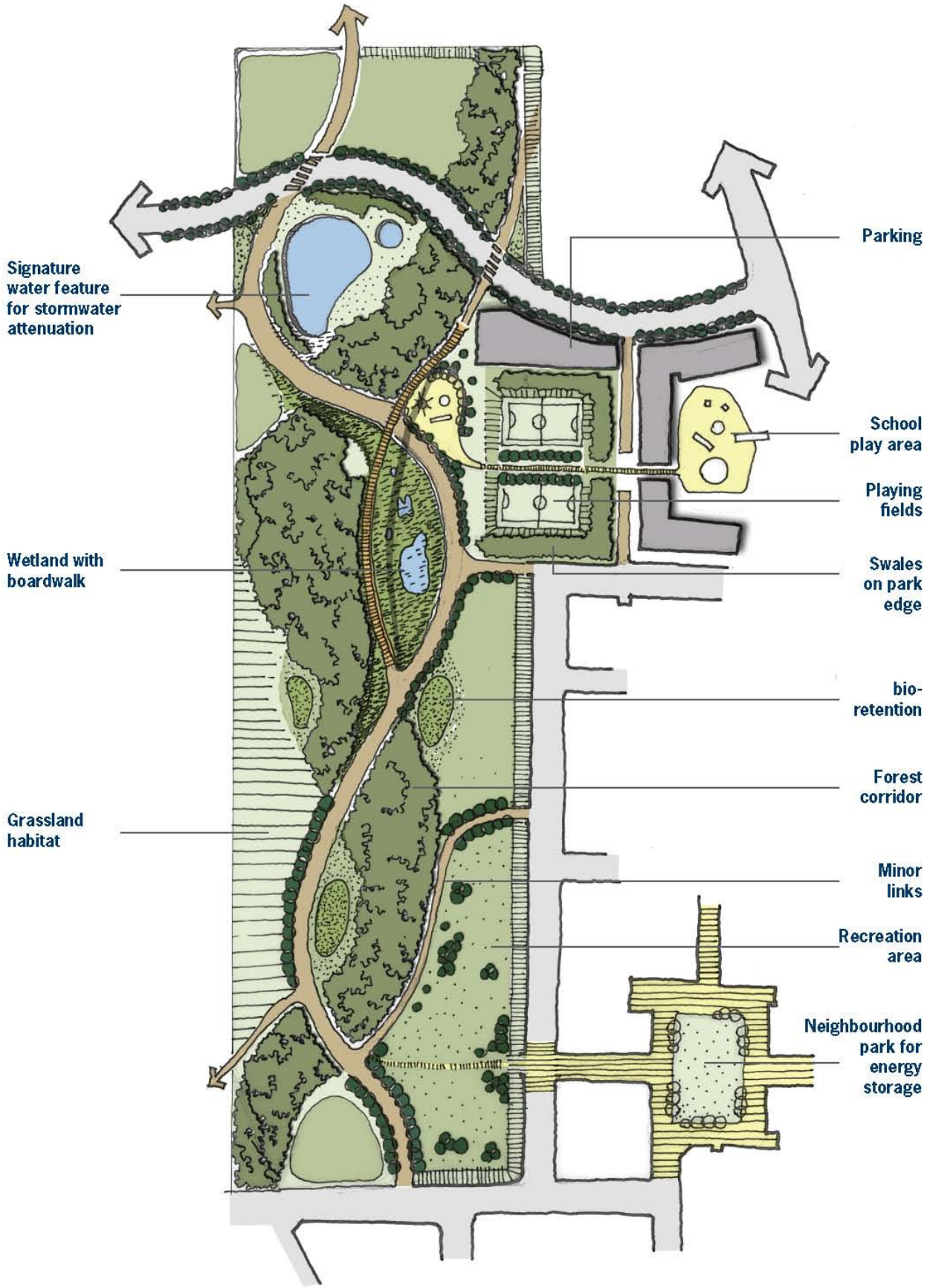


Figure 6.5 - Integration of SuDS features into open space design (courtesy of CIRIA)

Design streets to incorporate SuDS

6.3.28 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. 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. In some cases, overland conveyance features like swales can also be created alongside roadways. 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

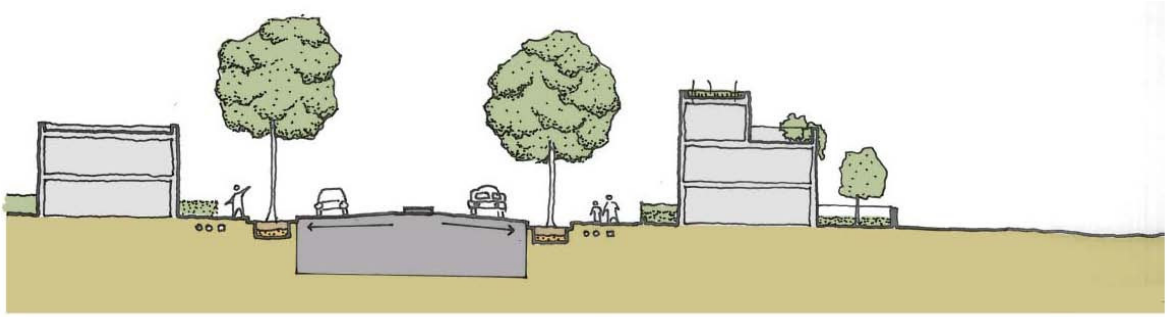


Figure 6.6 - Street design to drain SuDS features to either side (courtesy of CIRIA)

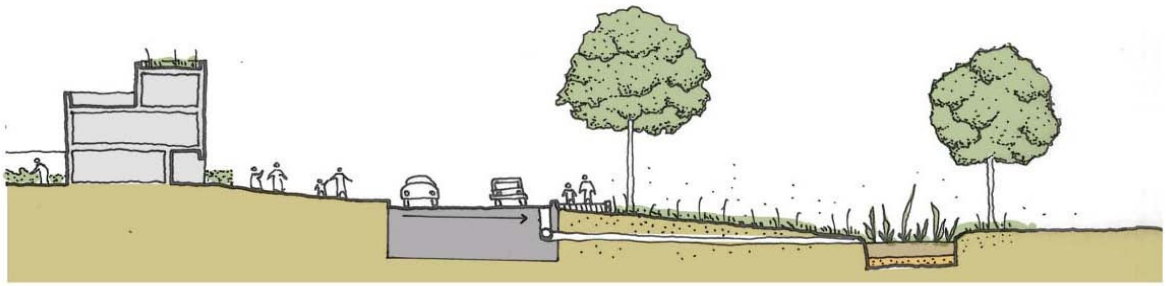


Figure 6.7 - Street design to drain to adjoining lower ground SuDS feature (courtesy of CIRIA)

