Local Flood Risk Management Strategy for Slough

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Slough
Borough Council

Local Flood Risk Management Strategy

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Part A Introduction guiding principles and objectives

1. Introduction - Local Flood Risk Management Strategy

1.1. What it is?

The Local Flood Risk Management Strategy for Slough Borough Council is an important new document which will:

- bring together the understanding of flooding in the local area;
- identify who is responsible for addressing flooding issues; and
- explore how flood risk can be managed within Slough

The main aim of the strategy is to identify where flooding can be reduced or managed in a sustainable manner and to alleviate where possible the misery, economic damage and social disruption that flooding causes. Any flood management activities carried out will aim to enhance the built and natural environment.

The LFRMS will be a statutory document, which will impact on the activities of all flood risk management authorities – i.e. local authorities, Environment Agency (EA), Highways Authorities and Internal Drainage Boards (IDB). These bodies will all have a 'duty to act consistently with the local strategy' when undertaking their flood and coastal erosion risk management functions and have a 'duty to have regard for the strategy' when discharging other duties that may affect flood and coastal risk (for example spatial planning and development). Water companies will also have a 'duty to have regard for the local strategy' for all relevant functions.

The focus of the strategy is on 'local flooding' from surface water, groundwater or ordinary water courses such as streams and ditches, but it also deals with how this type of flooding interacts with flooding from main rivers. The ways in which SBC have been addressing and will manage these risks in the future, with the help of central Government, local initiatives and through working in partnerships, will be covered in this document.

The draft document will be sent out for consultation and comments received from key stakeholders. These will be incorporated in the final document. The document will remain a “living document” with updates undertaken every six months to reflect the work done and any changes in fluvial and surface water flood information from the EA and SBC. It is expected that the delivery plan will be updated and the appendices as further options are clarified and work is carried out for the individual catchments.

1.2. What it includes?

The strategy document starts with the guiding principles and objectives for managing flood risk, Part A. It will be necessary to update and review the strategy and its associated action plan on a regular basis. The review process will be overseen by the Slough Strategic Flood Risk Management Group and is covered in Part A.

The local flood risks in Slough will be summarised, Part B, and readers will be pointed to other documents such as the Surface Water Management Plan for more detail. Part B will also cover the general measures and overarching delivery plans which can be used for flood management in Slough. In the appendices a more detailed action plan for each catchment covers small-scale local activities to long-term major ones.

The responsibilities that each authority and the landowners and householders have in the partnership to manage the flood risk will be covered in Part C.

The document covers the following:

- **Part A – Introduction and guiding principles/objectives**
- **Part B – Flood Risk in Slough** – what it is and how we can manage it
- **Part C – Responsibilities, Duties and Powers** - Who is responsible for what and how things are organised
- **Appendices:**
  - Links to other legislation
  - Details for each catchment

2. Guiding principle and objectives for flood management

2.1. Guiding Principles

The management of flood risk within the Slough Borough area will be based upon a number of guiding principles:

1) Improve safety health and wellbeing for residents

Flooding is a natural event that will occur despite all efforts to prevent it. It may not be possible to protect all property and people all the time. SBC will seek to focus on measures to prevent flooding and to reduce of the disruption that flooding causes.

2) Improve understanding of flooding and responsibilities for flooding

SBC is committed as the Lead Local Flood Authority LLFA to understand the sources, pathways and receptors of flooding. SBC as the, Environment Agency, Thames Water, riparian owners, individual householders and business holders all have responsibilities for flood management and SBC will seek to clarify these and communicate them to ensure all parties know their responsibilities.

3) Develop public awareness of flood risk

Improving the level of knowledge about flood risk across all stakeholders is a vital process which needs to be improved and sustained

4) Ensure everyone is informed and involved where relevant

No organisation is able to ensure that all households and businesses are safe from flooding and no single organisation can effectively manage flood risk across the Slough Borough so co-operation among relevant public agencies is essential for the success of long-term comprehensive flood risk management.

5) Create a cleaner/greener Slough

SBC is committed to ensuring that watercourses are more sustainable and establishing/developing management/maintenance plans for watercourses. Where possible watercourses will be opened up, with more public accessibility to the water bodies. The enhancement and improvement of water bodies will improve fisheries and fish movement and create greener spaces.

6) Avoid inappropriate development in areas of flood risk

New developments should look not only to ensure that there is no increase in flood risk but also seeks to reduce the existing flood risk. The cumulative impact of small developments on flood risk can be significant as the impact of major developments, and so both must be managed in order to ensure the threat of flood risk does not increase.

2.2 Objectives of the Strategy

The objectives of the strategy are as follows:

1) To develop a clearer understanding of the sources, pathways and receptors of flooding and the risks of flooding from surface runoff, groundwater and ordinary watercourses

2) To identify the options available to mitigate flooding for the catchments in Slough

3) To set out clear and consistent short, medium and long term plans and options for flood risk management from the different catchments and sources. This will enable communities and businesses to make informed decisions about the management of the residual risk.

4) To identify, where possible, sources of funding for the options identified

5) To provide a clear explanation of all stakeholders' responsibilities in flooding issues and the relevant legislative requirements.

6) To consider how best to communicate and share the information that becomes available, on flood risk and mitigation options, with all stakeholders

7) To show how environmental considerations and improvements will be taken into account when considering flood management

8) To ensure that planning decisions are properly informed by flooding issues and to understand the impact future planning policy may have on flooding.

9) To ensure that emergency plans and responses to flood incidents are effective and that communities are able to respond effectively to flood warnings.

Each of these objectives will be dealt with in a different part of the strategy document. The table below gives an indication of where in the document the objectives are covered.

Section / **Objective**	**B3.1**	**B3.2**	**B3.3**	**B4.1**	**B4.2**	**B4.3**	**B4.4**	**C2**	**C3**	**Appendices B-H**
1	X	X	X							
2				X	X	X	X			
3							X			X
4								X		
5									X	
6							X			
7						X				
8				X		X				X
9				X		X				X

3. Monitoring

3.1. Monitoring and review

The strategy provides the framework for the management of flood risk within Slough Borough council. It will be approved by the cabinet of the Council and adopted as Council strategy. The strategy will develop over time especially the appendices B to H as ideas and options for dealing with flood risk on a local catchment basis are refined. The development of the Strategy will be monitored on a quarterly basis by the Slough Flood Risk Management Partnership and updates will be produced as and when they are deemed appropriate by that group. The Strategy is currently designed to look at short to medium term plans (3 to 5 years). As the strategy evolves a more long term perspective for the management of flood risk will become apparent as information, legislation and evidence becomes available.

Under the requirements for the FWMA 2010, the Strategy must be updated on a 6 yearly cycle and this will be done for the requirements of the Act.

Part B - Flood risk in Slough

1. Introduction

The flood risk in Slough can be split geographically into two areas. To the west of the Borough there are a number of small catchments Huntercombe/Roundmoor Stream, Chalvey Ditch, Salt Hill Stream, Datchet Common Brook and The Myrke. The sources of flooding experienced in these catchments are numerous (fluvial, pluvial, sewer, overland flow, ordinary watercourses, and groundwater) and often occur in combination with each other. Several of these watercourses are culverted in sections while some of the ordinary watercourses to the north of Slough go into sink holes and emerge further downstream within Slough. Therefore, surface water flooding in the area to the west of Slough is a complex interaction of groundwater, overland and river flows.

To the east of the Borough there is the Colne Brook catchment and Horton Brook which flows into the Colne Brook. The flooding from these two catchments is predominantly fluvial flooding but there are also some issues with groundwater flooding.

The most common type of flooding affecting Slough occurs when localised heavy rainfall runs off pavements, roads, drives and roofs, overwhelming the surface water system of culverts, pipes and channels.

If this type of flooding occurs when the rivers and channels are very full then the situation is exacerbated. Localised surface water flooding is becoming increasingly common and there needs to be a better understanding of the risks and actions to address these risks.

2. General characteristics of Slough

In order to understand the flood risk, historic, current and future, it is useful to have a picture of the characteristics of the Slough area.

Catchments

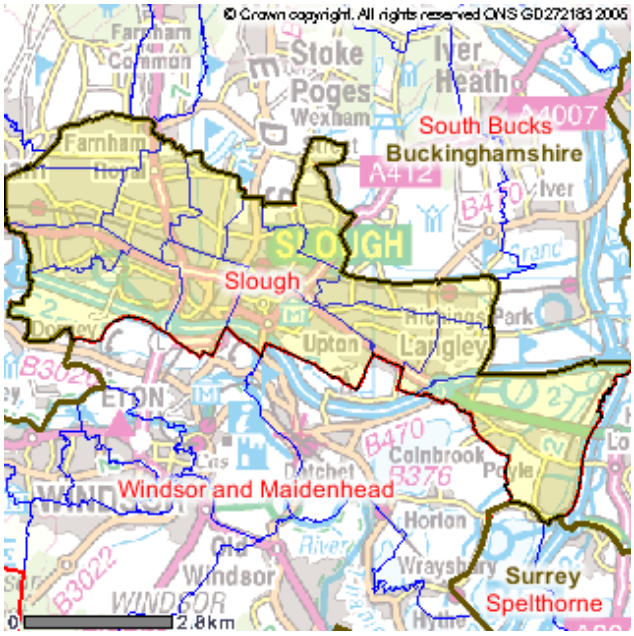
Slough is situated in the Thames Valley on the north-eastern boundary of Berkshire and immediately to the west of London. The Borough covers a total area of approximately 33 km^2, and the land generally slopes from north to south and west to east.

There are six main catchments with channels running from north to south. Starting in the west of the Borough these are Huntercombe Stream, Chalvey Ditch, Salt Hill Stream, Datchet Common Brook, Horton Stream and Colne Brook. All of these rivers, apart from Colne Brook, have their sources in the south Buckinghamshire area. The Colne Brook is a tributary of the River Colne which has its source in Hertfordshire.

Within the report the Myrke catchment is also described which is a small catchment south of the town centre in Slough.

Land Use

Slough is a densely built up area, and there is no scope to expand the urban area due to numerous constraints including the M4, areas liable to flood, air quality issues, green belt and landfill sites. The administrative boundary is shown on the adjacent figure: it shares borders with the Royal Borough of Windsor and Maidenhead, South Bucks District Council (Buckinghamshire CC), London Borough of Hillingdon and Spelthorne Borough Council (Surrey CC).



Map of Slough ONS 2004

The majority of the SBC area is built up urban environment with residential areas, industrial areas of Slough trading estate and the industrial and trading estates around Colnbrook and Poyle. The Town Centre has a retail area. There are some open and recreational areas amongst the residential areas.

The lack of unconstrained open land places the undeveloped areas under pressure from overspill that cannot be accommodated within the built up area. The increasing density of development means that the areas vulnerable to flooding within the Borough, such as Colnbrook and Poyle, need to be strongly protected from inappropriate development.

Population

Between 2001 and 2011 Slough had one of the fastest growing populations in the country, increasing by 16.3%, from 119,000 to 140,205. Overall, the population of England and Wales increased by 7.2%. Slough was the joint 10th fastest growing district in England and Wales and the 2nd highest in the South East, after Milton Keynes at 17%.

Slough has a culturally diverse community, with the lowest proportion of White British outside London at 34.5% and the highest Asian/Asian British population at 40% compared to 7.5% for England and Wales. Slough has the largest Sikh representation of all local authorities in England and Wales; the figure is 10.6% Slough also had the largest proportion of foreign born residents at 39% compared to 13% for England and Wales.

While the average age in Britain is increasing, Slough's residents are considerably younger than the national average. Slough has the highest proportion of people aged 19 and under at 29%, and the highest proportion of people under 5 at 9%, compared to 24% and 6.2% for England and Wales respectively. It also has the smallest proportion (9%) of people aged 65 and over compared to 16.4% for England and Wales.

The average size of households in the borough is 2.76 people, the highest outside London; the average for England and Wales is 2.4.

Geology

Although Slough is a small, compact area extending seven miles east to west and three miles north to south, the underlying geology is complex as it is so varied. The bedrock is comprised of varying thicknesses of chalk, Reading Beds (composed of silt, clay, and gravels, which is semi-permeable), and London Clay (impermeable), overlain by River Terrace Deposits which are comprised of gravels and brick earth.

However, this bedrock is not constant across the borough, lying as it does on the Windsor incline. In some areas, such as Haymill, the River Terrace Deposits lie almost directly on an outcrop of chalk, where the London Clay and Reading Beds have been eroded.

In the area of Langley and Colnbrook/Poyle, the river terrace deposits are underlain by London Clay, which in turn are underlain by Reading Beds and then by the Upper Chalk. In the rest of the Borough, the London Clay layer has been eroded, leaving the Reading Beds below the river terrace deposits.

The superficial deposits also vary across Slough. Across the northern part of the Borough, there are pockets of river terrace gravels with no connectivity within the exposed London Clay which is impermeable. South of this, there is a swathe of brick earth which is less permeable than the gravels but more permeable than the Reading Beds. Further south, there is a mixture of river terrace gravels as well as a few areas of where the river terrace deposits are clayey or thin over London Clay.

There has been disturbance of extensive areas of the superficial deposits. For example, large areas of brick earth south of the Grand Union Canal have been excavated for brick making in the 1800's, and gravel (and in places, clay) deposits in the Colnbrook and Poyle area have been excavated and backfilled. There are also other gravel deposits which have been excavated and backfilled located throughout the Borough.

The boundaries between the various areas of bedrock and superficial deposits as shown on the British Geological Survey maps are by no means precise; the survey maps are updated as new information becomes available.

SSSIs, wildlife sites and biodiversity

There are 5 Local Wildlife Sites covering approximately 1.4% of the area of Slough, three of which are designated as Local Nature Reserves (Cocksherd Bluebell Wood, Haymill Valley and Herschel Park). There are proposals in the Local Plan for 8 Informal Local Nature Reserves (Lynch Hill and Bangel's Spinney, The Green Walk, Watercress Beds west of Keel Drive, Chalvey Millennium Green, Land south of Stranrear Gardens, Halkincroft Wood, Land West of Hollow Hill Lane, and Old Slade Lake/Orlitts Lake and Colnbrook West Lake).

The Haymill Valley has been designated as a local Biodiversity Opportunity Area (BOA). A small part of Colnbrook falls within the Colne Valley Gravel Pits and Reservoirs BOA and land to the south of the M4, (plus Herschel Park), and west of The Myrke (with the exception of the sewage works) falls within the Bray to Eton Pits and Meadows BOA.

There are approximately 270 hectares of public open space as well as a number of smaller public amenity areas. There is still a shortage of open space in Slough – only 2.37 ha of public open space (including play space) per 1,000 population in

2005/06, less than the National Playing Fields Association minimum standard of outdoor play space of 2.4 hectares for 1,000 people.

There are no Special Areas of Conservation (SACs), Special Protection Areas (SPAs) and Ramsar sites affected by flooding within the Slough Borough Council boundary. To the north of Slough, in South Bucks, there are a number of sites, the most important of which is Burnham Beeches; it is located 1.2 km to the north of the borough boundary and is designated as a Special Area of Conservation (SAC) covering some **380** hectares. The southern half of Burnham Beeches is a National Nature Reserve covering 202 hectares.

Immediately to the south of Poyle is part of the South West London Waterbodies Special Protection Area and Ramsar site located within the Royal Borough of Windsor and Maidenhead and Spelthorne Borough Council. SPA/Ramsar covers 7 sites extending over wide area: RBWM and Spelthorne as well as Elmbridge, Hounslow and Runnymede.

There are small areas of Green Belt around the edges of the built up area of Slough. The largest area of Green Belt is in the east of the Borough where it also forms the central part of the Colne Valley Regional Park which stretches in an arc around the west of London. In addition to being important for wildlife and biodiversity, these Green Belt areas, together with other amenity areas and public open space, have significant visual amenity and provide educational and leisure opportunities for local residents.

According to the RBMP, the current ecological potential of Salt Hill Stream is poor whilst that of Datchet Common Brook, Chalvey Ditches, the Colne Brook and Horton Brook is moderate; a number of mitigation measures have been identified for the four watercourses.

Cultural Heritage

There are five Conservation areas, and 96 listed buildings with Slough. There are two parks on the Historic Parks and Gardens Register (Herschel Park and part of Ditton Park, both of which are Grade II) and two Scheduled Ancient Monuments (Cippenham Moat and Montem Mound), and some archaeological remains which offer evidence of ancient cultures. There are approximately 60 buildings which are designated as Locally Listed Buildings.

Stoke Park, which is located within South Bucks immediately north of the Manor Park area, is on Historic Parks and Gardens Register, Grade II. The landscaped park, covers 115 hectares, surrounds a country house and has been a golf course since 1908. Stoke Park Conservation Area is virtually coterminous with the Park and Garden boundary. The two branches of Salt Hill Stream run through this Historic Park and Garden/Conservation Area.

3. Assessment of local flood risk

3.1. Historic flooding

Slough has experienced surface water flooding since the 1930's. The records indicate surface water flooding appears to be mainly from overloaded sewers and overland flows from areas further to the north of Slough. Records also indicate that the Colnbrook and Poyle areas experience surcharged sewers, although details of the extent and effects of the surcharged sewers were not available.

There are records of fluvial flooding in 1947, 1969, 1989, 2000, 2001, 2003, 2007 and 2009 particularly in the areas around Chalvey, Myrke, Langley, Colnbrook,

Manor Park and Poyle. The surface water flooding incidents are mainly around the culverted watercourses. In addition there are surface water flooding incidents recorded more remotely from culverted watercourses in the areas of Britwell, Haymill, Farnham, Baylis and Stoke, Wexham Lea, Langley, Colnbrook and Poyle .

The fluvial and surface water flooding records highlight that in some years (1989, 2001 and 2003) flooding occurred from both fluvial and surface water sources. This highlights the connectivity and interaction between these two sources of flooding.

3.2. Description of current situation and issues.

Slough has experienced river flooding, surface water flooding, sewer flooding and groundwater flooding. There are a numbers of sources of information which give us a picture of the flooding in Slough:

- the fluvial flood maps available from the EA which are updated on a regular basis
- the extent of flooding from surface water (SWMP, 2012) in the western areas of the borough
- the areas susceptible to surface water flooding (AStSWF) described in the PFRA
- the historical flooding from all sources described in the PFRA
- Catchment Flood Management Plans produced by the Environment Agency
- Groundwater – EA maps on Areas Susceptible to Groundwater Flooding (AStGWF)

Fluvial flooding

The fluvial flooding extents can be found on the EA flood maps. These maps show distinct areas of the Borough of Slough to be at risk and these are related to the small river catchments (Huntercombe Stream, Chalvey Ditch, Salt Hill Stream, Datchet Common Brook) flowing from the north of Slough and then the rivers associated with the Colnbrook area in the east of the Borough (Colne Brook and Horton Brook). The table below details the number of properties at risk from fluvial flooding.