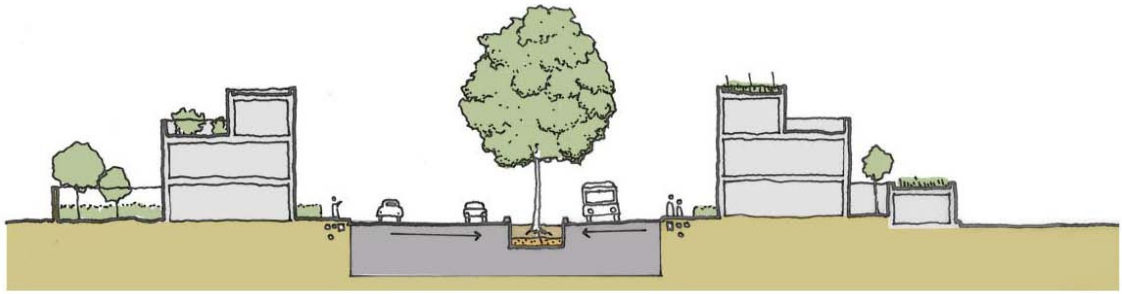


Figure 6.8 - Street design to drain to central SuDS feature (courtesy of CIRIA)

Design SuDS to match the density of developments

6.3.29 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.

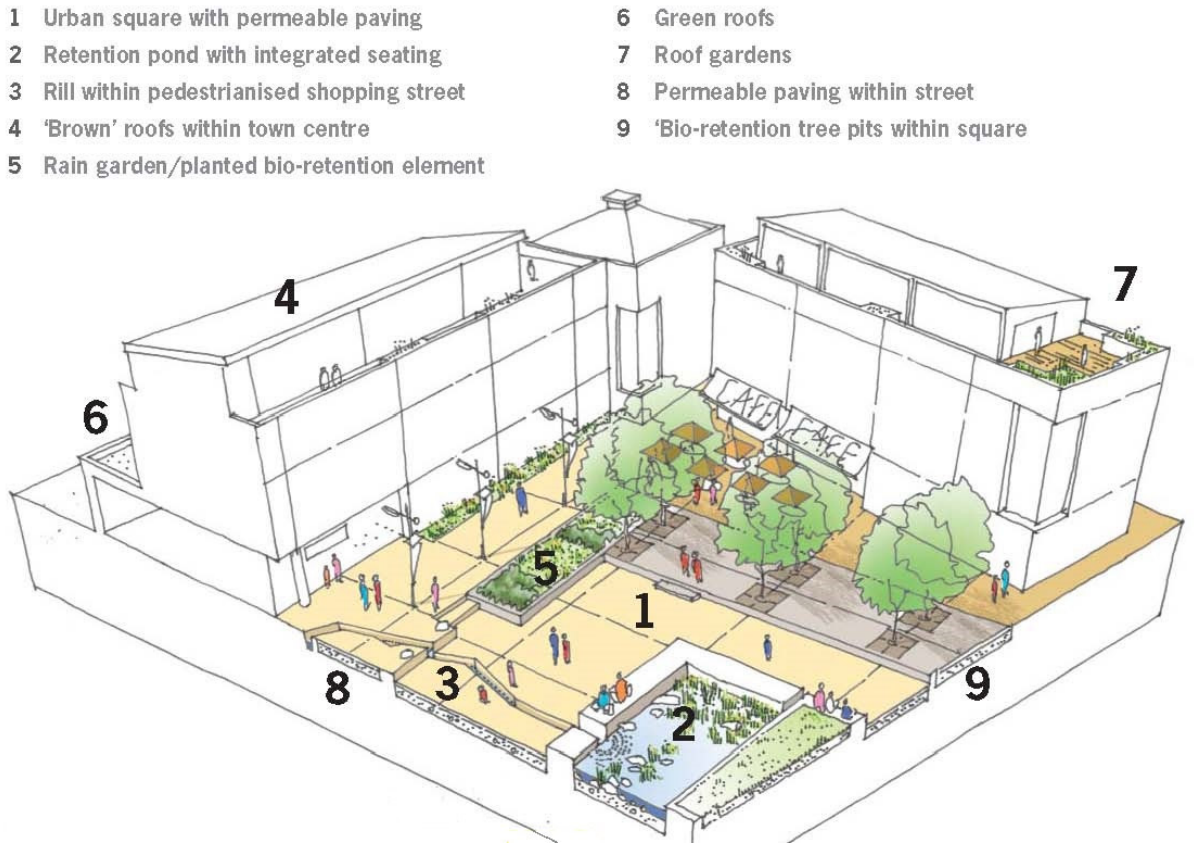


Figure 6.9 - SuDS options in high density developments (courtesy of CIRIA)

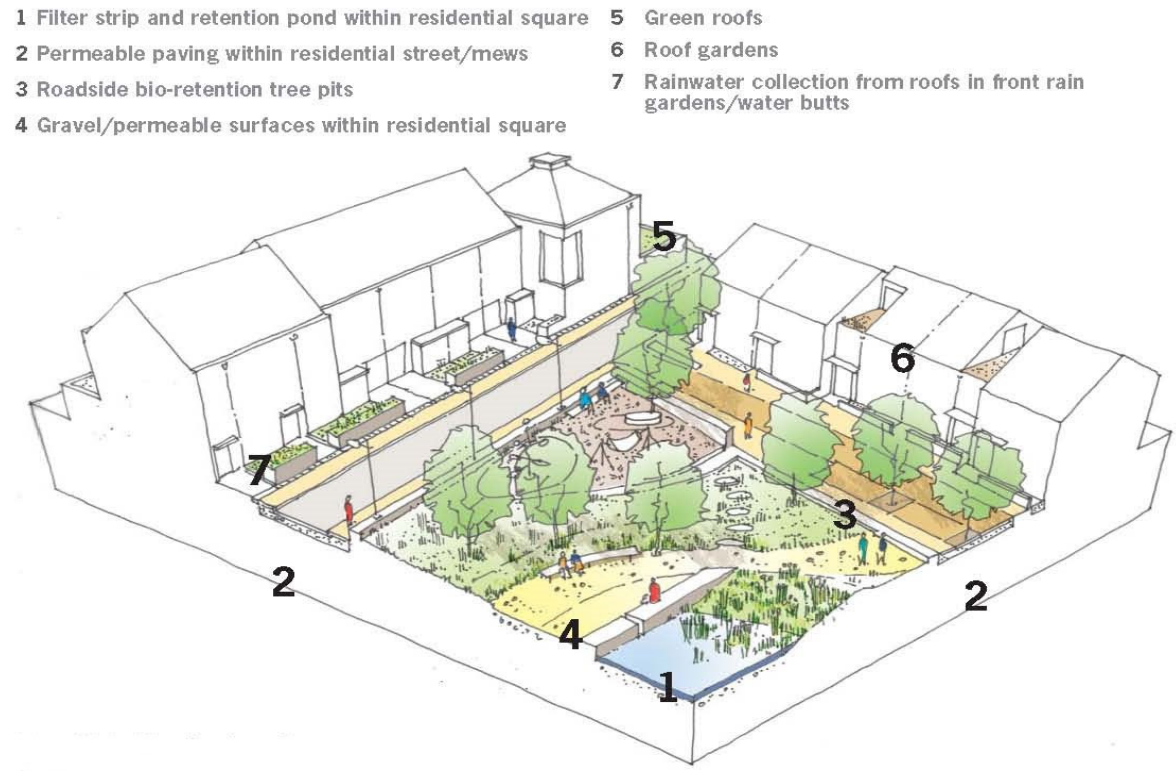


Figure 6.10 - SuDS options in medium density developments (courtesy of CIRIA)

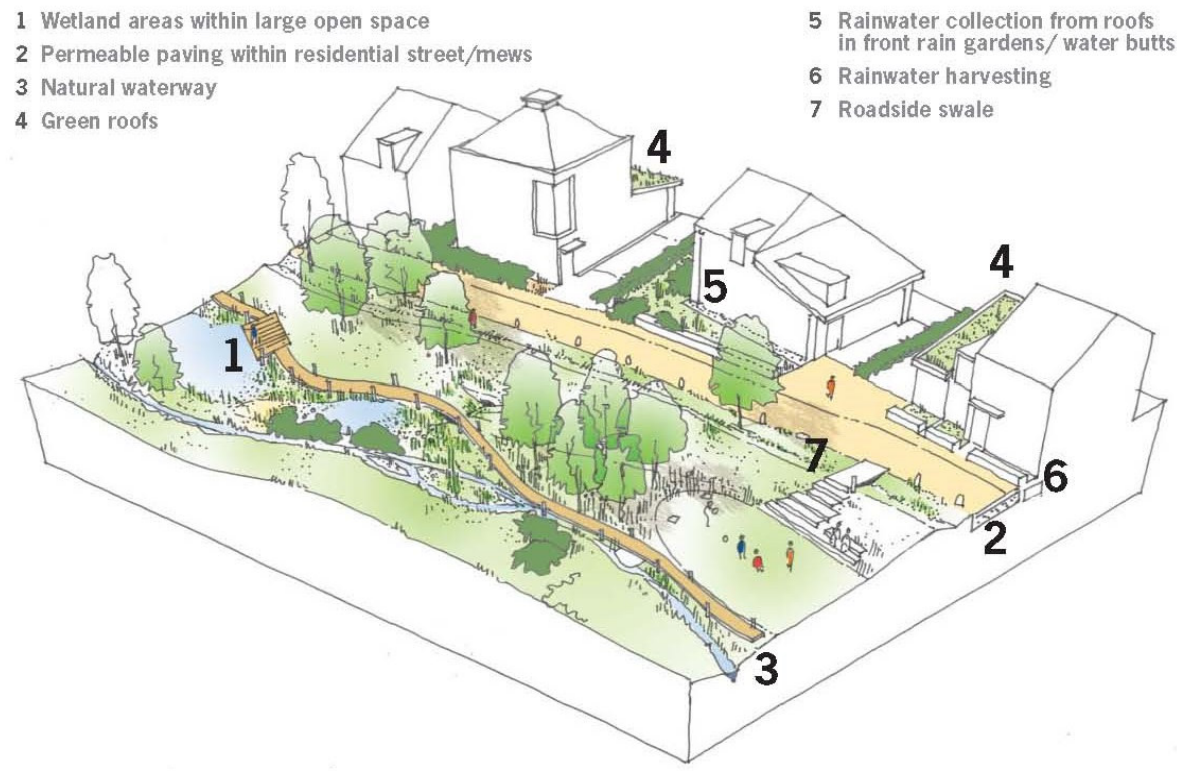


Figure 6.11 - SuDS options in low density developments (courtesy of CIRIA)

Design SuDS for flat sites

6.3.30 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. Figure 6.12 demonstrates the negative impact a piped system can have on flat sites. See Figures 6.6 and 6.8 for examples of how slight adjustments in street gradients and the use of above ground SuDS features can aid the drainage of flat sites.

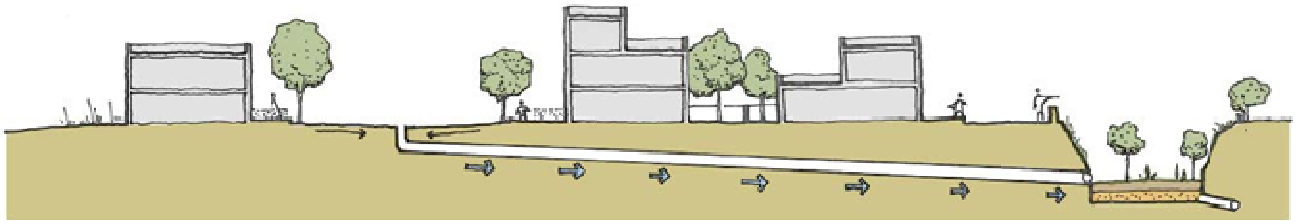


Figure 6.12 – How piped drainage on flat sites can lead to undesirable deep end of pipe SuDS features (courtesy of CIRIA)