Watercourse Valley	Number of Dwellings within Flood Zones 2 and 3	
	Zone 3 (Greater than 1:100)	Zone 2 (1:100 – 1:1000)
Huntercombe Lane	34	98
Chalvey Ditch	2625	3223
Salt Hill	1174	1624
Datchet Common Brook	729	1276
Horton Brook	48	94
Colne Brook	232	396
Myrke	6	70
Other	777	1756
Total	5625	8537

Surface Water Flooding

Slough's draft Surface Water Management Plan has analysed the distribution of the recorded flood events and found that the Chalvey Ditch and Salt Hill Stream catchments have suffered from the most historic flooding incidents followed by the Datchet Common Ditch catchment.

In April 2009, the extent of surface water flooding was represented by the Areas Susceptible to Surface Water Flooding (AStSWF) maps which were produced by the Environment Agency. On the basis of the AstSWF maps, the number of residential properties at risk of surface water flooding based on the AStSWF 'less' band is 15,500 whilst 1,700 non-residential properties are at risk. The Environment Agency also produced the Flood Map for Surface Water (FMfSW), 2010. Following a review in the Surface Water Management Plan, of the AStSWF and FMfSW, SBC decided that, for Slough, the AStSWF map is more representative of the flood risk.

Because of the high risk from surface water flooding SBC was funded in 2011/12 by DEFRA to develop a Surface Water Management Plan (SWMP) undertaken for the western part of the borough area to investigate the risks in the Chalvey Ditch, Salt Hill Stream and Datchet Common Brook catchments. As part of the SWMP, the properties at risk were analysed based on catchments and the 'less' band; half of the properties at risk are located within the Chalvey Ditches and Salt Hill Stream catchments with Datchet Common Ditch having the second greatest number of properties at future risk of surface water flooding.

Enhanced detailed modelling carried out for the SWMP identified the 6 hour summer storm as the most critical storm for the Chalvey Ditch and Salt Hill Stream catchments. The 100 year results indicate there are more areas with a significant hazard rating in the Salt Hill Stream catchment than the Chalvey Ditch catchment. However the majority of the hazard is confined to roads instead of properties. The flooding observed around Manor Park on the Salt Hill Stream catchment appears to be mainly from overland flows coming from Farnham Park. Although there are some overland flows from Stoke Park, these appear to be slowed down by the Stoke Poges dam. As the SWMP is based upon more accurate data and modelling than the AStSWF maps provided by the EA, its maps are likely to supersede the AStSWF maps for the west of Slough area.

Sewer Flooding

The Thames Water DG5 register indicates that the areas within Colnbrook and Poyle as well as areas around the western and north-western boundary of the borough with South Bucks have experienced flooding due to overloaded sewers in the last 10 years

Groundwater Flooding

Some areas have experienced groundwater flooding including the Wexham area, parts of Colnbrook and Poyle, and along the spring line in Cippenham, Chalvey, and Upton Park, Cocksherd Wood and Beechwood School.

Not all of these areas are shown as being in the risk band >=75% on the EA's Areas Susceptible to Groundwater Flooding (AStGWF).

Reservoir Flooding

There are four reservoirs in the vicinity of Slough whose failure would have a drastic impact on Slough. The Queen Mother and Wraysbury reservoirs to the south west of the borough are large raised reservoirs which fall under the responsibility of the Environment Agency. In October 2004, the Environment Agency took over responsibility for assuring the safety of the 2000 reservoirs by enforcing the Reservoirs Act 1975. The purpose of the Act is to prevent escapes of waster from large raised reservoirs (such as the Queen Mother and Wraysbury Reservoirs). The Environment Agency aims to bring a more coherent and uniform approach for ensuring reservoirs are operated safely and are properly managed.

The three other reservoirs which will impact upon Slough if they failed are:

- Stoke Park reservoir, just outside of the Borough area to the north of Slough located in the Stoke Park Park golf course;
- Haymill reservoir in the north west of the Borough. Neither of these reservoirs retains deep water and is not full except in a storm event; the Stoke Park reservoir is generally a quarter full and
- Upton reservoir in the Datchet Common Brook catchment upstream of the Wexham Park hospital

The Environment Agency has assumed responsibility from the Borough Council for the Haymill Reservoir, but not the Stoke Park one. The reason that responsibility for the Stoke Park reservoir remains with the Borough Council may relate to the fact that the Environment Agency does not designate Salt Hill Stream as main river north of Godolphin Recreation Ground. The Environment Agency prepared inundation maps for these two reservoirs in accordance with the Water Act 2003. The accuracy of these maps for the upper and lower Stoke Park reservoirs, Haymill reservoir and Upton reservoirs are under discussion.

Highway drainage

The Council is responsible for the provision and maintenance of highway drainage. It is considered that the capacity of the system is sufficient, though, as much of the highway drainage is connected to either surface water sewers or watercourses, flooding on the highway does occur in places, generally after extreme rainfall events. It is considered that where this does occur, it is a reflection of the incapacity of the surface water sewers/water courses rather than a failure of the highway drainage itself. In some areas, soakaways have been constructed which provide disposal by infiltration.

Given the finite capacity of the surface water sewers/watercourses/soakaways to which highway drainage is connected, it is important that surface water runoff from any developments does not drain onto the highway. It will be the strategy of SBC to restrict any drainage from developments onto highways.

Combined Flooding

The modelling which has been done and observations during flood events have highlighted the interaction between surface, fluvial and groundwater flooding. Some areas such as Cocksherd Wood and Beechwood School have clearly experienced both surface water flooding and groundwater flooding. Understanding how the different types of flooding interact is key to managing the flood risk within Slough.

Catchment Flood Management Plan

The Thames Catchment Management Plan (December 2009) identifies Slough as being in three different sub-areas with 2,000 to 5,000 properties at risk in a 1% annual probability river flood. The proposed actions for this sub-area in the short term encourages partners to develop policies, strategies and initiatives to increase resistance and resilience of all new development at risk of flooding. There is a need to identify opportunities to protect land that many be required to manage flood risk in the future.

3.3 Future Risk

In order to understand the future flooding risk various factors must be considered:

- Integrated system
- Climate change

- Urban Creep
- Future development

3.3.1 Integrated system
Any investigation into the flood risk and possible options and solutions for Slough should take into account all the sources of flooding and how they interact.

3.3.2 Climate change
The latest UK climate projections (UKCP09) are that by the 2080s there could be around three times as many days in winter with heavy rainfall (more than 25mm in a day) and that the amount of rain in extreme storms (1 in 5 year event) could increase locally by 40%. With wetter winters and more rain in extreme events this could increase river flooding in the heavily urbanised catchments such as Slough. The increased intensity of rainfall will cause greater surface runoff increasing localised flooding.

The Slough SWMP (2012) identified the impacts of climate change for a 1 in 100 year flood event. The results show that climate change would result in deeper flooding and increase the number of properties at risk from deeper flooding (over 350mm) by 100 properties which translates to an 18% increase in estimated damages due to surface water flooding. The impact of climate change on fluvial flooding in Slough is not known but it is anticipated that it will show a similar trend to the surface water flooding. There is a need to prepare for climate change and regularly review plans for increasing resilience and building capacity to adapt.

3.3.3 Urban Creep
Over the past 10 years the extent of increase of impermeable areas in Slough has increased with a large proportion of private, uncontrolled development. The evidence for this can be found in aerial photographs. The continuation of urban creep will only lead to increased pressure especially on the surface water system.

3.3.4 Future development
The Core Strategy for Slough indicates that areas of Green Belt in the borough will be protected from inappropriate development. The Core Strategy identifies the following major regeneration sites:

- Slough town centre (Heart of Slough Regeneration, 12,7ha);
- Britwell and Cippenham;
- Slough Trading Estate; and
- Parts of Chalvey

Opportunities to reduce existing surface water flooding will be considered during the design of all major development sites. This could involve maintaining existing overland flow routes or diverting them to areas where the consequence of flooding is significantly less.

4. Options and measures for managing flood risk
4.1 Approaches and objectives
There are a number of different approaches which can be taken to deal with flooding and the management of floods. These approaches are complementary and can be divided into structural and non-structural measures. *Structural measures* are most likely to be a physical construction to reduce or avoid the possible impacts of

flooding. The *non-structural measures* are making use of knowledge, communication, agreements to reduce risks and their impacts through policies, laws, raising public awareness and training and education

In the section below the general principles of the approach to be taken in the SBC area are defined. Based on these general principles, more specific options will be outlined on a catchment by catchment basis in catchment plans which are within appendices B to G. The measures for Slough need to be appropriate to the problem understanding both the scale and the context of the issues. Slough is a highly urbanised area where space for large scale storage attenuation of water is not readily available. A number of measures including storage/attenuation in several areas, surface water schemes, resistance and resilience measures, and flood warning are likely to be used in combination throughout a catchment to make best use of the space, taking into account the context of Slough as a densely populated urban environment.

The options and measures will be developed alongside the Environment Agency and Thames Water.

The general principle which SBC wish to apply to flooding in partnership with the EA and Thames Water is to reduce the risk of flooding to all those impacted as much as possible.

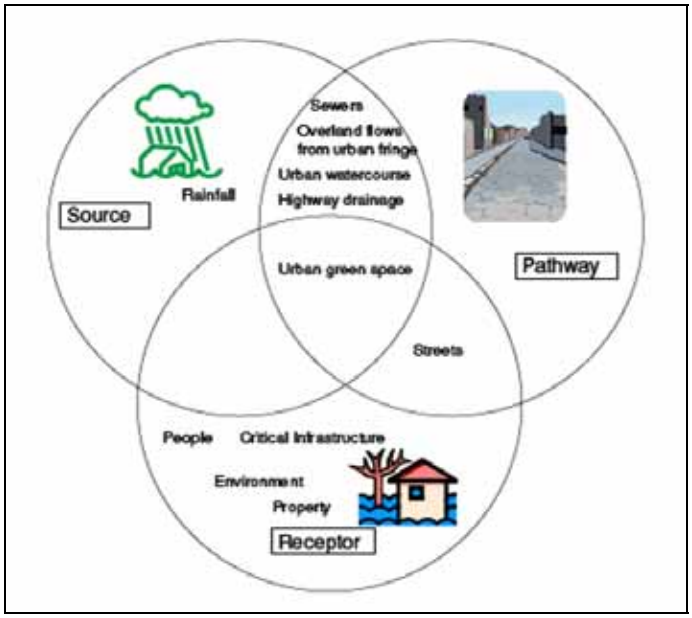
The measures ultimately will be assessed against the following criteria

Criteria	Description
Technical	Is it technically possible and buildable? Will it be robust and reliable?
Economic	Is it affordable and will benefits exceed costs?
Social	Will the community benefit or suffer from the implementation of the measure?
Environmental	Will the environment benefit or suffer from the implementation of the measure?
Objectives	Will it help to achieve the objectives set in the Local Flood Risk Management Strategy?

In every situation there will be three possible outcomes depending on the assessment of the situation against the criteria:

- Do nothing
- Maintain status quo (taking into account climate change)
- Improve

The ‘Do Nothing’ scenario is a required in every options assessment as it allows proposed options to be compared against the baseline during Cost Benefit Analysis.



4.2 Structural measures

The best way of managing fluvial and surface flood water is to try and deal with it as close to the source as possible. We cannot influence the rain falling from the sky but if we can manage the water as close to where it falls onto the land and as high up in the catchment as possible then that would be the ideal situation. This would be called "source control" and would involve storing water or slowing down water in the upper parts of the catchment which is termed attenuation. If source control is not possible then trying to influence the pathway or route of the flood water would be the next method. This could involve attenuation, re-routing or diverting water away from areas at risk and slowing down the flow of water.

If neither "source control" nor "Influencing the pathways of flooding" is an option then managing the water when it reaches the "receptors" needs to be considered. These options might involve resilience or resistance measures on individual properties or specific areas for example gates or barriers to prevent water entering a property.

The structural measures that are generally relevant for flood risk management within Slough are:

<u>Source Control</u>

- Flood storage - holding back the flood water in a storage area for the duration of the flood
- Attenuation - slowing down the flood water including tree and vegetation planting in the upper catchment

<u>Influencing the pathways</u>

- Decreasing the size of channel to attenuate within the channel or on the floodplain
- Reconnect river and floodplain by lowering banks of channel and using open spaces of floodplain
- Increasing size of channel to take flood water away from the affected area
- Diverting the flood water to another channel, area or catchment
- Embankments
- Flood walls

- Maintenance of channels, screens and structures

Managing at Receptors

- Gates
- Barriers
- Resistance measures aimed at preventing flood water entering properties e.g. gates, blocking of air vents

Some of these measures are possible in Slough alongside other non-structural measures. Some of the measures such as increasing the size of the channel and flood walls and embankments are not often technically feasible in Slough due to the constrained nature of the channel in densely urban areas. The size and scale of other structural options such as flood storage may be limited by the location and density in the urban areas.

4.3 Non-structural measures

The non-structural measures are very useful in either supporting or being used alongside structural measures or in their own right. They are not "built" or constructed solutions but rather use how we communicate and use the information and knowledge we have to make the situation or management of the risk more effective

Examples of non-structural measures would be:

- Resilience measures reduce the amount damage when water enters a building e.g. raising electrics above flood level and water compatible floors
- Advice and information on resistance and resilience measures
- Early flood warning for communities at risk of flooding
- Continue to enforce existing policies and education on updated policies;
- Advice leaflet for householders and developers on SUDS
- Development of information pack for self-help. This might involve Community Groups which could prepare flood action plans with the help of SBC and the EA.

Appendices B to H will deal with each catchment and the issues and options for that catchment

4.4 Prioritisation

All of the catchments in Slough have flood risk problems: fluvial; surface and; groundwater. The priority for development of measures will be based on the risk of flooding in a particular community and the opportunities available for options to be developed alongside the funding to appraise and implement the options. Many of the rivers in Slough are main rivers so working in partnership with the Environment Agency is the key to understanding, appraising and prioritising the measures across the borough.

4.5 Implementation of measures

The implementation of measures to deliver the options for flood risk management can be linked most effectively to the objectives given in Part A of the document.

The measures which are given below are those which Slough Borough Council are committed to undertaking under the statutory responsibilities and duties of the FWMA (2010). In addition there are measures which the Council can do in partnership with other Risk Management Authorities, as part of their role as Lead Local Flood Authority to ensure that the management of flood risk management in the Borough is as effective as possible.

1) To develop a clearer understanding of the sources, pathways and receptors of flooding and the risks of flooding from surface runoff, groundwater and ordinary watercourses

- Record Drainage and Flood Assets
- Maintain a public Asset Register
- Designating Flood/ Drainage Assets
- Recording/ mapping flood incidents
- Instigate flood investigations
- Assessment of high flood risk locations in Surface Water Management Plan
- Improve skills and knowledge of Flood Management officers

2) To identify the options available to mitigate flooding for the catchments in Slough and the measures being taken to seek the resources for these options.

- Continue with the current programme of maintenance and highway drainage management for example annual programme of gully and screen clearance
- Develop proposals to engage with significant landowners to employ land management techniques and initiatives which help to reduce the rate of surface water run-off
- Develop a programme of schemes and initiatives which are likely to be funded through the DEFRA GiA National Programme or Local Levy
- Determine all other funding sources, Council, partners and other external, and maximise “match-funding”

3) To set out clear and consistent short, medium and long term plans and options for flood risk management from the different catchments and sources. This will enable communities and businesses to make informed decisions about the management of the residual risk.

- Continue Slough Flood Risk Management Partnership Group
- Publish a clear strategy and communicate it – see objective 3 below
- Ensure that policies and programmes promoted through the LFRMS complement and support River Basin Management Plan (RBMP) and Catchment Flood Management Plan (CFMP)
- Consider the implication of climate change on the plans and regularly review plans for increasing resilience and building capacity to adapt.
- Monitor and review the above plans and strategies

4) To provide a clear explanation of all stakeholders' responsibilities in flooding issues and the relevant legislative requirements.

- Publish a clear strategy and communicate it
- Develop information strategy to improve stakeholder knowledge
- Publish and distribute information explaining responsibilities, local flood risk, property protection/resilience etc
- Involve local communities in local initiatives and schemes

5) To consider how best to communicate and share the information that becomes available to us with all stakeholders

- Publish a clear strategy
- Improve and maintain the Councils FRM web pages
- Work with Community workers within SBC and EA using their experience in engaging with the communities
- Use external "neutral" bodies such as National Flood Forum to communicate flood risk and measures

6) To identify, where possible, sources of funding for the options identified

- Research and understand the funding possible
- Work with the other partners in the Slough SFMG to identify funding possibilities
- Identify where capital and revenue monies from SBC can be used
- Work with planners to identify where section 106 monies or Community Infrastructure Levy could be used
- Look to use other sources of funding such as Water Framework Directive to enhance and support flood management options

7) To show how environmental considerations will be taken into account when considering flood management

- Ensure the environmental consequences of implementing the LFRMS are considered against the technical, economic and social benefits
- Develop options which take account of Water Framework Directive requirements
- Embed policies from local River Basin Management Plans, local environmental policies and "European " protected sites into FRM procedures and programmes
- Work closely with other parts of the Council to develop options that are consistent with the Local Development Framework and other plans and proposals for example open spaces

8) To ensure that planning decisions are properly informed by flooding issues and the impact future planning may have.

- Develop and apply a robust local policy on FRM and drainage solutions on new development sites
- Develop a process with the Planning Department to create clear advice and direction to developers on FRM and Drainage
- Establish the SUDS Adoption and Approval Body (SAB)
- Develop a procedure for SUDS

9) To ensure that emergency plans and responses to flood incidents are effective and that communities are able to respond properly to flood warnings.

- Use the information from LFRMS in flood response and recovery plans
- use developing knowledge on flood risk to adapt and add value to emergency procedures

4.6 Affordability and funding of the measures

The Government commits significant funding every year to flood management activities across the country. Funding for investigation, co-ordination and local management of flood risk issues has been allocated to LLFAs for a couple for years as the new responsibilities take effect. There is an indication that this funding will continue for Flood Risk Management although they are not ring-fenced.