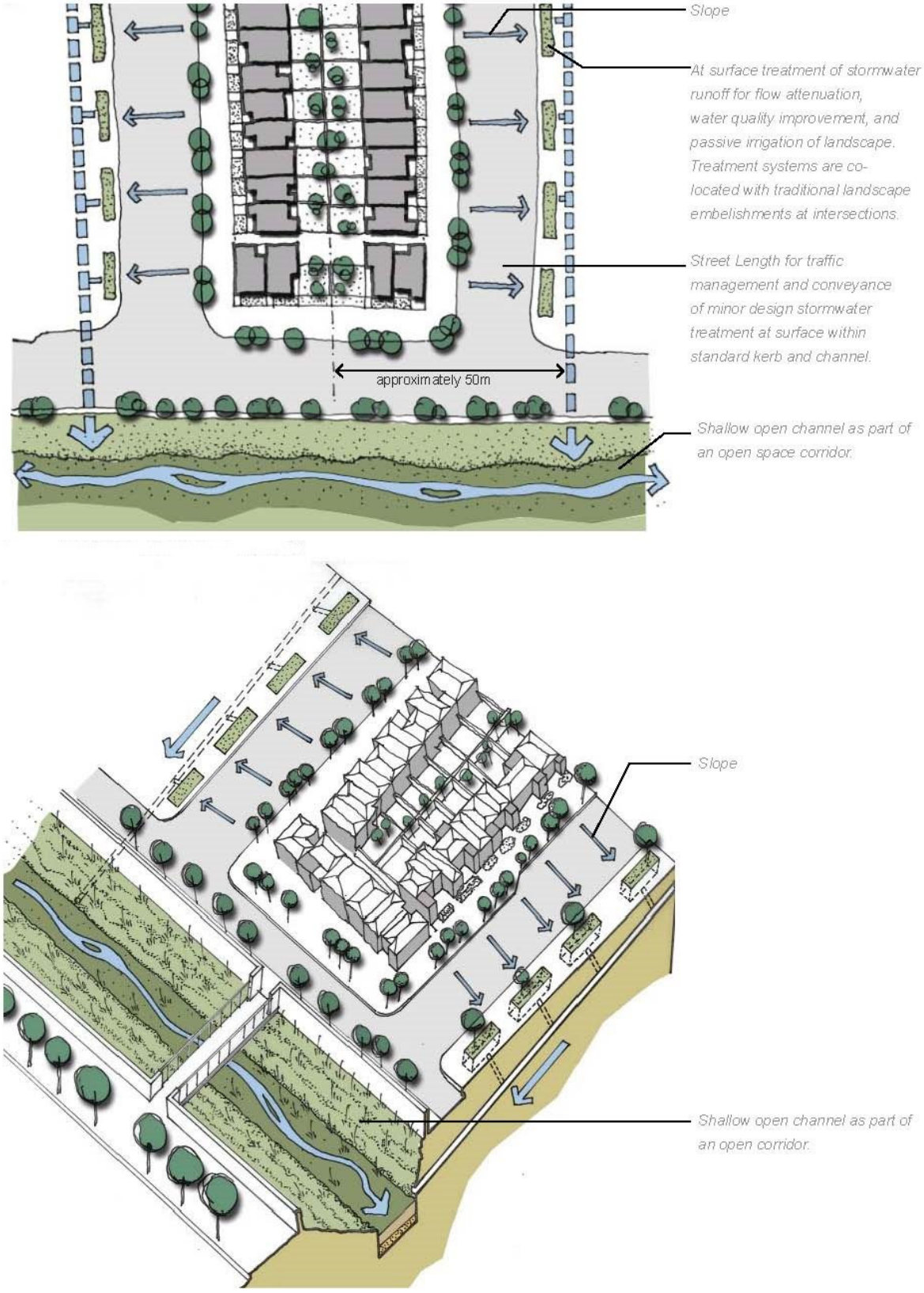


Figure 6.13 - Possible urban layout for flat sites (courtesy of CIRIA)

Design industrial and agricultural sites to incorporate SuDS

6.3.31 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 6.14 - Incorporating SuDS on industrial sites (courtesy of CIRIA)

6.4 Design standards and designing for exceedance

6.4.1 Allowable discharge rates are based on different catchments throughout the county, however the general principle is for a new system to follow greenfield runoff rates and volumes. Areas where there may be a requirement for an additional restriction beyond greenfield rates include IDBs and some river catchments such as the Cam.

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

6.4.5 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 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. The table below indicates the required level of treatment for a number of different land uses. These stages form a management train as described earlier.

Land use	Minimum number of treatment stages required
Roofs only	1
Residential roads, parking areas, commercial zones	2
Refuse collection, industrial areas, loading bays, lorry parks, highways	3

6.5.3 Each treatment stage must be designed to be effective in pollutant removal. This needs to be quantified at the application stage. Different features have different levels of effectiveness and the system should be designed as a whole to ensure there is no detriment in water quality.

6.5.4 Guidance on the effectiveness of each potential feature can be found in the CIRIA publication The SuDS Manual (C697).

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. The 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 (C697) 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 should be determined taking into account natural flow routes, topography, geology and greenspace,

ensuring a safe design and mitigating flood risk (see Figure 6.1). Seeking advice at the earliest opportunity from the relevant water management authorities will help avoid any costly issues or redesigns at a later stage. Considering SuDS at this stage will also maximise the financial benefits SuDS can bring, for example cheaper drainage construction costs and potentially a more desirable development.

Pre-application

6.7.2 The majority of planning applications do not require a masterplan but all applicants should seek pre-application advice from the relevant water management authorities before developing a surface water drainage strategy. This is the point at which key documents and information should be reviewed including topographic surveys, SFRAs, geological maps, relevant site surveys and FRAs which have already been undertaken. Again Figure 6.1 can be used as a stage guide for how to integrate SuDS across sites. See Appendix 5 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 5 includes an outline planning application checklist to be followed to ensure the correct information is included within the outline 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 water management authorities. At this stage applicants will also be expected to submit a detailed surface water drainage strategy with the planning application (see section 4.8). 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 confirm the SuDS for the site with detailed information being provided about the existing run-off rates and storm water storage requirements. In addition, it 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.

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;
- Discharge location(s);
- Drainage calculations;
- Drawings of the proposed surface water drainage scheme including sub catchment breakdown where applicable;
- Maintenance and management plan of surface water drainage system including details of future adoption;
- Completed SuDS planning and design checklists – the applicant must ensure that the surface water strategy contains the appropriate level of information in relation to the points covered in outline and full planning application checklists.

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 design checklists in Appendix 5 (a, b, and c) 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 at the different stages of the planning process can be found in Appendix 5.

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. 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 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. 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.

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

6.9.5 Anglian Water can adopt SuDS across a development. In this instance during pre-application discussions assurances should be sought by the developer from Anglian Water that the design will be acceptable for SuDS adoption and this confirmation provided to the LPA. Further guidance can be found on Anglian Waters webpages including their Sustainable Drainage Systems Adoption Manual.

6.9.6 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.

6.9.7 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 United Kingdom 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
- Brekland 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

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

7.3 WFD 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].

7.3.5 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

[7] This legislation regulates water resources, water quality and water pollution, and flood defence. Section 109 contains activities which require a separate consent from the Environment Agency in relation to works in, over, under or near a main river.

District	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

Table 7.1 - Water Resource Zones in Cambridgeshire[8]

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 and associated 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

[8] *Sources*
- Water Cycle Study and URS/Scott Wilson Water Cycle Study, Cambridgeshire Horizons, July 2011,
- URS Stage 2: Detailed Water Cycle Study Update Draft Report, December 2013,
- Joint Position Statement on growth in the Water Recycling Centre. (WRC) catchments in East Cambridgeshire District, January 2014
- East Cambridgeshire WCS Stage 2 Report Final Report September 2011

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 for development that takes place inside or within a certain distance of a non-main river watercourse. Developers should contact Cambridgeshire County Council (the 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 1). 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 1 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 1: List of Relevant Local Planning Authorities Planning Policies

Local planning policy

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:

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)

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 sustainable drainage systems in public open spaces.

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 showpeople 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

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.

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.

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 2 Internal Drainage Boards and associated maps

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

2a. List of Internal Drainage Boards (IDBs)

IDBs	IDB contact	Applicable to the Relevant District Council Area
North Level Drainage Board	http://www.northlevelidb.org/	• Fenland District Council
Ramsey IDB *	http://www.ramseyidb.org.uk/	• Huntingdonshire District Council
Whittlesey Consortium of IDBs *	http://www.wcidb.org.uk/	• Huntingdonshire District Council • Fenland District Council
• Drysides • Feldale IDB • Holmewood and District IDB • Woodwalton Drainage Commissioners • Whittlesey IDB		
Bedford Group of IDBs (In Cambridgeshire)	http://www.idbs.org.uk/contact-us/	• Huntingdonshire District Council
• Alconbury and Ellington IDB • Bedfordshire and River Ivel IDB		
IDB that have been agreed to be represented by Ely Group	http://www.elydrainageboards.co.uk/contact.html	• East Cambridgeshire District Council • South Cambridgeshire District Council
• Burnt Fen IDB • Cawdle Fen • Littleport and Downham • Middle Fen and Mere • Old West • Padnal and Waterden • Swaffham		

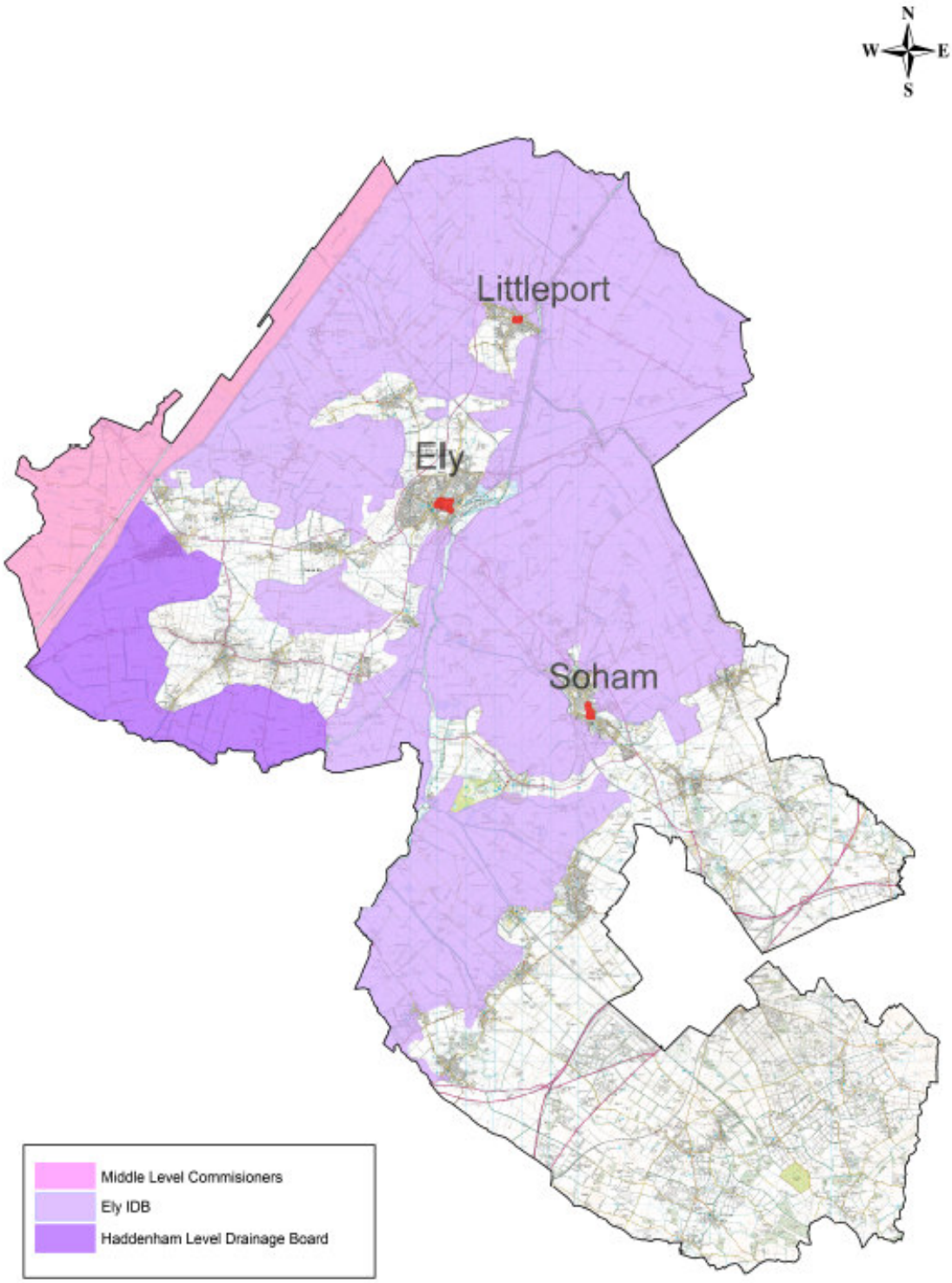
• Waterbeach Level		
IDBs presently managed by Middle Level Commissioners • Benwick IDB • Bluntisham IDB • Conington and Holme IDB • Churchfield and Plawfield IDB • Curf and Wimblington Combined IDB • Euximoor IDB • Haddenham Level • Hundred Foot Washes IDB • Hundred of Wisbech IDB • Manea and Welney District Drainage Commissioners • March and Whittlesey IDB • March East IDB • March and Whittlesey IDB • March Fifth District Drainage Commissioners • March Sixth District Drainage Commissioners • 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	http://www.middlelevel.gov.uk/	• Fenland District Council • East Cambridgeshire District Council • South Cambridgeshire District Council • Huntingdonshire District Council