Capital funding for mitigation works (such as flood defences, property resilience schemes, flood storage etc) is generally allocated on the basis of risk and, inevitably, areas where high density populations co-exist with high risk from river flooding tend to attract much of the available funding. Where there are deprived communities more funding will be available.

The new funding arrangement that has recently been introduced encourages local authority, community and business contributions to the funding of schemes which improves their chance of being supported through the national funding allocation. Essentially, the success of an FRM proposal will be improved if the cost burden is shared amongst as many contributors as possible, the share from the national allocation is as low as possible and the outcomes from the proposal are evidenced as clearly as possible. The new national funding scheme has also been extended to include proposals which address risk from surface water flooding as well as from main river-related fluvial flooding.

The Strategy has identified a range of measures to improve how flood risk is managed across the district – some measures can be delivered quickly with existing council resources but others need external funding support. The challenge for the council is to maximise the benefit from limited (council and external) funds through creative and innovative scheme development, mobilising community and business support for projects and initiatives and preparing sound and evidenced cost-benefit justifications.

The main sources of potential funding are summarised in the following sections:

Flood Defence Grant in Aid (FDGiA)
Central government funding for flood (and coastal) defence projects – recently revised to encourage a partnership approach to maximise match-funding, work towards achieving specified outcomes with a requirement to evidence a reduction in flood risk to properties. This funding is administered by the Environment Agency through the Regional Flood and Coastal Committee. This funding can be used for small, medium to large capital projects.

Local Levy
Annual contributions from Councils to a regional "pot", smaller than the FDGiA budget but offers more flexibility on the type and size of project it can fund. The Levy Funding for Thames Region for 1012/13 was £10Million

Water Company investment
Investment heavily regulated by OFWAT but opportunities for contributions to area-wide projects which help to address sewer under-capacity problems

Water Framework Directive
There is funding available through the Environment Agency for projects on river and floodplains which enhance, improve and develop habitats. WFD cannot be used for flood management projects per se but if habitat enhancement is part of the project then this source of funding will be useful for those aspects of a scheme

Section 106 contributions (Town & Country Planning Act)
Contributions from developers, linked to specific development sites where off-site improvements to drainage infrastructure are required to make the developers' proposals acceptable in planning terms. Future S106 monies may not be available, as new CIL requirements restrict use of S106 to specific projects and the Councils priorities for education and housing. After April 2014, S106 planning obligations will no longer be used as the basis for a tariff to fund infrastructure. CIL will be the mechanism for pooling contributions from new developments to fund infrastructure. Whether or not monies will be available for drainage infrastructure will depend on the priorities of the Council.

Business Rates Supplements
Agreement from local businesses to raise rates for specified purposes.

Community Infrastructure Levy (CIL)
A local levy applied by the Planning Authority on developers to contribute to a general infrastructure fund. A bid for CIL would have to be made for flood management/drainage improvements against other competing council priorities.
In the current economic climate CIL may not be viable, and any monies received will be directed according to the Council's priorities and probably not to flood measures.

SUDS Approval Board Income
Application and inspection fees from developers in support of the approval and inspection of new development related SUDS

Council Capital Funding
The Councils infrastructure programme prioritising capital improvement projects. The programme has included funding for drainage capacity improvements for a number of years which is targeted at the highway drainage systems

Council Revenue Funding

The Council has a number of revenue streams to support technical and administration processes and to maintain council infrastructure. Existing revenue budgets include Highway Drainage Maintenance, Highway Gully Maintenance, Watercourse Maintenance and funding for the Flood Management Team discharging the LLFA duty for the Council.

5. Delivery Plans

Based on the implementation of the measures given in section 4.4 a delivery plan for each of the strategy objectives has been developed. These delivery plans which include the description and benefits of the measures, the success criteria of the measure and the planned completion date and possible funding source are given in a series of tables below:

Table 1 Objective 1 Delivery Plan

Objective 1: To develop a clearer understanding of the sources, pathways and receptors of flooding and the risks of flooding from surface runoff, groundwater and ordinary watercourses				
Action	**Description and Benefits of Carrying out the Measure**	**Success Measures**	**Planned Completion Date**	**Funding Source**
Record Drainage and Flood Assets	Developing and maintaining an asset register in relation to drainage and flood risk management infrastructure is vital in understanding flood risk. SBC are developing an integrated asset register comprising of drainage and flood risk assets. This will provide a holistic view of the drainage network including sewers, culverts, open watercourses and water storage facilities (ponds and reservoirs) and key flow controls such as weirs, dams, penstocks, flap valves, screens, inlets and outlets. Where assets are likely to have a significant effect on flood risk information on condition and ownership will be recorded The register will improve the ability to determine ownership and responsibility for managing flood risk and flood risk assets, and assist in ensuring that the capacity of critical aspects of the drainage network is maintained. The register will be maintained and improved routinely using feedback from flood incident investigations, planned maintenance programmes, new highway works and 3rd party information.	Establishment of a comprehensive Drainage and Flood Asset Register. Publication of a Policy and Procedure for ensuring that the register is maintained.	Complete 06/2013	DEFRA DEFRA

Maintain a public Asset Register	A register of those drainage assets which are likely to have a significant effect on flood risk within Slough will be made available for inspection during normal working hours, within SBC's St Martins Place offices located at 51 Bath Road, Slough, SL1 3UF. This will assist residents in understanding what assets are located in their vicinity and who is responsible for maintaining them.	Publication of the Asset Register. Publication of Policy and Procedure for ensuring that the register is maintained.	End 2013 06/2012	DEFRA DEFRA
Designate Flood/ Drainage Assets	SBC may designate key structures or features that are privately owned and maintained, but which make a contribution to the flood risk management of people and property at a particular location. Designation will mean that the asset cannot be altered or removed without consent as it forms part of a flood management system The decision as to whether or not to designate will be taken on a case by case basis and follow a risk based approach. This will ensure that all assets which are critical in providing flood defences are adequately protected against change.	Establishment of designation policy and procedures Completion of designation assessment for all flood assets.	06/2013 Ongoing	DEFRA DEFRA
Record/ map flood incidents	All known historic flood incidents are recorded and mapped. This assists in prioritising investigation/interventions and enables flood risk assessments to be validated. All future incidents investigated by SBC will be recorded to ensure that the incident map is kept up to date.	Establishment of flood incident map. Establishment/Implementation of flood record policy and procedure.	02/2013 02/2013	DEFRA DEFRA
Carry out Flood investigations	SBC will investigate all flood events that it considers necessary or appropriate to investigate in order to clarify which flood risk management authorities have responsibility for the source of the flooding and establish what actions those authorities are taking or intend to take in response to the flood. This will ensure that people affected by significant flooding have a point of	Publish policy and procedure for undertaking flood investigation. Undertake investigations in accordance with the SBC policy.	11/2012 Ongoing	DEFRA TBC

	contact to assist them by identifying the party responsible for the flood event. **The SBC policy on flood investigations is included in Appendix I.**			
Assess high flood risk locations	SBC are committed to improving the understanding of flood risk within Slough. The Chalvey Ditch and Salt Hill Stream catchments were identified as a high risk flood area requiring a more detailed assessment to understand the mechanisms of flooding. A SWMP has been undertaken to identify key overland flow routes between buildings and establish the surface water flood risk. **The SWMP is available on the SBC website.**	Undertake a SWMP for Slough.	Complete	DEFRA
Improve skills and knowledge of FRM officers	By improving the skills and knowledge of its FRM staff SBC will be able to develop a local centre of expertise on general FRM. Staff will be encouraged to develop a wide range of FRM skills rather than relying on specialists, and set up a competency matrix and training programme to ensure that the necessary skills are gained.	Produce a competency framework for SBC drainage staff. Implement a training programme to ensure competencies are achieved.	04/2013 06/2013	DEFRA TBC

Table 2 Objective 2 Delivery Plan

Objective 2: To identify the options available to mitigate flooding for the catchments in Slough and the measures being taken to seek the resources for these options.				
Actions Proposed	Description and Benefits of Carrying out the Measure	Success Measure	Planned Completion Date	Funding Source
Continue with the current programme of maintenance and highway drainage management	SBC has an annual gully clearance programme which ensures that where possible all road gullies are cleaned once a year. The team used is very knowledgeable and is responsive to and aware of high risk areas. The monthly screen clearance procedure provides a risk based approach to the screens where blockages may cause a problem. Land and highway ditches are cleaned on a reactive basis and a watching brief is kept on the most vulnerable areas known to be at risk from flooding	To maintain the level of service on highway drainage and maintenance which keeps the gullies and screens clear. Develop a risk based approach	Ongoing	SBC
Champion land management techniques which reduce surface water runoff.	SBC will work with landowners and partners to develop specific proposals to engage with significant landowners to employ land management techniques and initiatives which help to reduce the rate of surface water run-off. The Environment Agency booklet, *Best farming practice: profiting from a good environment* (2003) and Soil Protection Review2010 at www.rpa.defra.gov.uk/crosscompliance/farmerguidance will be useful.	Development and implementation of an engagement plan.	End 2014	DEFRA
Develop an optimised programme of schemes and initiatives for reducing flood risk within Slough.	SBC are committed to ensuring that schemes and initiatives have been developed and assessed for all areas exposed to a high risk of flooding and commissioned a SWMP to achieve this objective. All options identified within the SWMP have been scored based on technical, economic, social, environmental criteria. This leads to an optimised programme of scheme and initiatives. This approach ensures that the proposals achieve the right balance of	Delivery of the SWMP.	End 2013	EA/SBC/ DEFRA

	protection and affordability.			
Make the case for funding of prioritised schemes by demonstrating achievement of funding criteria through the DEFRA GiA National Programme or Local Levy.	This Strategy sets out a suite of measures which could be taken to manage local flood risk. Some measures are more cost beneficial than others (i.e. the benefits exceed the costs). The national funding administered by the Environment Agency targets schemes with evidenced high risk of property flooding, preferably with contributory funding from partners and stakeholders benefiting from the scheme. SBC will set out the level of risk reduction that each flood risk measure will achieve, the whole life cost of the measure and the associated benefit cost ratio. This information will be used to establish which measures to put forward for capital funding. SBC will make the case for funding of the preferred options identified through the SWMP through submission of a Project Appraisal Report (PAR) to the EA.	Delivery of a PAR. Securement of funding.	End 2013	EA/SBC/ DEFRA
Identify all other potential funding sources, Council, partners and other external, and maximise "match-funding"	Some high priority schemes and initiatives may not meet the criteria for funding through the DEFRA GiA National Programme or Local Levy. Where there is a clear net benefit in implementing these schemes SBC will seek to determine all other funding sources, so as to ensure the best overall outcome for residents and businesses.	Development of a live list of funding sources applicable to flood risk reduction measures.	End 2013	EA/SBC/ DEFRA

Table 3 Objective 3 Delivery Plan

Objective 3: To set out clear and consistent short, medium and long term plans and options for flood risk management from the different catchments and sources. This will enable communities and businesses to make informed decisions about the management of residual flood risk.				
Actions Proposed	**Description and Benefits of Carrying out the Measure**	**Success Measure**	**Planned Completion Date**	**Funding Source**
Continue the Slough Flood Risk Management Partnership Group (FRMG)	The Slough FRMG will monitor the Strategy on a quarterly basis. The Strategy is currently designed to look at short to medium term plans (3 to 5 years). As the strategy evolves, a more long term perspective for the management of flood risk will become apparent as additional information, legislation and evidence becomes available.	Completion of quarterly FMRG meetings.	Ongoing	DEFRA
Publish a clear strategy and communicate it	This Strategy provides the framework through which local flood risk will be managed. The Strategy includes catchment specific plans which inform local businesses and communities of the flood risk within their locality and sets out the short to medium plans for managing that risk.	Publication of the Slough LFRMS.	06/2013	DEFRA
Ensure that policies and programmes promoted through the LFRMS complement and support the Thames River Basin Management Plans (RBMP) and Catchment Flood Management Plan	It is essential that local flood risk is considered in the context of wider flood risk, so that conflicts between objectives are avoided and overall benefit is maximised. As Slough falls within the Thames catchment it is necessary to ensure that the LFRMS is consistent with the wider Thames RBMP and CFMP. This will be achieved through close working with the EA and cross referencing of the key documents.	Regular meetings with EA. Cross referencing of key documents.	Ongoing	DEFRA

(CFMP)				
Consider the implication of climate change on the plans and regularly review plans for increasing resilience and building capacity to adapt.	The impact of the increase in intensity and frequency of rainfall in latest climate change projections (UKCP09) will be considered for the existing flood risk areas in Slough. Any flood management options considered will consider the impact of climate change. Plans will continue to monitor the resilience of flood management measures to climate changes	Include climate change resilience into flood management options and measures. Regular Review of impact of climate change	Ongoing	DEFRA
Monitor and review plans	The monitoring and reviewing of short, medium and long term plans such as this strategy and the PFRA and surface and fluvial modelling will be vital ongoing measures to ensure ongoing success of managing flood risk in the Borough. This will be overseen by the Strategic Flood Risk Management Group	Updates plans and strategies and improved flood modelling	Ongoing	DEFRA/SBC/EA

Table 4 Objective 4 Delivery Plan

Objective 4: To provide a clear explanation of all stakeholders' responsibilities in flooding issues and the relevant legislative requirements.				
Actions Proposed	**Description and Benefits of Carrying out the Measure**	**Success Measure**	**Planned Completion Date**	**Funding Source**
Publish a clear strategy and communicate it	Part C of this Strategy clearly sets out the roles and responsibility of all stakeholders. Through the publication and communication of the Strategy SBC aim to clarify the relevant legislative requirements.	Publication of the Slough LFRMS.	06/2013	DEFRA
Develop information strategy to improve stakeholder knowledge	The Council needs to translate the technical information on flood risk into simple, readily understandable terms. Text and graphics should be used to allow partners and stakeholders to understand the risk relevant to their interests. Innovative means of conveying complex information will be investigated, sharing best practice from other LLFAs.	Publication of information strategy Implementation of tasks outlined within the strategy	08/2013	DEFRA/ SBC/EA
Publish and distribute information explaining responsibilities, local flood risk, property protection/resilience etc	Part C of this Strategy outlines the responsibilities of each Stakeholder with regards to flood risk. Information on local flood risk is included in Appendices B-G as well as the SWMP. Through the SBC website guidance will be provided on where to find information on property protection and resilience measures, including the National Flood Forum and EA guidance.	Publication of the Slough LFRMS and other key documents on the SBC website.	06/2013	DEFRA
Involve local communities in local initiatives and schemes	Individual householders and business holders often have a good understanding of local flood risk and potential mitigation measures. Involving local communities throughout the planning and implementation of schemes can ensure that this information is captured and that communities buy into the initiatives and schemes. SBC will seek to ensure community involvement through developing and implementing an engagement plan. **The SBC engagement plan is included in Appendix B of the SWMP.**	Publication of the SBC engagement plan. Delivery of actions set out within the engagement plan.	10/2013	SBC/EA

Table 5 Objective 5 Delivery Plan

Objective 5: To consider how best to communicate and share the information that becomes available to us with all stakeholders				
Actions Proposed	Description and Benefits of Carrying out the Measure	Success Measure	Planned Completion Date	Funding Source
Publish a clear strategy	The Strategy will act as a live document that provides signposts to key sources of information with regards to flood risk. By publishing the Strategy on the SBC website stakeholders will have access to key information relating to flood risk.	Publication of the Slough LFRMS.	06/2013	DEFRA
Improve and maintain the Councils FRM web pages	SBC is committed to ensuring it communicates the message on Flood Risk as effectively and widely as possible and will employ a number of methods to achieve this. However, the SBC website will become increasingly important as the most useful and flexible method of displaying both policies and graphical demonstrations of flood risk.	Publication of all relevant information on The Flood Management pages of the SBC website. Ongoing maintenance of the SBC website as an up to date record of local flood risk.	06/2013	DEFRA
Work with Community workers within SBC and EA using their experience in engaging with the communities	It is appreciated that not all householders and business owners will have access to the internet, or will proactively seek out Flood Risk information. To ensure that this does not prevent SBC from communicating information on flood risk SBC will aim to engage with the local community through SBC community workers and the EA. An engagement plan will be produced outlining how this will be achieved.	Publication of the SBC engagement plan. Delivery of actions set out within the engagement plan.	06/2013	DEFRA
Use a internal SBC expertise and external organisations to communicate flood risk and measures	Where significant flood risk is identified SBC will work with the EA to seek to raise awareness and communicate flood risk and potential mitigation measures. SBC will use internal experts on community engagement and where appropriate engage with a neutral body such as the National Flood Forum to assist SBC and EA in communicating the flood risk.	Engage with 'internal communication experts and external relevant bodies to undertake intermediary role.	Ongoing	DEFRA/ SBC/EA

	This will ensure that a community perspective is developed and the experience that SBC has locally and that the EA and NFF has gained from across the UK will be built upon.			