(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 Warboys Somersham and Pidley IDB • White Fen District Drainage Commissioners		

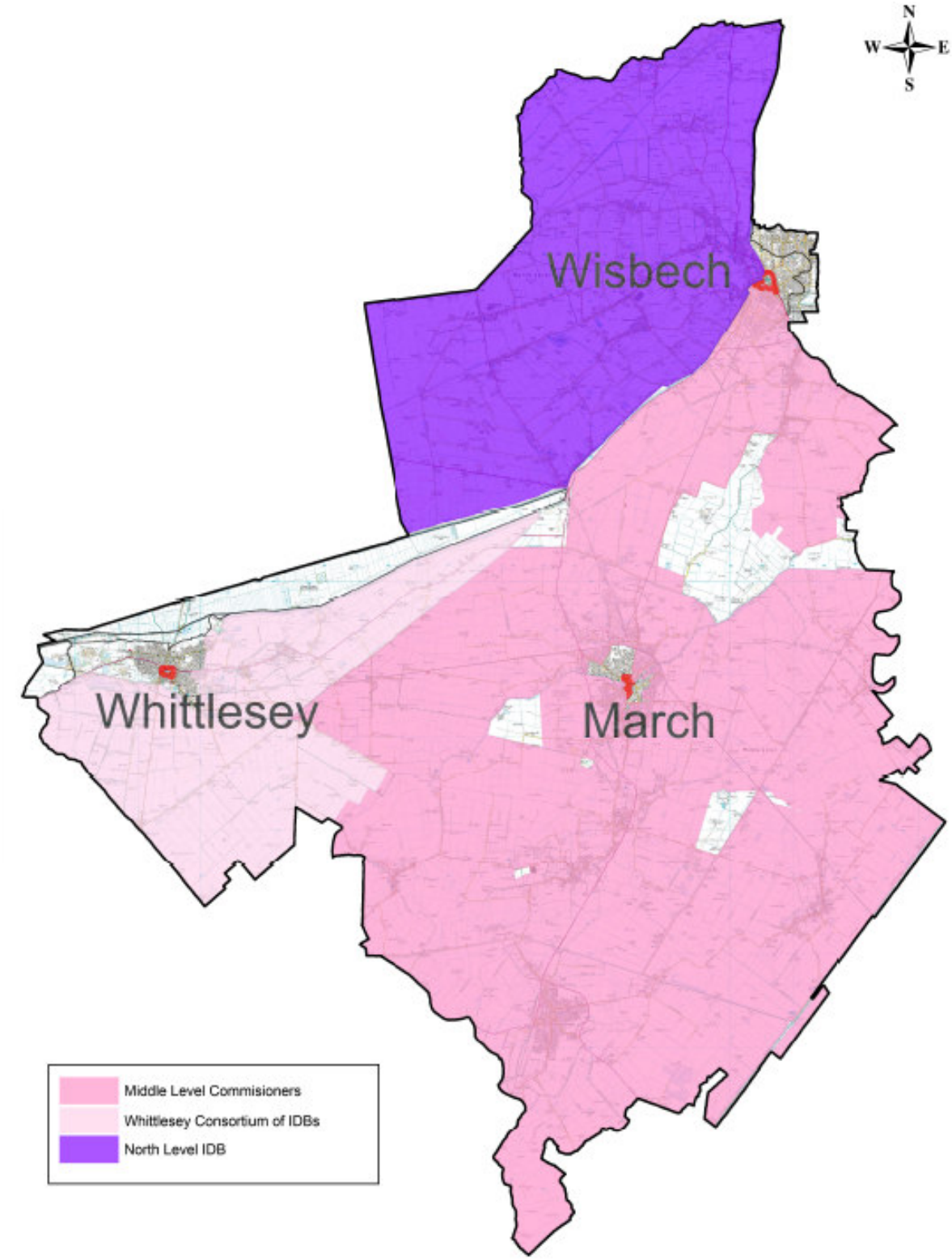
* The MLC provide planning services for Ramsey IDB and the Whittlesey Consortium of IDBs.

2b – e Maps of IDB groups that cover areas within the city and district councils

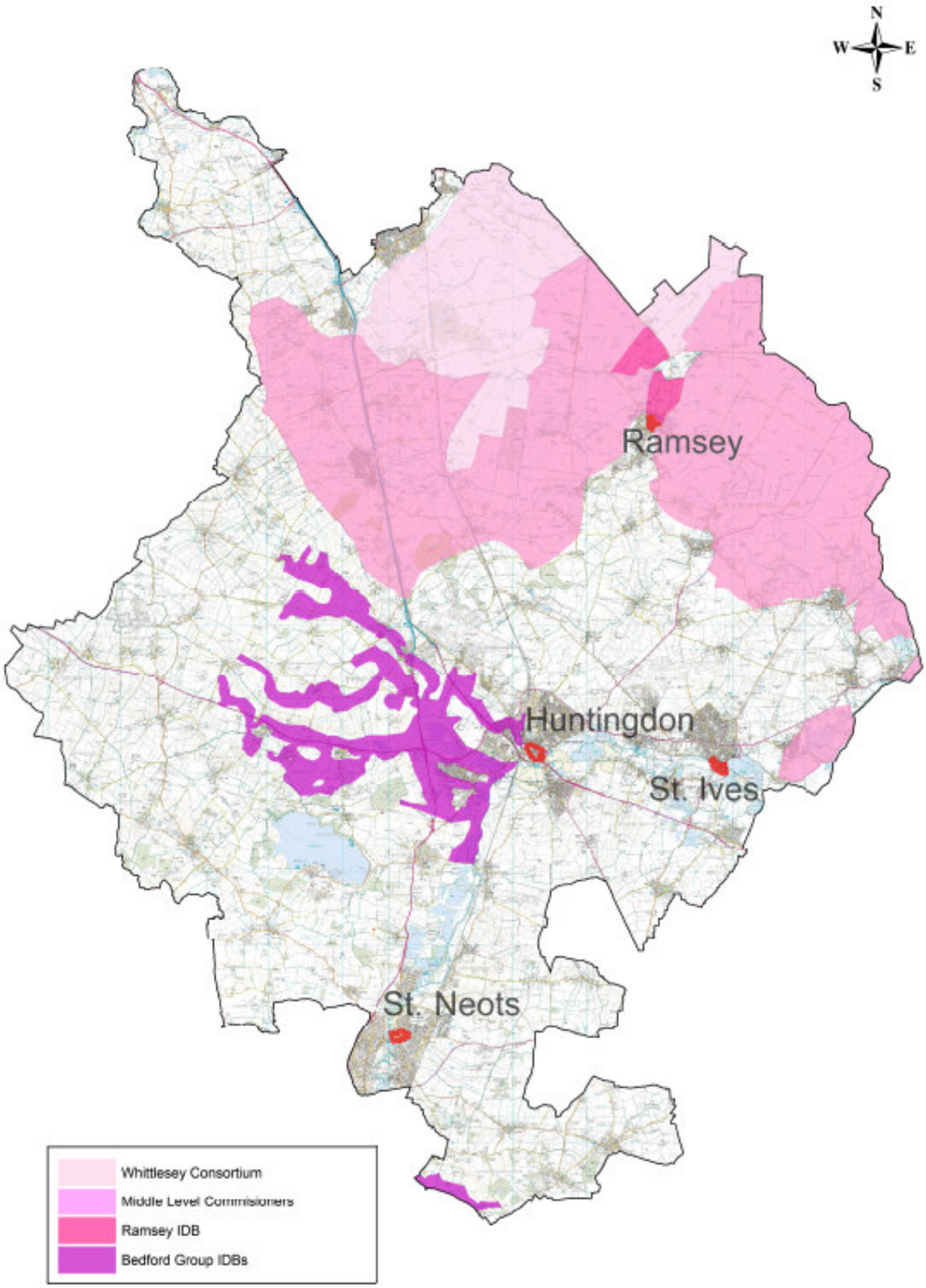
Appendix 2b – Map of IDBs within East Cambridgeshire District Council (ECDC) Area



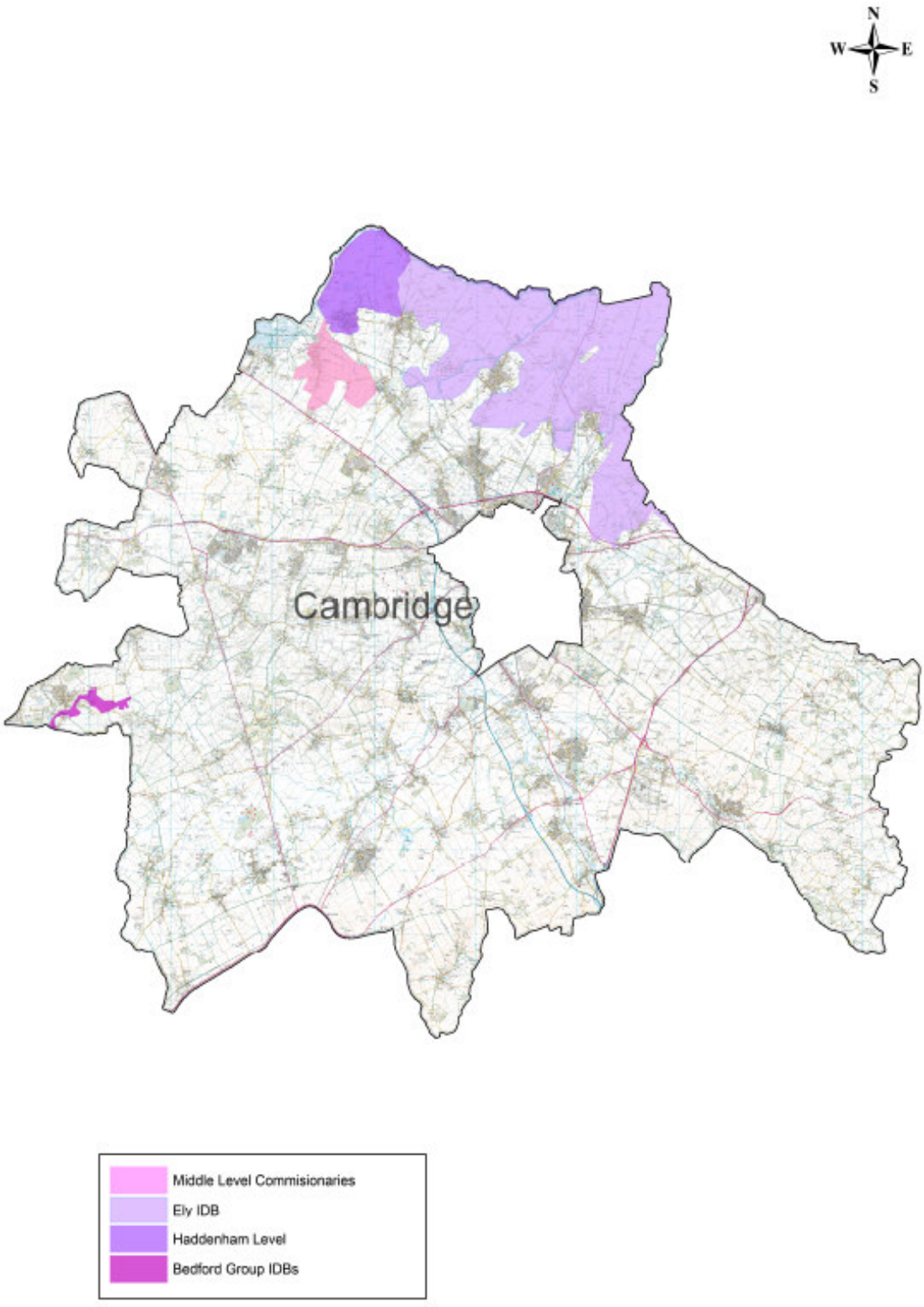
Appendix 2c – Map of IDBs within Fenland District Council (FDC) Area



Appendix 2d – Map of IDBs within Huntingdonshire District Council (HDC) Area



Appendix 2e – Map of IDBs within South Cambridgeshire District Council (SCDC) Area


N
W
E
S
Cambridge
Middle Level Commisionaries
Ely IDB
Haddenham Level
Bedford Group IDBs

Appendix 3 - Applicant Drainage and Flood Risk Assessment Checklist

Development:

Location:

Date:

LPA contact:

EA contact:

IDB contact:

General Notes:

Recommended actions to consider for water management and flood risk in your proposal.	Notes	Tick
Managing the Risk of Flooding (see Chapters 4 & 5)		
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 flood risk assessment, 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 flood risk assessment 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.		
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 flood risk assessment 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.		