Table 6 Objective 6 Delivery Plan

Objective 6: To identify, where possible, sources of funding for the options identified				
Actions Proposed	**Description and Benefits of Carrying out the Measure**	**Success Measure**	**Planned Completion Date**	**Funding Source**
Research and understand the funding possible	SBC will undertake a detailed review of all potential funding sources, and associated criteria to ensure that the best possible outcome for residents is secured.	Develop a maintained list of funding sources	10/2013	DEFRA
Work with the other partners in the Slough SFMG to identify funding possibilities	The current national capital funding arrangements for FRM encourages a partnership approach to maximise outcomes and funding contributions. In general terms, FRM projects stand the best chance of national funding if they are community led and supported.	Publication of the SBC engagement plan. Delivery of actions set out within the engagement plan.	10/2013	DEFRA/ EA
Identify where capital and revenue monies from SBC can be used	The Council has a number of revenue streams to support technical and admin processes and to maintain council infrastructure. Existing revenue budgets include Highway Drainage Maintenance, Highway Gully Maintenance, Watercourse Maintenance and funding for the Flood Management Team discharging the LLFA duty for the Council. Improved understanding of flood risk and flood risk assets gained through the actions proposed under objective 1 will improve the targeting of these revenue streams at critical assets/locations so that the benefit of investment is maximised.	Complete maintenance review with consideration findings from Objective 1 actions and SWMP.	06/2013	DEFRA
Work with planners to identify where section 106 monies could be used	The NPPF and the Core Strategy recognise all forms of flooding, and the infrastructure delivery plan supporting the CIL process will look at what flood risk measures are needed to reduce flood risk as a whole. However the current economic climate means CIL may not	Update planning procedures to ensure drainage engineers are consulted at an		

COMMENT: future S106 monies may not be available, as new CIL requirements restrict use of S106 to specific projects and the Councils priorities for education and housing	be viable, or any monies received will be directed according to the Council's priorities and not flood measures. Specific planning applications will need to continue to address their own requirements on site through design measures that reduce flood risk proportionately to cost/ benefit ratio. Explanation for deletion below: in light of viability at present S106 requests are being directed towards the Councils priority for education and affordable housing provision.	early stage in the planning process, and all forms of flooding are considered and mitigated on site.		
Look to use other sources of funding such as Water Framework Directive to enhance and support flood management options	Some high priority schemes and initiatives may not meet the criteria for funding through the DEFRA GiA National Programme or Local Levy. Where there is a clear net benefit in implementing such schemes SBC will seek to identify all other funding sources, so as to ensure the best overall outcome for Slough residents and businesses.	Development of a live list of funding sources applicable to flood risk reduction measures.	10/2013	DEFRA

Table 7 Objective 7 Delivery Plan

Objective 7: To show how environmental considerations will be taken into account when considering flood management				
Actions Proposed	**Description and Benefits of Carrying out the Measure**	**Success Measure**	**Planned Completion Date**	**Funding Source**
Ensure the environmental consequences of implementing the options within the LFRMS are considered against the technical, economic and social benefits	There are a variety of options available to reduce flood risk within Slough. These measures and initiatives can have both positive and negative impacts on the environment, as well as the local economy and community. It is important that the benefits and dis-benefits of the options in the LFRMS consider all of these aspects so that the net overall benefit of the proposals is maximised. This will be achieved by utilising multi criteria analysis when assessing schemes and initiatives.	Incorporate environmental consequence within the SWMP scoring approach. Prepare the Strategic Environmental Assessment (SEA) alongside the LFRMS	Ongoing 06/2013	DEFRA DEFRA
Develop options which take account of Water Framework Directive requirements	Work closely with the EA to develop options which are in line with WFD assessment. Work closely with the Parks and Open Spaces Team to develop options in line with the Parks and Open Spaces Management Framework	Development of some WFD options with and alongside the FRM options	10/2013	DEFRA/ SBC/EA
Embed policies from local River Basin Management Plans, local environmental policies and "European " protected sites into FRM procedures and programmes	Where there are significant and predictable environmental risks from schemes and initiatives promoted by the strategy, the council will commit to carrying out formal Environmental Impact Assessments for the proposals.	Prepare the Strategic Environmental Assessment (SEA) alongside the LFRMS	06/2013	DEFRA
Work closely with other parts of the Council to develop options that are consistent with the	SBC Planners and Drainage engineers have historically worked closely to ensure that the LDF gives due consideration to Flood Risk, to ensure that development	Clear links and references between the LDF, LFRMS	Ongoing	SBC/D

Local Development Framework (LDF) and other plans and proposals for example Parks and Open Spaces Management Framework	does not occur within or impact upon areas of high flood risk. In addition options considered will, where feasible release areas for future development. Going forward SBC will continue to maintain the close working relationship between Planners and drainage engineers, this will be documented through links and references between key documents.	and other relevant strategies and frameworks		

Table 8 Objective 8 Delivery Plan

Objective 8: To ensure that planning decisions are properly informed by flooding issues and the impact future planning may have.				
Actions Proposed	**Description and Benefits of Carrying out the Measure**	**Success Measure**	**Planned Completion Date**	**Funding Source**
Develop and apply a robust local policy on FRM and drainage solutions on new development sites	As a Planning Authority SBC have a responsibility to consider flood risk when assessing applications for development; development should not be permitted if it increases the overall risk of flooding in the area and is not adequately protected from flooding itself The development of new and existing sites can also give SBC the opportunity to reduce flood risk. To ensure that this is achieved SBC will develop a robust local policy on FRM and drainage solutions on new development sites. Drainage from developments onto public highways will not be permitted	Publish a Policy on FRM and drainage on new development sites		
Develop a process with the Planning Department to create clear advice and direction to developers on FRM and Drainage	Providing clear advice and direction to developers on appropriate FRM and drainage options within the Slough area will help developers produce proposals which are acceptable to all parties. It will also help to ensure the best outcomes are achieved for residents and businesses in terms of reduced flood risk. This advice will form part of an overall SBC procedure that integrates technical advice with the planning application process. Application of FRM and Drainage advice has to be translated into appropriate conditions attached to planning approvals. SBC will develop a procedure to ensure that appropriate advice is given to planners and developers and that planning approvals and conditions are	Publish developer advice process Embed the developer advice process within wider planning procedure.		

	clear and enforceable.			
Establish the SUDS Approval Body (SAB)	The Council will maximise the future benefits from SUDS by setting up a SAB that is knowledgeable, well-resourced and committed to working effectively with developers. The SAB will be integrated into existing Council activities to provide links between the development planning, environment/biodiversity, highways and grounds maintenance processes. Existing relationships with SBC's main partners, Thames Water and the Environment Agency, will be strengthened and focused on developing clear and strong policies and working arrangements for SUDS. Details on SUDS/SAB implementation are still to be determined nationally but a draft SAB will be established in the interim.	Establishment of a SAB. Publication of procedures for SUDS approval Ongoing technical assessment work on planning applications and SUDs applications	Awaiting Defra confirmation	
Develop a procedure for SUDS	To support developers in understanding which SUDS options are most appropriate for different parts of Slough, SBC will produce a SUDS procedure which will seek to provide local context to current guidance and best practice. The SUDS procedure will be published on the SBC website.	Publication of an SBC SUDS procedure.	04/2014	

Table 9 Objective 9 Delivery Plan

Objective 9: To ensure that emergency plans and responses to flood incidents are effective and that communities are able to respond properly to flood warnings.				
Actions Proposed	**Description and Benefits of Carrying out the Measure**	**Timescales**	**Planned Completion Date**	**Funding Source**
Use the information from LFRMS in flood response and recovery plans	The Corporate Safety and Resilience team have responsibility for the council's management of flood incidents affecting the Slough community. Any action required to manage the incident and its aftermath is co-ordinated through the council's Major Incident Plan. The new responsibilities in the FWMA, 2010 and outlined in the LFRMS, Part C, will improve the understanding of flood risk, thereby supporting informed decision making on where best to deploy resources if a severe area-wide flooding event occurs.	Update Major Incident Plan	03/2013	
Use developing knowledge on flood risk to adapt and add value to emergency procedures	The Council's responsibilities under the Flood and Water Management Act, 2010, will lead to an improved knowledge of flood risk and asset criticality over time. For example post-flooding feedback will be added to the information held by the Flood Management team and information will be taken into consideration when emergency procedures are reviewed.	Update flood incident record as incidents occur	Ongoing	DEFRA

Part C Responsibilities, Duties and Powers

1. Introduction

The Flood and Water Management Act identified certain organisations as 'risk management authorities' (RMAs) which have responsibilities around flooding, both new ones from the Flood and Water Management and longstanding ones from previous legislation. The RMAs in the Slough Borough council area are SBC as Lead Local Flood Authority (LLFA), Environment Agency, Thames Water and Highways Authority.

2. Roles and Responsibilities, Powers and Duties

There are a number of different bodies who have specific duties and powers. This also extends to the individual riparian owner as stated in the sections below.

The main roles, responsibilities and functions to be exercised by the RMAs are as given below. These authorities have all of the following duties and powers:

- Duty to be subject to scrutiny from the lead local flood authority's democratic processes.
- Power to take on flood and coastal erosion functions from another risk management authority when agreed by both sides.

NB. A duty is something the council is legally obliged to do; a power can be used if appropriate but does not have to be used.

<u>The Lead Local Flood Authority</u>

- Development of the strategy for local flood risk management
- Strategic leadership of local risk management authorities
- Reducing the risk of flooding from surface water, groundwater and ordinary watercourses
- Powers to request a person for any information relating to its flood management responsibilities
- A duty to investigate significant flood incidents and determine and allocate responsibilities
- A duty to maintain a register of structures or features likely to have a significant effect on flood risk
- Powers to designate structures and features relating to flood risk, other than from "main river"
- Advise on land use planning processes to mitigate flood risk resulting from new or re-development of land
- Responsibility as SUDS Approval Body (SAB) to approve, adopt and maintain SUDS on new development sites
- A duty to ensure local flood risk management functions are consistent with the national strategy

<u>The Environment Agency</u>

- Strategic overview of all forms of flooding
- Risk-based management of flooding from "main rivers"
- Regulation of the safety of higher-risk reservoirs
- Development of the National Strategy for Flood and Coastal Erosion Risk Management
- Coordination of Regional Flood and Coastal Committees

- Powers to request a person for any information relating to its flood management responsibilities
- Powers to designate structures and features relating to “main rivers”
- A duty to report to ministers on flood risk management
- Statutory consultees to the SUDS approving body

The Water Company

- Where appropriate, assist the LLFAs in meeting their duties in line with the national strategy and guidance.
- Where appropriate, assist the LLFAs in meeting their duties in line with local strategies in its area.
- Where appropriate, sharing of information and data with RMAs, relevant to their flood risk management functions.
- A duty to effectually drain their area, in accordance with section 94 of the Water Industry Act 1991.
- A duty to register all reservoirs with a capacity greater than 10,000m3 with the Environment Agency
- An agreement with Ofwat to maintain a register of properties at risk from hydraulic overloading in the public sewerage system (DG5 register).
- The appropriate management of surface water in combined systems.
- Encouraging the use of SUDS.
- Creating a detailed understanding of flood risk from the public sewer system.
- Explore and implement multi benefit/agency schemes.

The Highway Authority

- A duty to act in a manner which is consistent with the local and national strategies and guidance
- A duty to share information with other RMAs relevant to their flood risk management functions
- A duty to drain the adopted highway of surface water

Planning Authority

- A responsibility to consider flood risk in Local Plans
- A responsibility to consider flood risk when assessing applications for development
- Working with the SAB (See Section 3.3.5)

SUDS Approval Body (SAB)

- A duty to establish a SUDS Approval Body (SAB)
- A duty to receive applications for, and approve all construction work associated with, construction work which has drainage implications A duty to adopt SUDS which serve more than one property
- A duty to maintain adopted SUDS

In addition, all authorities have a universal duty to comply with **environmental legislation**. They have a duty to take reasonable steps, consistent with the proper exercise of the authority's functions, to further the conservation of Sites of Special Scientific Interest. (Wildlife & Countryside Act 1981, as amended by the Countryside and Rights of Way Act 2000).

All authorities are required to have regard for the requirements of the Habitats Directive in the exercise of their functions (regulation 9(5)).

Riparian owners

For those owning land or property alongside a river or other watercourse including a culvert, there are certain rights and responsibilities. In legal terms the land or property owner is a 'riparian owner'.

Some of the responsibilities include:

- maintaining river beds and banks;
- allowing the flow of water to pass without obstruction, pollution or diversion;
- accepting the flow from upstream
- controlling invasive alien species such as Japanese knotweed.

More useful information can be found about responsibilities of a riparian owner in the booklet “Living on the Edge” booklet published by the Environment Agency in 2012

Emergency Planning - Category 1 Responder

- A duty to assess risk of emergencies occurring and use this to inform contingency planning
- A duty to put in place emergency plans
- A duty to put in place Business Continuity Management arrangements
- A duty to put in place arrangements to make information available to the public about civil protection matters and maintain arrangements to warn, inform and advise the public in the event of an emergency
- A duty to share information with other local responders to enhance co-ordination
- A duty to Co-operate with other local responders to enhance co-ordination and efficiency
- A duty to provide advice and assistance to businesses and voluntary organisations about business continuity management (Local Authorities only)

3. Partnership working

3.1. Slough Strategic Flood Risk Management Group

Slough Borough Council has an important role to play as the strategic leader for local flood risk management in Slough. This involves developing this strategy, ensuring that all organisations involved in flood risk management are aware of their responsibilities, monitoring progress and activity by all parties involved in flood risk management and co-ordinating communication with the public and between organisations.

In Slough there is a Strategic Flood Risk Management Group with a SBC councillor and representatives from the RMAs duty to co-operate with other risk management authorities in the exercise of their flood and coastal erosion risk management functions, including sharing flood risk management data. The Slough Strategic Flood Risk Management Group is led and managed by the council and provides an important forum to discuss all aspects of flood risk management in the Borough.

3.2. Engagement and Consultation

SBC is committed to engaging with local people to ensure that they are aware of the flood risk which they face. This engagement will begin with developing a communication plan alongside the Communications Team and community wardens within SBC to make use of their expertise and local knowledge. Engagement with the Environment Agency team in this area will make use of their considerable expertise in communicating flood risk. External independent groups such as National Flood Forum will be used where appropriate for advice and help on flood workshops and public meetings

Initially relationships with the local communities will be developed and the following approach taken:

- Explore extent of flood risk and understanding internally within SBC employees and hold internal workshops to increase understanding and develop relationships within communities

- Identify community groups and leaders within main flood risk areas and make contact with them
- Attend local parish, community forum and residents groups/associations meetings to explain flood risk and raise awareness
- Ask above groups for ideas for raising flood awareness in local communities
- Develop a raising flood awareness plan for individual communities by a variety of methods such as: preparing leaflets on flooding; hold public meetings or flood workshops; setting up local Flood Action Groups.

In addition to the above consultation will be undertaken on any structural or non-structural flood measures which will be suggested for any local area.

Appendix A - Context for Flood risk management in relation to other plans/policies/strategies

Following the extreme rainfall and subsequent floods of 2007 the Pitt Review (2008) was set up. Many of the recommendations from that review were implemented through the Flood and Water Management Act (2010). This places greater responsibilities on Lead Local Flood Authorities, of which SBC is one particularly for the management of surface water.

A summary of the key, current legislation is given below:

Making Space for Water, DEFRA (2005)
Making Space for Water was the cross Government programme taking forward the developing strategy for flood and coastal erosion risk management in England.

The aim was to manage the risks from flooding and coastal erosion by employing an integrated portfolio of approaches which reflect both national and local priorities, so as:

- to reduce the threat to people and their property; and
- to deliver the greatest environmental, social and economic benefit, consistent with the Government's sustainable development principles.

Pitt Review 2008
Independent review of national flood risk management practises after the widespread and devastating floods during the summer of 2007. Pitt Review was published in 2008 and contained 92 recommendations for Government, Local Authorities and other stakeholders. The review led to the FWMA, 2010.

Flood and Water Management Act 2010
The Flood and Water Management Act 2010 was enacted as part of Government's response to address the issue of flood risk and flooding. That Act places a duty on Lead Local Flood Authorities (LLFAs) to develop strategies for flood risk (Section 9 (1)). Local Flood Risk Management Strategies should encourage more effective risk management by enabling people, communities, business and the public sector to work together. The local strategies must be consistent with the National Flood and Coastal Erosion Risk Management Strategy which was approved by Parliament in July 2011, although there is no prescribed date by which they must be adopted. The strategy must meet the given requirements, but the form and content has been largely left to authorities to determine, according to their needs.

The area covered by Slough's LFRMS will principally be the Borough of Slough; however the nature of catchment areas means they extend beyond Slough's administrative boundary so it has been necessary to liaise with adjoining authorities, particularly South Bucks, as there are surface water flow routes from South Bucks and therefore the possibility that mitigation measures within South Bucks may be identified.

The strategy will be updated on a six yearly cycle, more often if necessary because of: a flooding incident; additional data or modelling becoming available; the outcome of investment decisions partners which is different to the preferred option; or changes within the catchment area such as a major development which affects flood risk.

Flood Risk Regulations (2009)

The Flood Risk Regulations transpose the EU Floods Directive into law for England and Wales and require three main pieces of work:

1. *Preliminary Flood Risk Assessment (PFRA)* – information on past floods and future flood risk from surface, groundwater and ordinary watercourses. Identification of Flood Risk Areas. Slough was not identified as a Flood Risk Area
2. *Flood Hazard and Flood Risk Maps* – where Flood Risk Areas are identified, the Environment Agency and LLFA are required to produce hazard and risk maps for the Indicative Flood Risk Areas by 22nd December 2013. This does not apply to Slough
3. *Flood Risk Management Plans* – where Indicative Flood Risk Areas are identified a Flood Risk Management Plan needs to be produced by 22nd December 2015. This is not applicable to Slough

River Basin Management Plans, Water Framework Directive, 2007

A River Basin Management Plan will be produced for each river basin district, every six years. The plan relevant to Slough is the Thames RBMP. The River Basin Management Plan describes the river basin district, and the pressures that the water environment faces. It shows what this means for the current state of the water environment in the river basin district, and what actions will be taken to address the pressures. It sets out what improvements are possible by 2015 and how the actions will make a difference to the local environment - the catchments, estuaries, the coast and groundwater.

River Basin Management is a continuous process of planning (to develop River Basin Management Plans) and delivery. The Water Framework Directive, 2007, introduces a formal series of 6 year cycles. The first cycle will end in 2015 when, following further planning and consultation, the River Basin Management Plan will be updated and reissued.

Catchment Flood Management Plans

Catchment Flood Management Plans gives an overview of the flood risk in river basins. They recommend ways of managing those risks now and over the next 50-100 years. The CFMP relevant to Slough is the Thames CFMP. The role of CFMPs is to establish flood risk management policies which will deliver sustainable flood risk for the long term. The CFMP identifies flood risk management polices to assist all key decision makers in the catchment.

National Planning Policy Framework, 2012

The National Planning Policy Framework sets out the Government's planning policy for England and how these are expected to be applied. It must be taken into account in preparing local and neighbourhood plans, and is a material consideration in planning decisions. It replaces a myriad of planning policy documents, including Planning Policy Statement 25 (PPS25).