Flood Risk Assessment (FRA) checklist for developers/applicants

Note: 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 local planning authority by the Environment Agency); 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).

A step by step guide on how to complete a FRA in support of a planning application is set out in Chapter 4.

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 EAs website).		
b. If there is a SFRA covering this site (check with the Local Planning Authority), 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 EAs 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?		
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).		

Note: The above checklist is taken from the National Planning Practice Guidance (NPPG) on Flood Risk and Coastal Change – Site-Specific Flood Risk Assessment: Checklist (http://planningguidance.planningportal.gov.uk/blog/guidance/flood-risk-and-coastal-change/site-specific-flood-risk-assessment-checklist/).

Appendix 4 – Building materials guidance for flood resilience or resistance.

Component information:

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;
- 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:

- 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;
- 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 5 - SuDS Planning and Design Processes for Surface Water Drainage Strategy

(a) Pre-Application Checklist of Information To Be Agreed

Ref	Requirements	Details (or reference documentation)	Accepted?
(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. These should be provided to the developer by the drainage approval body.		
(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, BS8582). 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/SAB 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		

Note that all of the above should be agreed (where relevant) with the LPA, LLFA, Highways Authority, IDB, EA and Anglian Water. The SuDS planning process should be closely linked to the development planning process and the drainage design should be integrated wherever possible with the design of the development as a whole.

(b) Conceptual Drainage Design Documentation Suggested for Consideration and Submission at Outline Planning

Ref	Requirements	Details (or reference documentation)	Accepted?
(a)	Definition of the natural drainage characteristics within and hydrologically linked to the site and demonstration that the drainage proposals will integrate with and not compromise the function of the natural drainage systems. Natural flow paths for surface water runoff should be identified on a plan where appropriate.		
(b)	Definition of state, performance and ownership of any existing site surface water drainage infrastructure and demonstration that the drainage proposals consider, use or protect these systems (where appropriate).		
(c)	Proposed strategic approach to managing on-site flood risk from all sources (as part of or in alignment with the Flood Risk Assessment (see Chapter 4)), and implications of existing flood risk for proposed SuDS design.		
(d)	Outline assessment of existing geology, ground conditions (including contamination and stability) and permeability through desk-based research (e.g. a review of geological/hydrogeological maps, infiltration potential maps, and site visit observations) –to determine the suitability of infiltration drainage for the site runoff. Infiltration tests should be carried out at this stage wherever possible. If infiltration is proposed but tests are not available an alternative outfall should be identified in case future tests show that infiltration is not possible.		
(e)	Identification of the requirements of any environmentally sensitive potential receiving water bodies for the runoff (e.g. groundwater protection zones, archaeological features, receiving water body environmental designations).		

(f)	Confirmation of discharge points (i.e. to ground, watercourse or public sewer) for all return period events.		
(g)	Confirmation of the design criteria for the SuDS system (including an assessment of the need and opportunity for rainwater harvesting and use), including climate change and urban creep allowances[9].		
(h)	Conceptual SuDS design including interception, treatment, conveyance, peak flow and volume control, storage and exceedance routes and components (and demonstration that required indicative storages and conveyance flows can be delivered on site).		
(i)	Proposed multi-functional use of SuDS 'space' to meet community and environmental requirements (where possible green infrastructure) and the potential contribution of the surface water management system (e.g. BREEAM Community, Building for Life 12) to the development design objectives for sustainability (including climate resilience).		
(j)	Proposed split of the SuDS between private (within curtilage) and public (i.e. in public open space and/or highway) land.		
(k)	Confirmation of approval and adoption arrangements for all SuDS components.		
(l)	Details of any required offsite works and consents.		
(m)	Appropriate consideration of the maintainability of the proposed SuDS.		
(n)	Appropriate consideration of the constructability of the proposed SuDS (including the requirements for phasing or protection of components).		

[9] http://www.uksuds.com/surfacewaterstorage_js.htm

(c) Drainage Design Documentation for Consideration and Submission at Full Planning or Reserved Matters

Ref	Requirements	Details (or reference documentation)	Accepted?
(a)	Where infiltration is proposed, an acceptable Infiltration Assessment (to BRE365) has been submitted.		
(b)	A scheme design assessment with appropriate supporting calculations has been submitted that demonstrates design conformity with the required design criteria for the site.		
(c)	Plans of the proposed drainage system, showing: • drainage catchment areas including impermeable and permeable zones, and any phasing details (where applicable) • existing and proposed site sections and levels • long and cross sections for the proposed drainage system (including exceedance flow management routes) and final building finished floor levels • details for connections to watercourses and sewers • maintenance access and any 'arisings' storage and disposal arrangements • operational characteristics of any mechanical features		
(d)	All necessary consents required for off-site works		
(e)	Commitments for maintenance and adoption arrangements for all elements of the system (including exceedance flow management components).		

	Commitments to any cost contributions, valuation and security of any required non-performance bond.		
(f)	Appropriate consideration and management of any health and safety issues relating to SuDS implementation.		
(g)	The design of each element has been undertaken in accordance with available best practice (e.g. Anglian Water: SuDS Adoption Manual[10])		
(h)	A Construction Management Plan for the proposed SuDS system has been submitted including: • construction processes to protect the SuDS functionality (including the provision of any required temporary drainage systems) • programming to protect the SuDS functionality • landscape planting • consideration of access for inspections by the approving or adopting organisation		
(i)	A Maintenance Plan for the proposed SuDS has been submitted including: • a description of the system and how each part of the system is expected to work • management objectives for the site • inspection and maintenance schedules, material, tools and initial cost estimates • maintenance access points, easements and outfalls		
(j)	An Information and Communications Plan for the proposed SuDS scheme has		

[10] http://www.anglianwater.co.uk/_assets/media/AW_SUDS_manual_AW_FP_WEB.pdf

	been submitted where appropriate, including: • communication with and education of existing residents • communication with and education of new residents • site and SuDS component specific information boards • local community education and education strategies (e.g. through schools) Note this is only likely to be required on larger sites and may be provided by the developer (to be agreed with the LPA if necessary).		

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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
Cesspools	Underground holding tank used for the temporary collection and storage of faeces, excreta or faecal sludge as part of an onsite sanitation system.
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	Design and consideration of above-ground areas that act as pathways permitting

flow route	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	Is 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	For the purposes of assessing flood risk, Minor Development is defined within the

Development	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	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.
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	Sustainable Drainage Systems; an approach to surface water management that

Drainage Systems (SuDS)	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.

Acronym List

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
NPPG	National Planning Practice Guidance
PPA	Planning Performance Agreements
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