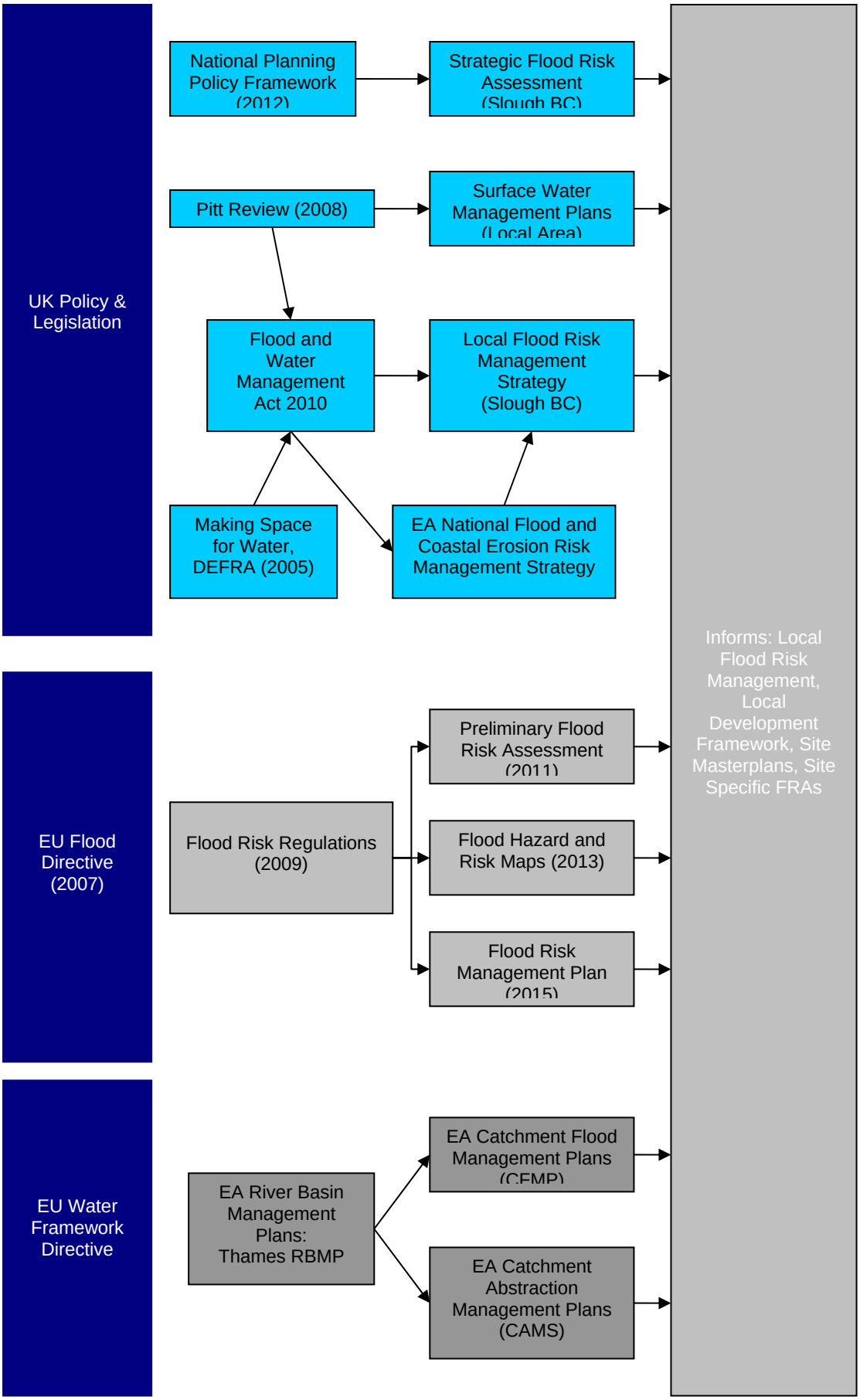
Figure A1 below shows the summary of European, national and local policies concerning flood and water management and the linkages between them.

Figure A1 below shoes the summary of European, national and local policies concerning Flood and water management and the linkages between them.

Other Legislation

Flood Risk Management is impacted by a range of other legislation and guidance. These include:

- Climate Change Act (2008)
- Conservation of Habitat and Species Regulations (2010)
- Civil contingencies Act (2004)
- Strategic Environmental Assessment (SEA) Directive (2001)
- Land Drainage Act (1991)
- Water Framework Directive (2007)
- Wildlife and Countryside Act (1981)
- Countryside and Rights of Way Act (200)
- Public Health Act (1936)
- Highways Act (1980)
- Reservoirs Act (1975)


UK Policy & Legislation
National Planning Policy Framework (2012)
Strategic Flood Risk Assessment (Slough BC)
Pitt Review (2008)
Surface Water Management Plans (Local Area)
Flood and Water Management Act 2010
Local Flood Risk Management Strategy (Slough BC)
Making Space for Water, DEFRA (2005)
EA National Flood and Coastal Erosion Risk Management Strategy
EU Flood Directive (2007)
Flood Risk Regulations (2009)
Preliminary Flood Risk Assessment (2011)
Flood Hazard and Risk Maps (2013)
Flood Risk Management Plan (2015)
EU Water Framework Directive
EA River Basin Management Plans: Thames RBMP
EA Catchment Flood Management Plans (CFMP)
EA Catchment Abstraction Management Plans (CAMS)
Informs: Local Flood Risk Management, Local Development Framework, Site Masterplans, Site Specific FRAs

B Huntercombe Stream and Roundmoor Ditch

1. Description of catchment

The Huntercombe Lane Stream is a tributary of the Roundmoor Ditch, which originates in the South Bucks area. The catchment of Huntercombe Stream covers an area of 2.7km^2. Part of the catchment is outside of the SBC area in South Bucks. The Huntercombe Stream and Roundmoor Ditch are both classified as main river.

Huntercombe Lane Stream is culverted for most of its length within the Slough Borough area north of Huntercombe Manor, appearing as an open watercourse in West Point allotment site and then again south of the M4 motorway. Just south of the motorway the open channel of the Huntercombe Stream meets the Roundmoor Ditch.

The Roundmoor Ditch has a larger catchment area of 14.5km^2 .For the majority of its length, it is not within the Slough Borough area but the adjoining area of South Bucks and its source, within South Bucks is situated in an open area to the north of the M4 and west of Huntercombe Manor and Burnham Abbey. The Roundmoor Ditch flows south from its source, flows in a culvert under the M4 and then turns east flowing under the B3026 and into the SBC area just west of the Thames Water Slough sewage works. At the point where it enters Slough SP936798, the Huntercombe Stream joins it and it remains the Roundmoor Ditch. It then flows south east, around the sewage works, and underneath the weir on the Jubilee River in a pipe before leaving SBC area.

2. Current issues on flooding

There are currently 34 properties at risk of greater than 1 in 100 year (flood zone 3) fluvial flooding and 98 at risk of 1 in 100 to 1 in 1000 year (flood zone 3) fluvial flooding in the Huntercombe Stream/Roundmoor Ditch catchments within SBC area. There are 576 properties at risk from 1 in 100 year surface water flooding. The table below shows the total numbers of properties at risk from fluvial, surface water and both types of flooding.

Catchment	Fluvial flooding		Surface water flooding	Both fluvial and surface water	Total
	Zone 2 (1:100 – 1:1000)	Zone 3 (Greater than 1:100)	1 in 100 year	1 in 100 year	1 in 100 year
Huntercombe Lane	98	34	576	9	601

The risk from surface water flooding was assessed in the SWMP. The extent of fluvial flooding is provided by the Environment Agency fluvial flood maps.

The total extent of the estimated surface and fluvial flooding for a 1 in 100 flood is shown in Figure B1 below

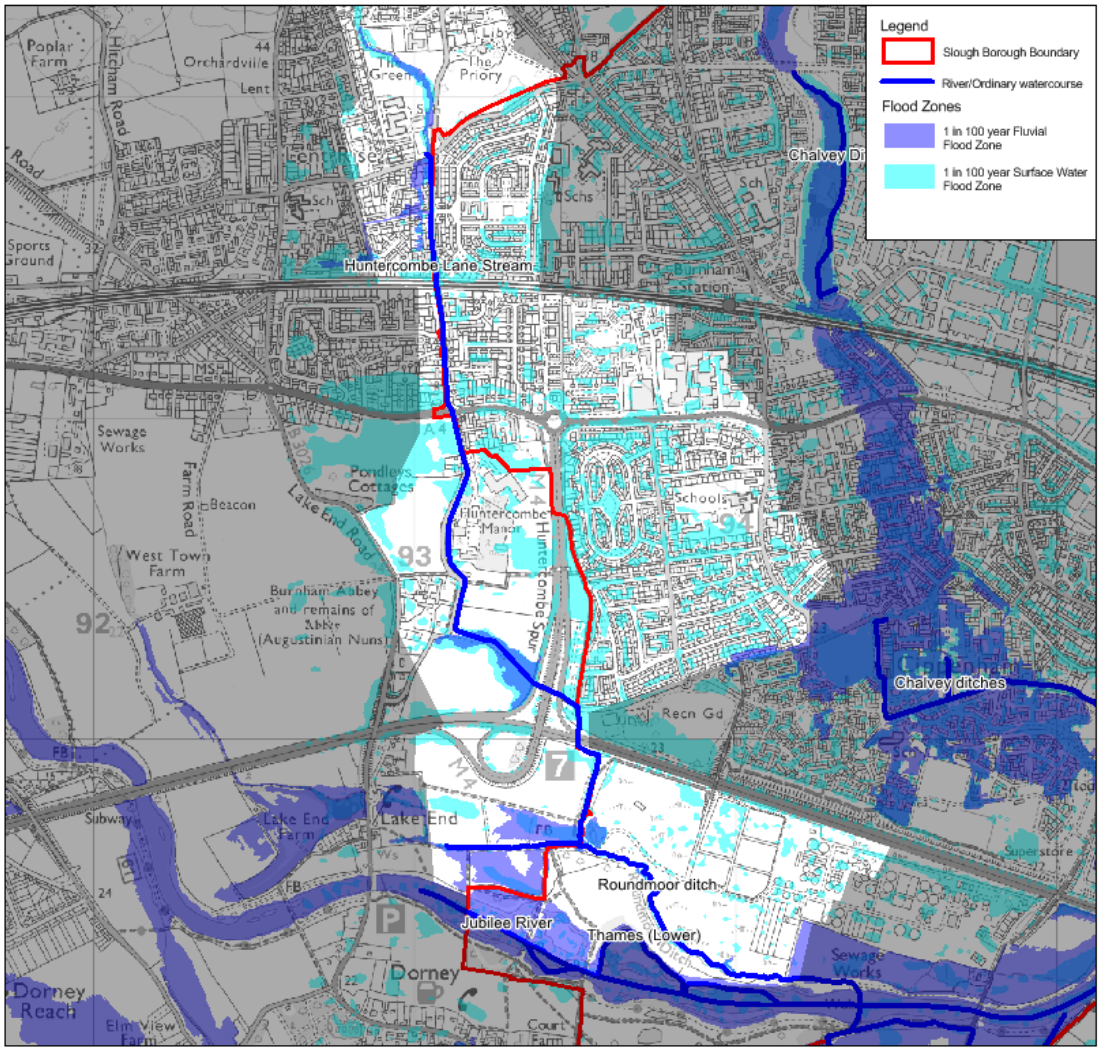


Figure B1 Estimated surface and fluvial flooding for a 1 in 100 flood

Whatever the source, and depth, of flooding the consequences are disruptive and upsetting. SBC is committed to understanding the sources, pathways and receptors of flooding so that the risk can be managed and alleviated by reducing the risk wherever possible.

2.1 Source of flooding

Source of flooding from the Huntercombe Stream in the SBC area is mainly from surface water flooding as the watercourse is in a culvert for its extent in the Borough, north of the M4. There are parts of the sewer which are surcharged in high flows and this can be a source of flooding. The routes of surface water are given in the section below. The fluvial flooding from the Huntercombe Stream comes from the reaches either side of the M4 where the stream is in open channel around the area of West Point allotment site.

The flooding from Roundmoor Ditch is not known to impact upon residential property flooding in Slough area. The area of fluvial flooding from Roundmoor Ditch is shown as being in flood zone 2 (1 in 1000 year risk) to the north of the Jubilee River and does not impact upon any property or infrastructure.

The Surface Water management plan (SWMP) identified some quite large areas of surface water flooding in the areas around the Huntercombe Stream and Roundmoor Ditch catchments where surface water is not able to drain away as it is located in a low point or surface water drains are surcharged especially at higher, more severe rainfall events.

2.2 Pathways of flooding

The routes of flooding in the Huntercombe Stream catchment are all along roads and overland flow routes. Figure B2 shows the catchment routes of the watercourses.

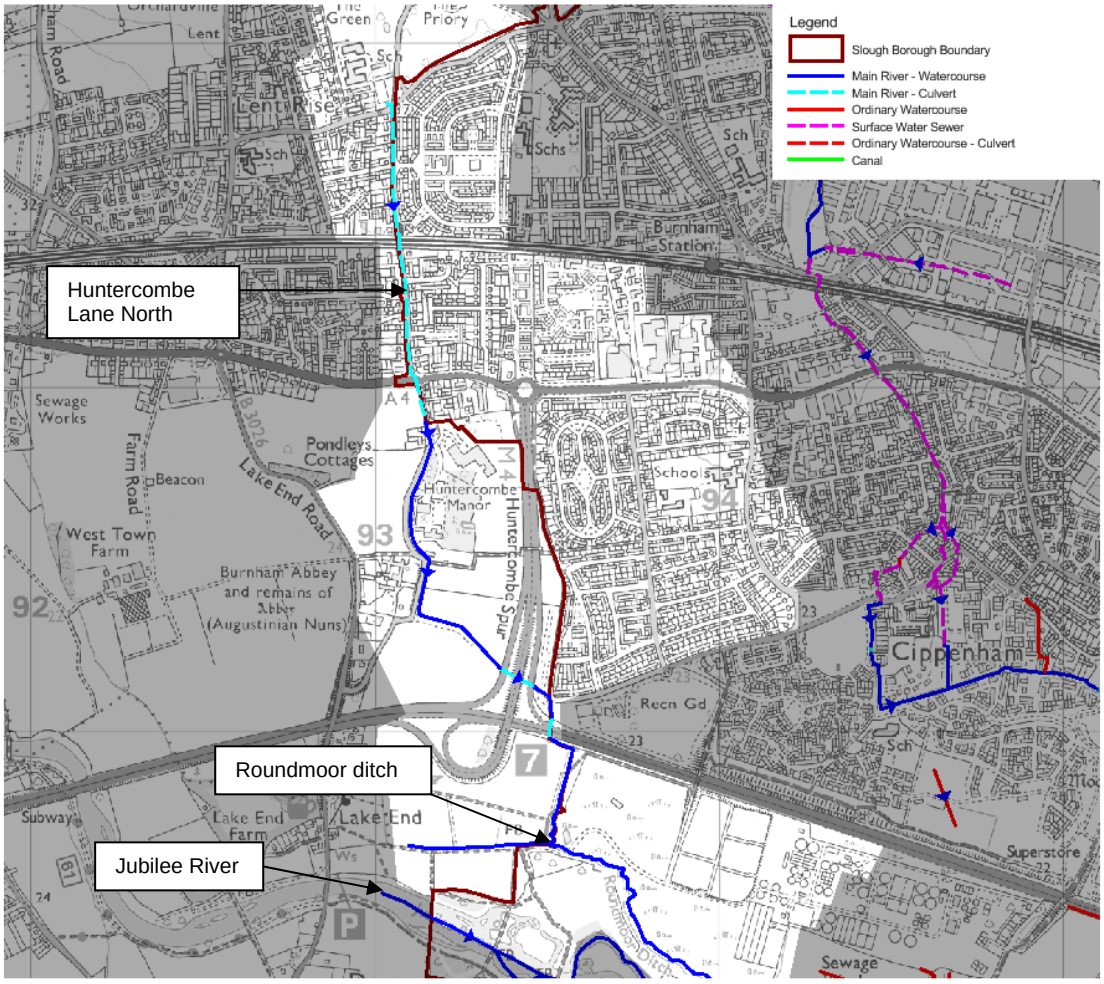


Figure B2 Route of watercourses for Huntercombe Stream

The main flow routes are shown in Figure B3 and shows the flow coming along Huntercombe Lane from the north and also from Burnham Lane (Five Points) from the north and flowing in a south westerly direction towards the M4 spur.

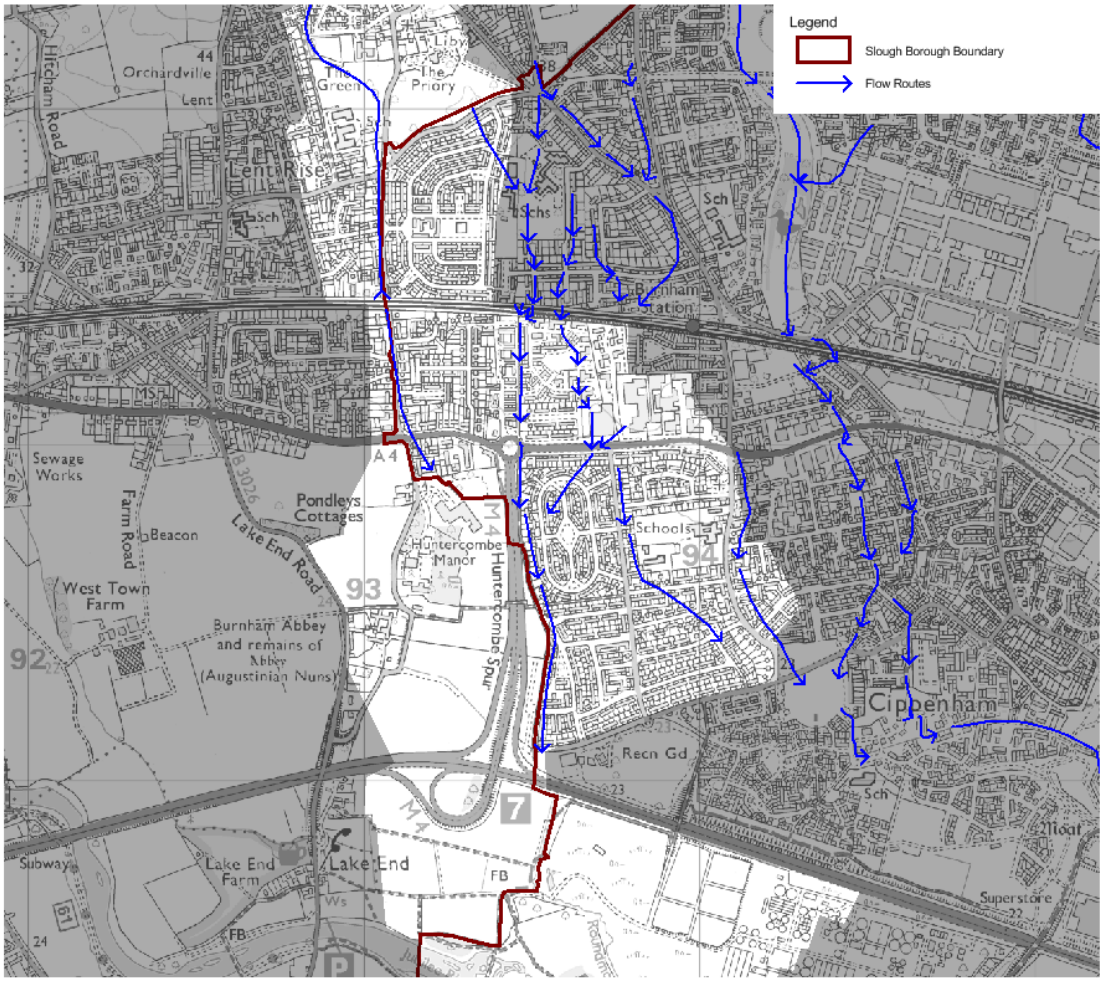


Figure B3 Flow routes – Huntercombe Stream catchment

2.3 Receptors of flooding

The receptors of flooding are the areas where the flood water reaches or areas which are affected by flooding. The areas at risk from surface water and fluvial flooding are shown in figure B1. These at risk areas can be residential properties, commercial properties, and critical infrastructure. Roads, public open spaces such as parks and people are also the receptors of the flooding.

At present the main receptors of flooding are areas which are low lying and receive flood waters overland and surface water flooding from north of the borough boundary or from blockages to culverts or screens. The locations which are shown in the SWMP to be at most risk from this overland surface water flooding are to the east of the M4 spur road where the water collects and is not able to flow under the spur road or south under the M4 through the Huntercombe Stream culvert.

The places where flooding is known to have occurred are:

* Huntercombe Lane at the railway bridge and by the A4 (mixture of surface, fluvial and foul sewer flooding)
* West Point allotments as a result of Huntercombe Stream backing up from the culvert under M4 as explained above.

Plate B1 Flooding along Huntercombe Lane North at the railway bridge

3. Options and measures for managing flood risk

3.1 Structural measures

As the Huntercombe Stream is culverted for the upper reaches of its length in Slough Borough Council area, there is very little structurally that can be done to the watercourse itself which would be economically viable. The culvert experiences surcharging and unless the surface water sewer is replaced this will continue to happen. Replacement of the culvert with a larger pipe is not seen as being economically viable therefore structural measures or capital works are not an option at this moment in time.

Culvert assessment, improvement and maintenance

For ordinary watercourses and culverts, ongoing inspections of the culvert will be undertaken to ensure that the culvert condition is good. Blockages which occur need to be cleared quickly before they become an issue. The culvert was assessed and maintenance works undertaken in 2012.

Creation of swales and infiltration ponds from development

Opportunities for creating storage or attenuation of surface water through swales and infiltration ponds within development sites will be encouraged.

3.2 Non-structural measures

Develop asset register

SBC are developing and asset register which will provide an ongoing understanding of the assets and identification of the risks within the fluvial system and flooding risk if that asset failed or becomes blocked.

Checking, ongoing and reactive maintenance of screens

A service undertaken by SBC on a regular basis on some of the screens in the Huntercombe Ditch catchment. SBC clears screens which are responsibility of SBC and reports any blockages to those responsible for the screens such as EA. Some screens are also cleared during periods of heavy rainfall and flow as required.

Investigation of Flood Incidents

Commitment to this duty from the FWMA (2010) provides an ongoing picture of the flood risk on the catchment.

Communication and engagement with residents and stakeholders

A plan will be developed to communicate the flood risk and proposed options to residents and stakeholders in the catchment.

Flood Warning

Flood warnings will be issued by the Environment Agency as Huntercombe Stream and Roundmoor Ditch in SBC area are main rivers. Once engagement has been made with community and the structural measures have been agreed on the catchment, SBC will work with the Environment Agency and local communities to ensure that residents are aware of the process of flood warning.

Individual Property Protection (IPP) to properties at risk of flooding

Door barriers, air brick covers and other measures can be considered for individual properties to protect from flooding. The use of IPP is dependent on the residents having sufficient warning to be able to implement the measures. In this catchment there are currently no Environment Agency flood warnings available and so IPP is not suitable at this time as flood warnings are not able to be given to alert householders to the danger. This option will be considered further once flood warning is in place. It is noted that providing resistance/resilience measures may

need to be given further consideration should it not be possible to sufficiently reduce the risk of flooding through other options. SBC will work with communities, where appropriate, to assess and determine the most appropriate funding for IPP.

Continue to enforce existing policies
Continue to work closely with planning department with SBC to work on new planning applications ensuring that they are compliant with existing policies on drainage and runoff and encourage the use of SUDS, see below.

Education on updated policies
Encourage use of SUDS for new developments as laid out in Appendix J. Move towards the establishment of a SUDS Approval Board within SBC to be ready for the implementation of SUDS legislation under FWMA 2010.

4. Recommendations and Actions

- Ongoing inspection and maintenance of the culverted watercourse along with the Environment Agency
- Communication with upstream landowners and South Bucks District Council about the sources and routes for flood water from the northern parts of the catchment
- Develop a programme for communicating flood risk to stakeholders with the other Risk Management Authorities
- Continue to discuss and explore flood warning options for the catchment with Environment Agency
- Continue to explore possibilities for funding options for resistance/resilience measures.

Appendix C Chalvey Ditch

1. Description of catchment

The catchment of Chalvey Ditch covers an area of 41km^2. The upper parts of the catchment are rural and the channel flows through woodland area in Burnham Beeches. The underlying geology in this catchment is complex with the river terrace deposits lying almost directly on an outcrop of chalk, where the London Clay and Reading Beds have been eroded. The majority of the land to the north of Slough within the Chalvey Ditch catchment is underlain by Winter Hill gravel, Boyn Hill gravel, Lynch Hill gravel and chalk. These upper reaches are sometimes called the Haymill Stream and the stream is also known as Two Mile Brook.

Hydro-geological studies investigated the presence of sink holes within the Burnham Beeches area and combined groundwater monitoring with groundwater modelling. At a pond, Swilly Pond in the upper reaches, the studies established the presence of two sink holes. The established sink holes to the north of Slough have a significant impact on surface water flooding in Slough as they affect surface water runoff from the areas to the north.

The catchment is predominantly rural in the upper catchment and then once the channel enters the Slough Borough Council area the catchment is predominantly urban.

The spring line occurs just south of the Whitaker Road in Slough SU942821, at the upstream, northern end of the Haymill Valley. Upstream of this there is a surface water pipe which runs along the Lynch Hill valley and which also picks up groundwater. This valley is dry except in exceptional wet weather circumstances. From Whitaker Road an open watercourse runs through the Haymill Valley to Burnham Lane. In high flows the water ponds behind a structure and dam, Haymill Dam at Buckingham Avenue, Burnham Lane SU942814. From the Haymill Dam structure, the channel is culverted down to the Cippenham area. There is a branch, Mill Stream, (which is the original, old course) which branches off in a culvert from this main culvert. The main channel flow from the culvert into an open watercourse by the College Road allotment site and runs eastward, and then southwards, in an open channel through Cippenham Green, Cippenham and western parts of Chalvey. The branch of the Mill Stream flows in a number of open sections, joining the other watercourse just south of Earls Lane.

The channel flows under the M4 (in a culvert) to the east of Asda supermarket and then turns east to flow alongside the south side of the M4, under the A355 and crosses under the Jubilee River in a siphon.

2. Current issues on flooding

There are currently 2625 properties at risk of greater than 1 in 100 year (flood zone 3) fluvial flooding and 3223 at risk of 1 in 100 to 1 in 1000 year (flood zone 3) fluvial flooding in Chalvey Ditch catchment. There are 1951 properties at risk from 1 in 100 year flooding and 558 properties that fall in the 1 in 100 year fluvial and surface water flooding areas.

Catchment	**Fluvial flooding**		**Surface water flooding**	**Both fluvial and surface water**	**Total**
	Zone 2 (1:100 –	Zone 3 (Greater than	1 in 100 year	1 in 100 year	1 in 100 year

	1:1000)	1:100)			
Chalvey Ditch	3223	2625	1951	558	4018

The risk from surface water flooding was assessed in the SWMP. This identifies that properties in the Cippenham area of Slough are at risk from surface water flooding. Of this number of properties at risk some are at greater risk than others and a number of properties would experience deep flooding of between 350-1000mm depth in severe flood events whilst others would experience shallower flooding of depths between150mm and 350mm. At the present time it is not clear how many of the properties are at combined risk from both surface and fluvial flooding but there will be some overlap. It is not possible to give a total number of properties at risk (greater than 1 in 100 year) from combined surface water and fluvial flooding but the number will be between 500 and 1000 in the Chalvey Ditch catchment.

The total extent of the estimated surface and fluvial flooding for a 1 in 100 flood is shown in Figure C1 below

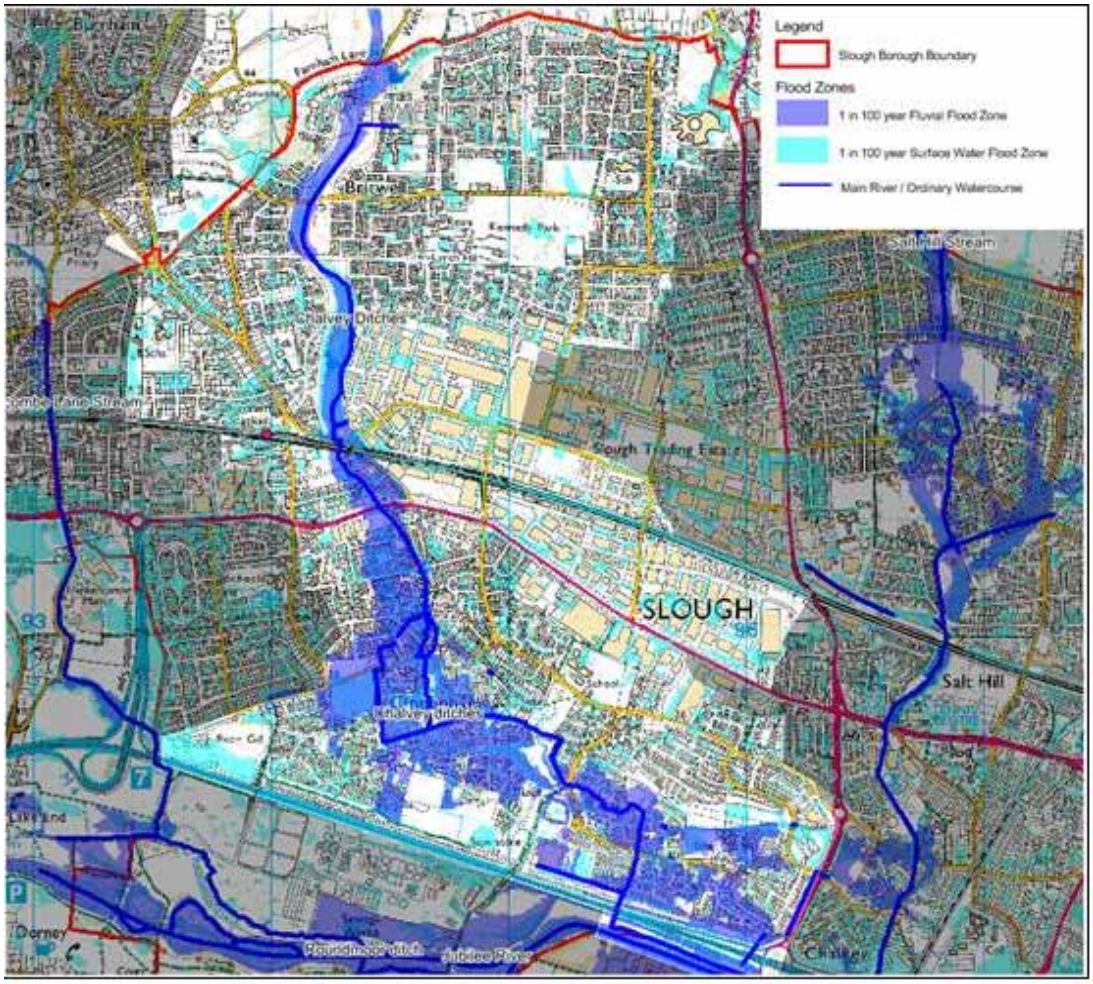


Figure C1 Estimated surface and fluvial flooding for a 1 in 100 flood

Whatever the source, and depth, of flooding the consequences are disruptive and upsetting. SBC is committed to understanding the sources, pathways and receptors of flooding so that the risk can be managed and reduced wherever possible.

2.2 Source of flooding

In very extreme weather the spring line has known to move north to Lynch Hill where the dry valley has become wet and the surface water sewer has surcharged.

If the Haymill reservoir overtops then flooding will occur downstream.

The channel south of Millstream Lane and then alongside Richards Way overtops in extreme flows and causes flooding in the Cippenham area

The Chalvey Ditch flows under the Jubilee River in a siphon and any blockage of the culvert and siphon could represent a flood risk as demonstrated and described in the Chalvey Ditches hydraulic modelling work, JBA, 2010

There are some areas of surface water flooding particularly within the Cippenham area where the possibilities for water to drain naturally to the south has been blocked by the M4 sound bund and associated works. The surface water for the Cippenham phase 4 development will be drained to soakaways and the raised areas to the west as part of the development will drain to an infiltration trench to the south of the housing. Other areas of Cippenham still remain at risk from surface water flooding from paved areas, roofs and the limited capacity for water to drain away to the south of the housing. Figure C1 shows the extent of the potential surface water flooding.

2.2 Pathways of flooding

The Chalvey Ditch spring line is a Whitaker Road. Upstream of this, the valley is dry and there is a surface water sewer along the base of Lynch Hill dry valley which also picks up some groundwater. The area around Farnham Lane, Lynch Hill Lane / Cocksherd Wood appears to be affected mostly by an overland flow route from areas to the north within South Bucks. Figure C2 below shows the predicted flooding with around the Lynch Hill Lane / Cocksherd Wood during the 100 year rainfall event (N.B. shallow flooding: 100mm – 350mm; deep flooding: 350mm – 1000mm)..

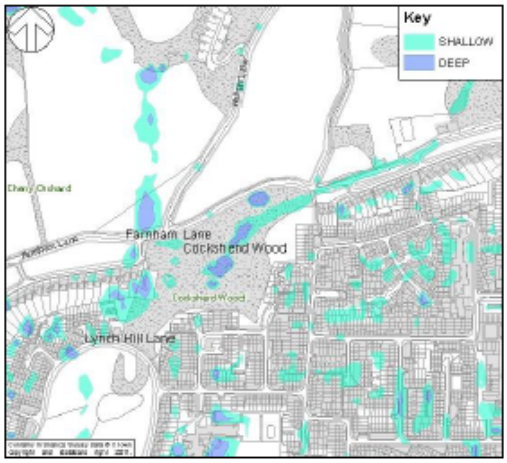


Figure C2: Surface water flooding around Cocksherd Woods during the 100 year event

The channel flows into the Haymill Valley south of Whitaker Road and in a flood will fill the Haymill Reservoir behind the structure. The reservoir discharges through a pipe which runs for approximately 1km down to the Cippenham area. In the event of a large flood the water will spill over the spillway and flow down the roads, under the railway at Burnham Lane. The flood pathways will follow the roads down through the Cippenham Green area. Figure C3 shows the route of the watercourses and Figure C4 shows the flood routes. The watercourse splits into two branches in the culvert

running south from Haymill reservoir and one branch comes into an open channel at Mill Stream Lane and the other emerges at a pond south of the allotments in Cippenham. The two channels join and the flow and flood route follows the route of the watercourse through Cippenham and under the M4.

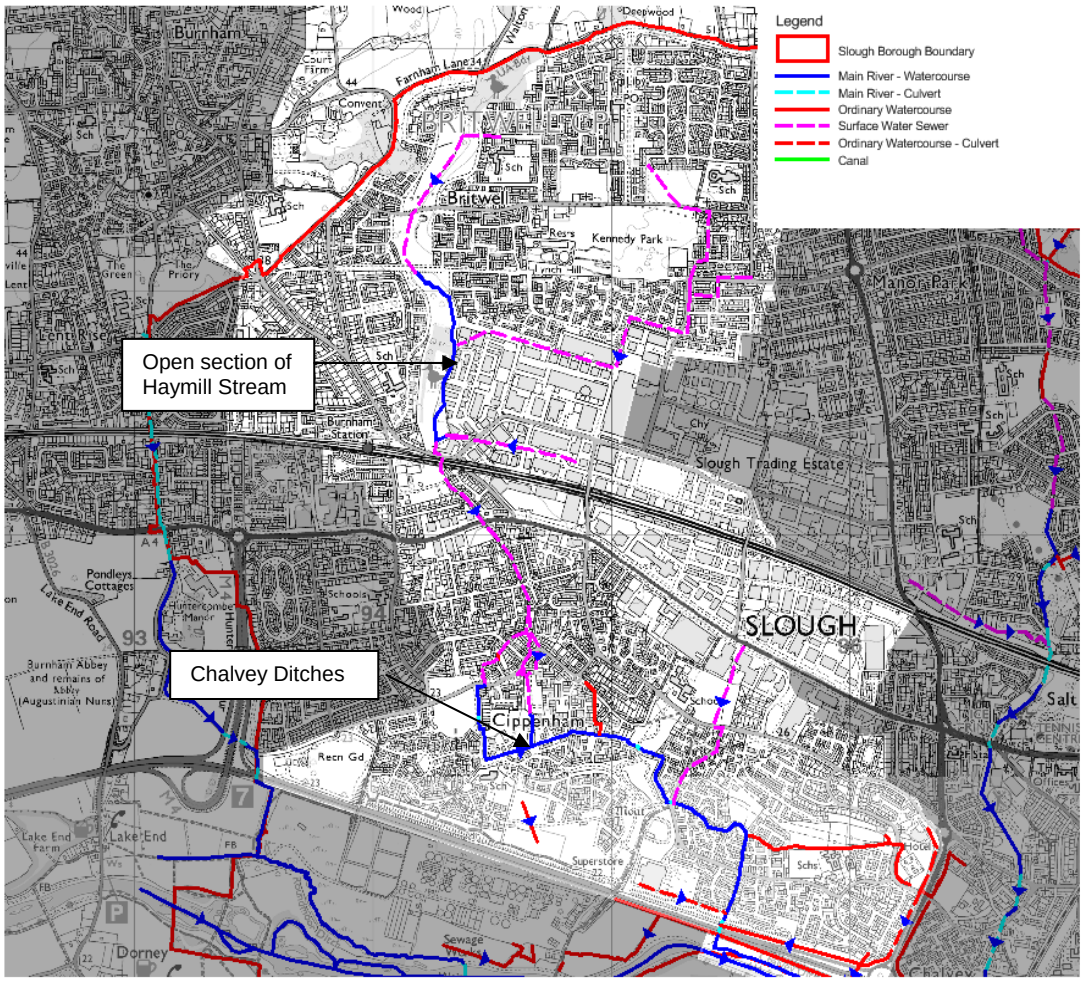


Figure C3 Route of watercourses for Chalvey Ditch

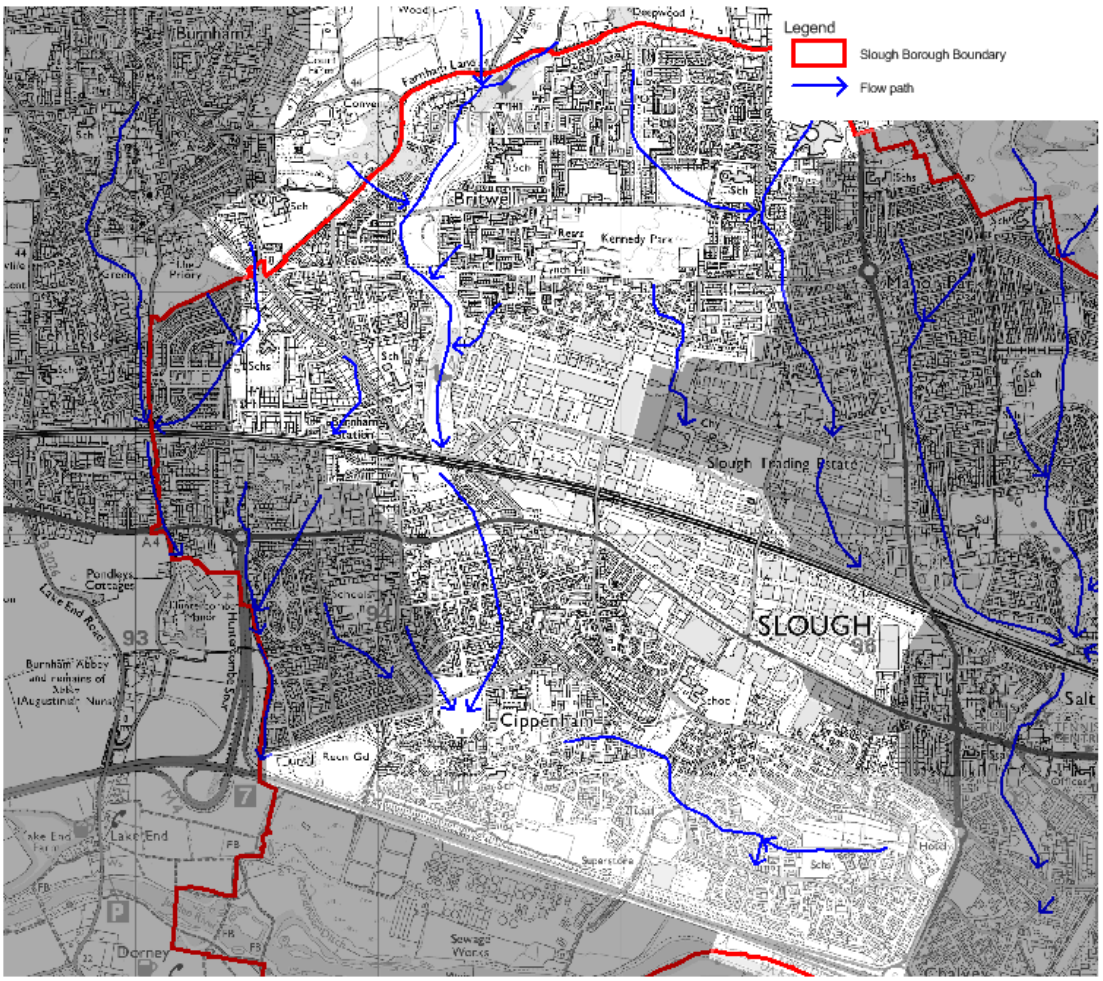


Figure C4 Flow routes – Chalvey Ditch catchment

2.3 Receptors of flooding

The receptors of flooding are the areas where the flood water reaches or areas which are affected by flooding. The areas at risk from surface water and fluvial flooding are shown in figure C1. These at risk areas can be residential properties, commercial properties, and critical infrastructure. Roads, public open spaces such as parks and people are also the receptors of the flooding. At present the main receptors of flooding are the communities in Cippenham as this area is low lying and receives flood waters from the Chalvey Ditch and surface water flooding. Other low-lying areas where water collects are under the railway bridge at Burnham Lane

Plate C1 Flooding at railway bridge, Burnham Lane

3. Options and measures for managing flood risk

Based on the principles mentioned above in Part B section 5, a number of measures are being considered for the Chalvey Ditch catchment. The structural measures are now part of a flood risk assessment being undertaken in a partnership between Environment Agency, Slough Borough Council and Thames Water. The project will

assess a number of flood options in the Salt Hill, Chalvey Ditch and Datchet Common Brook catchment.

The options being addressed for Chalvey Ditch will be along the following lines.

3.1 Structural measures

Attenuation of flood water in the upper catchment

Some of the upper parts of the catchments are a dry valley but there may be options in the Lynch Hill area to attenuate surface water flows in a pipe and use the Lynch Hill valley to store any excess flood water.

Storage of water in open areas

Any existing open areas are being investigated for use for flood storage where space is not already being used for flood storage. Deepening of existing flood storage using higher bunds will be assessed but is unlikely due to backing up into surrounding land. Although there is limited open space in the Cippenham area any space available which may be suitable will be considered for flood storage. This may require re-profiling of open land to create lower areas and bunds to contain the water.

Re-routing of water through open areas to provide attenuation

Some flood water can be re-routed through open areas in a flood to prevent water entering houses. This does not necessarily store the water but route some of the water through different locations in open flood routes or pipes to locations which may not be impacted by flooding and where the water can then be discharged without flooding. This may be possible in the Cippenham area.

Re-sectioning of the channel

This can be effective in creating a smaller low flow channel which needs less maintenance and a larger flood channel by creating a “two-stage channel”. This can be created by re-profiling the existing channel and provides good habitat enhancement opportunities. This may be possible through the Cippenham area.

Creation of swales and infiltration ponds from development

Opportunities for creating storage or attenuation of surface water through swales and infiltration ponds within development sites will be encouraged.

3.2 Non-structural measures

Develop asset register

SBC are developing and asset register which will provide an ongoing understanding of the assets and identification of the risks within the fluvial system and flooding risk if that asset failed or becomes blocked.

Ongoing and reactive maintenance of screens

A service undertaken by SBC on a regular basis on some of the screens in the Chalvey Ditch catchment such as Haymill reservoir helps to ensure good flows through the system. SBC reports any blockages to those responsible such as EA for Haymill Reservoir. Some screens are also cleared on a reactive basis during periods of heavy rainfall and flow as required.

Investigation of Flood Incidents

Commitment to this duty from the FWMA (2010) provides an ongoing picture of the flood risk on the catchment.

Communication and engagement with residents and stakeholders
A plan will be developed to communicate the flood risk and proposed options to residents and stakeholders in the catchment.

Flood Warning
Flood warnings will be issued by the Environment Agency as Chalvey Ditch in SBC area is a main river. Once engagement has been made with community and the structural measures have been agreed on the catchment, SBC will work with the Environment Agency and local communities to ensure that residents are aware of the process of flood warning.

Individual Property Protection (IPP) to properties at risk of flooding
Door barriers, air brick covers and other measures can be considered for individual properties to protect from flooding. The use of IPP is dependent on the residents having sufficient warning to be able to implement the measures. In this catchment there are currently no Environment Agency flood warnings available and so IPP is not suitable at this time as flood warnings are not able to be given to alert householders to the danger. This option will be considered further once flood warning is in place. It is noted that providing resistance/resilience measures may need to be given further consideration should it not be possible to sufficiently reduce the risk of flooding through other options. SBC will work with communities, where appropriate, to assess and determine the most appropriate funding for IPP.

Continue to enforce existing policies
Continue to work closely with planning department with SBC to work on new planning applications ensuring that they are compliant with existing policies on drainage and runoff and encourage the use of SUDS, see below.

Education on updated policies
Encourage use of SUDS for new developments as laid out in Appendix J. Move towards the establishment of a SUDS Approval Board within SBC to be ready for the implementation of SUDS legislation under FWMA 2010.

4. Cost, benefits and funding possibilities

There is currently a Flood Alleviation Study (FAS) being undertaken by Environment Agency with support from SBC to look at a number of flood options across three catchments: Chalvey Ditch; Salt Hill Stream; and Datchet Common Brook. The study will involve a combined fluvial/surface water model study for all three catchments and will assess the costs and benefits for all options individually and combined. The options for funding for all options will depend on the benefit cost ratios. The options may be put forward for DEFRA GiA funding and contributions will be sought from other sources such as Thames Water, SBC, Water Framework Directive funding will be sought for parts of the options which will enhance and develop habitats.

5. Recommendations

- Proceed with exploring structural options with Environment Agency through Slough Flood Alleviation Study programme
- Develop environmental options alongside the structural options
- Continue with development of asset register, ongoing maintenance of screens and investigation of flood incident.
- Develop a programme for communicating flood risk to stakeholders with the other Risk Management Authorities
- Discuss and explore flood warning options for the catchment with Environment Agency

- Continue to explore possibilities for funding options for resistance/resilience measures.
- Continue to explore possibilities for funding options for all flood management options

Appendix D Salt Hill Stream

1. Description of catchment

The catchment of Salt Hill stream covers an area of 17km^2. The upper parts of the catchment are rural and the channel originates in two tributaries in wooded or rural parts of the Farnham Common and Stoke Poges area. The catchment is predominantly rural in the upper catchment and then once the channel enters the Slough Borough Council area the catchment is predominantly urban with the two tributaries meeting just south of the Stoke Poges golf course where they flow into a culvert. The river is mainly culverted through the Manor Park area.

2. Current issues on flooding

There are currently 1026 properties at risk of greater than 1 in 100 year (flood zone 3) fluvial flooding and 1357 at risk of 1 in 100 to 1 in 1000 year (flood zone 3) fluvial flooding in the Salt Hill Stream catchment.

Catchment	**Fluvial flooding**		**Surface water flooding**	**Both fluvial and surface water**	**Total**
	Zone 2 (1:100 – 1:1000)	Zone 3 (Greater than 1:100)	**1 in 100 year**	**1 in 100 year**	**1 in 100 year**
Salt Hill Stream	1624	1174	1994	306	2862

The risk from surface water flooding was assessed in the SWMP. This identifies that 483 properties in the Manor Park area of Slough are at risk from surface water flooding. Of these some are at greater risk than others and a number of properties would experience deep flooding of between 350-1000mm depth in severe flood events whilst others would experience shallower flooding of depths between150mm and 350mm. At the present time it is not clear how many of the properties are at combined risk from both surface and fluvial flooding but the number will be between 500 and 1000 in this catchment.

The total extent of the estimated surface and fluvial flooding for a 1 in 100 flood is shown in Figure D1 below

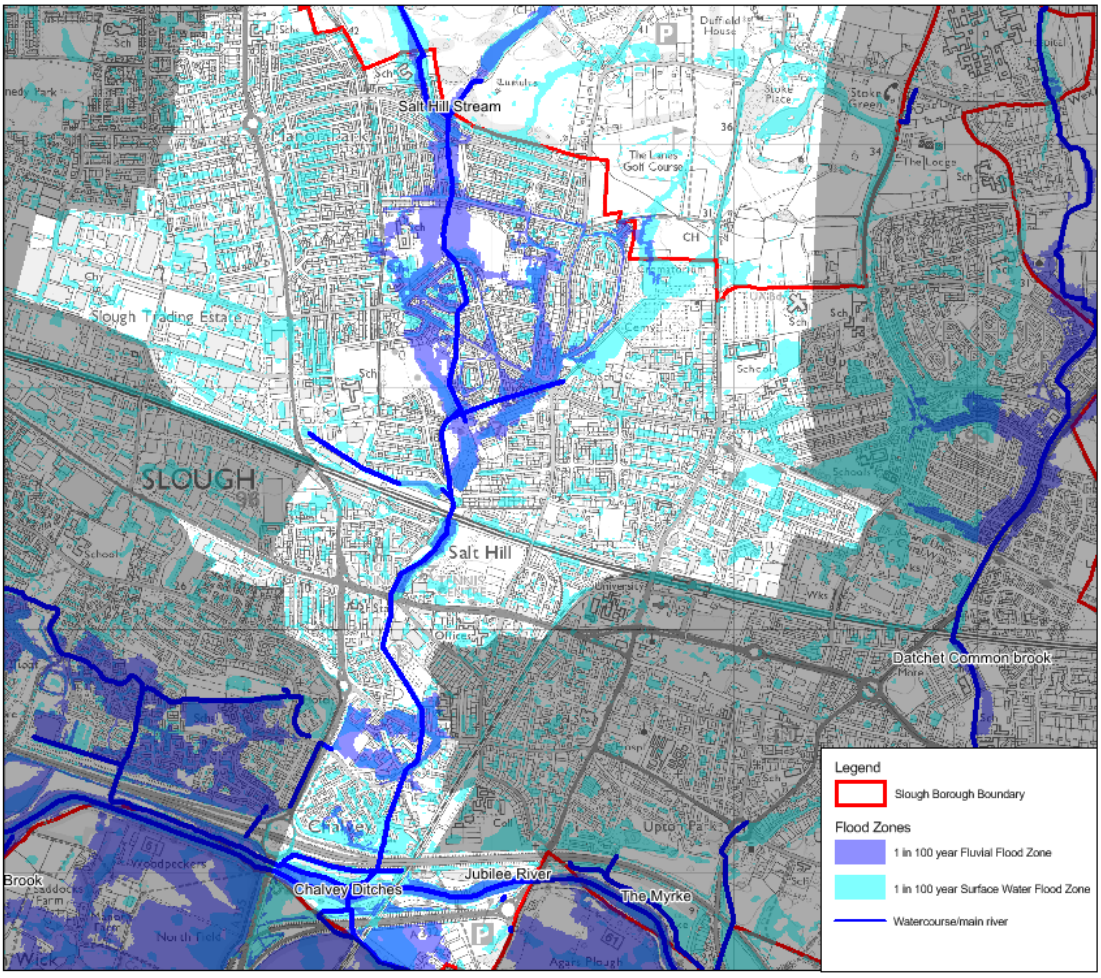


Figure D1 Estimated surface and fluvial flooding for a 1 in 100 flood

Whatever the source, and depth, of flooding the consequences are disruptive and upsetting. SBC is committed to understanding the sources, pathways and receptors of flooding so that the risk can be managed and reduced wherever possible.

2.1 Source of flooding

The Salt Hill Stream has two tributaries. The west tributary has its source on Farnham Common, Brockhurst Wood. The east tributary has its source from a couple of ponds around Stokes Poges village. Both of these tributary sources are in the South Bucks area. The east tributary flows through the Stoke Poges golf club and through an ornamental lake, which is also a reservoir which performs a limited balancing function, and then a second reservoir on the golf course. The upper and lower reservoirs are greater than 25,000m^3 and come under the Reservoir Act, 1975.

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2.2 Pathways of flooding

The two tributaries flow into culverts at Penn Wood school and at the downstream end of the Stoke Poges golf club. These culverted tributaries meet in beneath Manor Park estate near to Northern Road. Figure D2 shows the route of the watercourses.

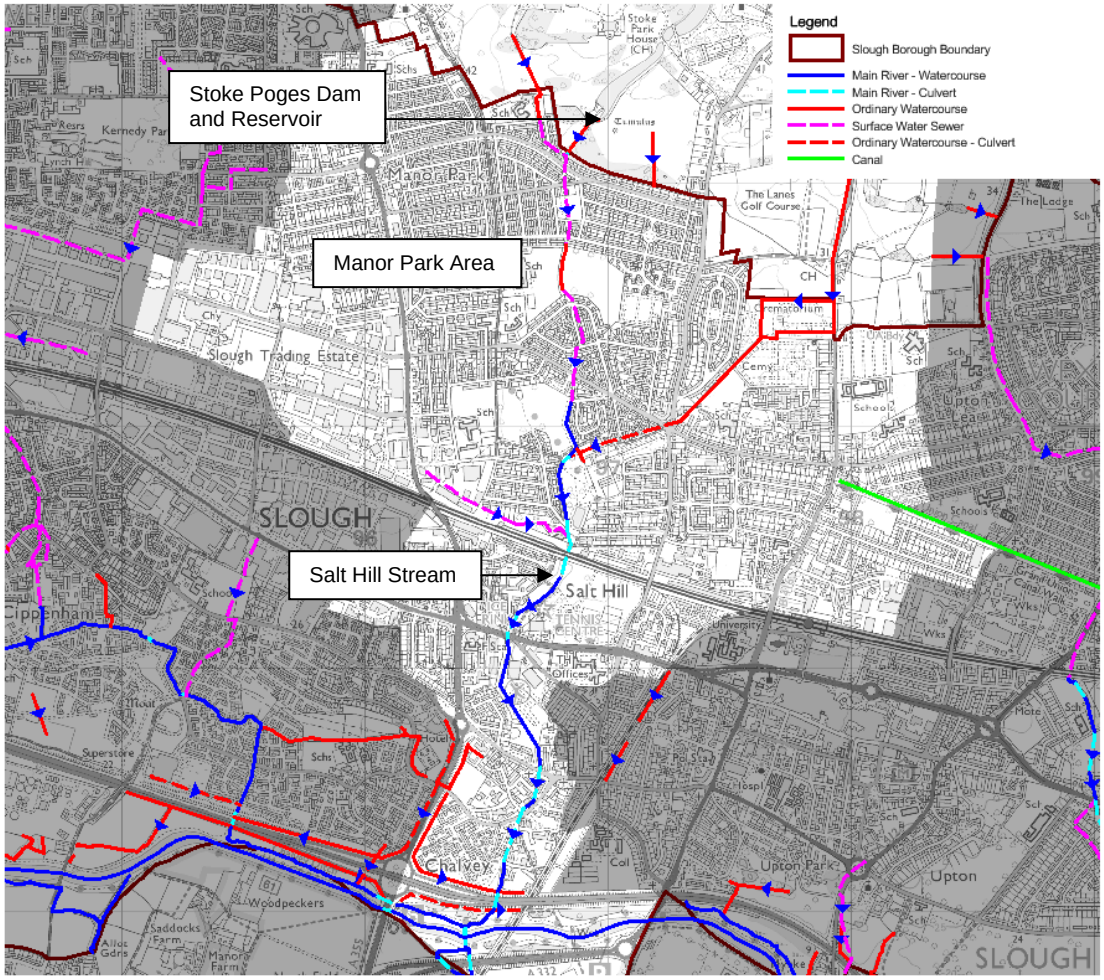

Figure D2 Route of watercourses for Salt Hill Stream

The Salt Hill Stream follows a course in a culvert through to Granville Recreation Ground where it emerges into an open watercourse through the edge of the park for approximately 100m and then back into a culvert. It emerges at the upstream end of Godolphin Park, flows through Godolphin and Baylis Parks in open water courses (apart from a short length of culvert) to Woodland Avenue where it flows in culvert under the railway and pedestrian underpass and emerges as an open channel in Salt Hill Park. The channel remains an open watercourse (apart from a culverted section under the A4) until Newbery Way where it flows again into a culvert. It is mainly in culvert through the Chalvey area and then appears again at Spackmans Way in an open channel before flowing under the motorway in a culvert. The Salt Hill Stream flows under the Jubilee River in a siphon and leaves Slough at that point.

In addition to the water courses there are a number of routes that surface water flooding can take. These are shown for Salt Hill stream in figure D3. The pathways for flooding are currently in this area, along roads, footpaths and between buildings.

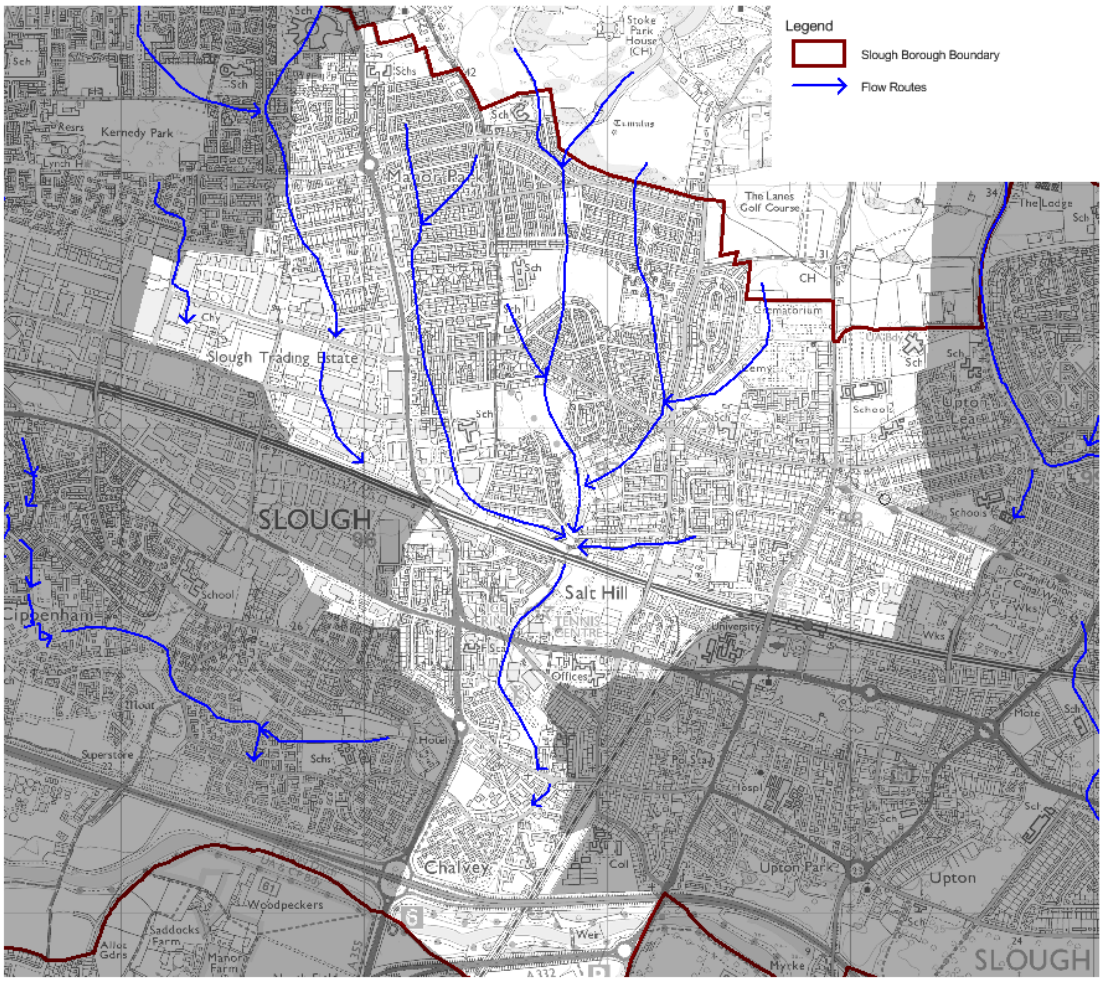

Figure D3 Flow routes – Salt Hill Stream catchment

2.3 Receptors of flooding

The receptors of flooding are the areas where the flood water reaches or areas which are affected by flooding. The areas at risk from surface water and fluvial flooding are shown in figure D1. These at risk areas can be residential properties, commercial properties, and critical infrastructure. Roads, public open spaces such as parks and people are also the receptors of the flooding. Many of the parks including Granville Recreation Ground and Salt Hill Park have experienced flooding in the recent past and the residential areas of Manor Park and Chalvey are at risk from surface water and fluvial flooding.


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Plate D1 Flooding in Manor Park area

3. Options and measures for managing flood risk

Based on the principles mentioned above in Part B section 5, a number of structural measures are being considered for the Salt Hill stream catchment. These measures are now part of a flood assessment being undertaken in a partnership between EA, SBC and TW and known as the Slough Flood Alleviation Study (FAS). The project will assess a number of flood options in the Salt Hill, Chalvey Ditch and Datchet Common Brook catchment in a feasibility study.

The options being addressed for Salt Hill Stream will be along the following lines.

3.1 Structural measures

Attenuation of flood water in the upper catchment

Opportunities for planting and change of land use in the upper catchment can be explored with South Bucks District Council, Environment Agency and land owners. This may help to slow down the flow coming off the catchment through tree planting, management of runoff from roads and fields.

Creation of flood storage in open spaces

Among the feasible technical options identified for detailed analysis was the construction of detention basins or flood storage areas. The worst historical flooding incident had been experienced in the Manor Park area because of overland flows from areas to the north within the Salt Hill Stream catchment. Therefore it was agreed to identify technical options that would alleviate flooding within the Manor Park area.

The ideal locations for the basins were identified by Slough BC following a review of the baseline modelling results and land ownership boundaries in order to locate the basins in locations where Slough BC would be able to acquire the land.

The construction of a flood storage area immediately north of Park Road (B416) on land owned by SBC was proposed in the Surface Water Management Plan.

Other possible locations of flood storage are the parks and open spaces along the route of Salt Hill Stream: Granville Recreation Ground, Godolphin and Baylis Parks, Salt Hill Park and open space behind Montem Leisure Centre.

In all of these locations there is potential to achieve Water Framework Directive aspirations such as an increase in-channel morphological diversity and link into improved landscape ideas for the parks and open spaces alongside provision of improved flood management.

Re-sectioning of the channel
This can be effective in creating a smaller low flow channel which needs less maintenance and a larger flood channel by creating a "two-stage channel". This can be created by re-profiling the existing channel and provides good habitat enhancement opportunities. It may be possible to re-section the channel through some parks and open spaces areas where the channels are very deep. This will help improve accessibility to the river for people and wildlife and improve safety.

Creation of swales and infiltration ponds from development
Opportunities for creating storage or attenuation of surface water through swales and infiltration ponds within development sites will be encouraged.

3.2 Non-structural measures

Develop asset register
SBC are developing and asset register which will provide an ongoing understanding of the assets and identification of the risks within the fluvial system and flooding risk if that asset failed or becomes blocked.

Ongoing and reactive maintenance of screens
A service undertaken by SBC on a regular monthly basis on some of the screens in the Salt Hill Stream catchment helps to ensure good flows through the system. SBC maintains screens which are the responsibility of SBC and reports any blockages to those responsible such as EA and Thames Water. Some screens are also cleared on a reactive basis during periods of heavy rainfall and flow as required.

Investigation of Flood Incidents
Commitment to this duty from the FWMA (2010) provides an ongoing picture of the flood risk on the catchment.

Communication and engagement with residents and stakeholders
A plan will be developed to communicate the flood risk and proposed options to residents and stakeholders in the catchment.

Flood Warning
Flood warnings will be issued by the Environment Agency as Salt Hill Stream in SBC area is a main river. However currently there are no telemetry points with Salt Hill catchment to provide information for issuing flood warnings. SBC will work with EA to assess where and when telemetry can be provided within the catchment and how a flood warning system can then be established. Once engagement has been made

with community and the structural measures on the catchment have been agreed, SBC will work with the Environment Agency and local communities to ensure that residents are aware of the process of flood warning.

Individual Property Protection (IPP) to properties at risk of flooding
Door barriers, air brick covers and other measures can be considered for individual properties to protect from flooding. The use of IPP is dependent on the residents having sufficient warning to be able to implement the measures. In this catchment there are currently no Environment Agency flood warnings available and so IPP is not suitable at this time as flood warnings are not able to be given to alert householders to the danger. This option will be considered further once flood warning is in place. It is noted that providing resistance/resilience measures may need to be given further consideration should it not be possible to sufficiently reduce the risk of flooding through other options. SBC will work with communities, where appropriate, to assess and determine the most appropriate funding for IPP.

Continue to enforce existing policies
Continue to work closely with planning department with SBC to work on new planning applications ensuring that they are compliant with existing policies on drainage and runoff and encourage the use of SUDS see below.

Education on updated policies
Encourage use of SUDS for new developments as laid out in Appendix J. Move towards the establishment of a SUDS Approval Board within SBC to be ready for the implementation of SUDS legislation under FWMA 2010.

4. Cost, benefits and funding possibilities

There is currently a Flood Alleviation Study (FAS) being undertaken by Environment Agency with support from SBC to look at a number of flood options across three catchments: Chalvey Ditch; Salt Hill Stream; and Datchet Common Brook. The study will involve a combined fluvial/surface water model study for all three catchments and will assess the costs and benefits for all options individually and combined. The options for funding for all options will depend on the benefit cost ratios. The options may be put forward for DEFRA GiA funding and contributions will be sought from other sources such as Thames Water, SBC, Water Framework Directive funding will be sought for parts of the options which will enhance and develop habitats.

5. Recommendations

- Proceed with exploring structural options with Environment Agency through Slough Flood Alleviation Study programme
- Develop environmental options alongside the structural options
- Continue with development of asset register, ongoing maintenance of screens and investigation of flood incident.
- Develop a programme for communicating flood risk to stakeholders with the other Risk Management Authorities
- Discuss and explore flood warning options for the catchment with Environment Agency
- Continue to explore possibilities for funding options for resistance/resilience measures.
- Continue to explore possibilities for funding options for all flood management options.

E Datchet Common Brook

1. Description of catchment

The source of Datchet Common Brook is in the South Bucks area. The catchment of Datchet Common Brook covers an area of 19.69km^2. The Datchet Common Brook is classified as a main river for its length south of the Wexham Park Hospital where it leaves the ponded area.

Datchet Common Brook initially enters the Borough to the east of Wexham Hospital as an open watercourse. It flows through a ponded area to the north of Wexham Park Lane. Upstream of the ponded area the channel is ordinary watercourse and then it is main river or Thames Water surface water sewer. South of Wexham Park Lane, the watercourse flows out of the Borough, continues in an open channel flowing south towards Church Road where it then re-enters the Borough near the junction of Church Lane and the Uxbridge Road. The watercourse remains an open channel through the allotments to the south of Church Lane and then flows into a culvert at the south side of the allotments. From this point, it is culverted most of the way south to Upton Court Park, with the exception of three short sections in the grounds of St. Bernards Convent. The watercourse splits at the London Road with the original route running as an open watercourse parallel and north of Quaves Road; it enters a culverted section at Upton Court Road and runs southwards into Upton Court Park. The main flow is culverted as a surface water sewer under Quaves Road. The two sewers join at a point in Upton Court Park. The sections which are culverted are surface water sewers, the responsibility of Thames Water.

2. Current issues on flooding

There are currently 729 residential properties at risk of greater than 1 in 100 year (flood zone 3) fluvial flooding and 1276 at risk of 1 in 100 to 1 in 1000 year (flood zone 3) fluvial flooding in the Datchet Brook catchment within SSBC area. There are 1023 properties at risk from 1 in 100 year surface water flooding and 228 properties at risk from both 1 in 100 year fluvial and surface water flooding.

Catchment	**Fluvial flooding**		**Surface water flooding**	**Both fluvial and surface water**	**Total**
	Zone 2 (1:100 – 1:1000)	**Zone 3 (Greater than 1:100)**	**1 in 100 year**	**1 in 100 year**	**1 in 100 year**
Datchet Common Brook	1276	729	1023	228	1524

The risk from surface water flooding was assessed in the SWMP.

The total extent of the estimated surface and fluvial flooding for a 1 in 100 flood is shown in Figure E1 below

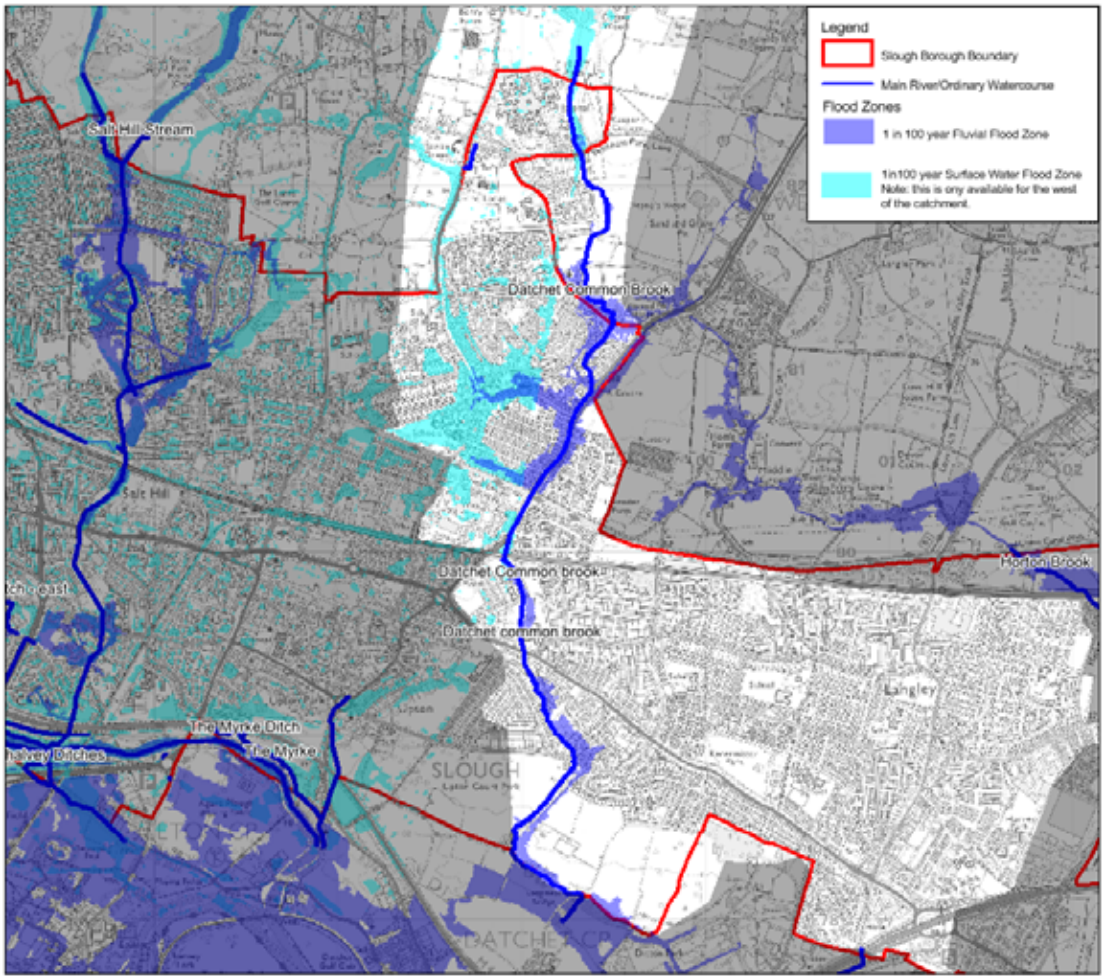

Figure E1 Estimated surface and fluvial flooding for a 1 in 100 flood

Whatever the source, and depth, of flooding the consequences are disruptive and upsetting. SBC is committed to understanding the sources, pathways and receptors of flooding so that the risk can be managed and reduced wherever possible.

3.3 Source of flooding

The Surface Water Management Plan (SWMP) did not extend to cover the Datchet Common Brook catchment. In the upper parts of the catchment the source of flooding will be from excessive rain falling onto saturated catchments and running off into the channel. Any excess water which the channel cannot contain will cause fluvial flooding. Within the built up areas the surface water runoff from heavy rainfall may not be contained in the surface water sewers and may cause flooding along roads and in houses in the lower lying areas.

2.2 Pathways of flooding

The routes of flooding in the catchment are all along roads and overland flow routes. Figure E2 shows the catchment routes of the watercourses.

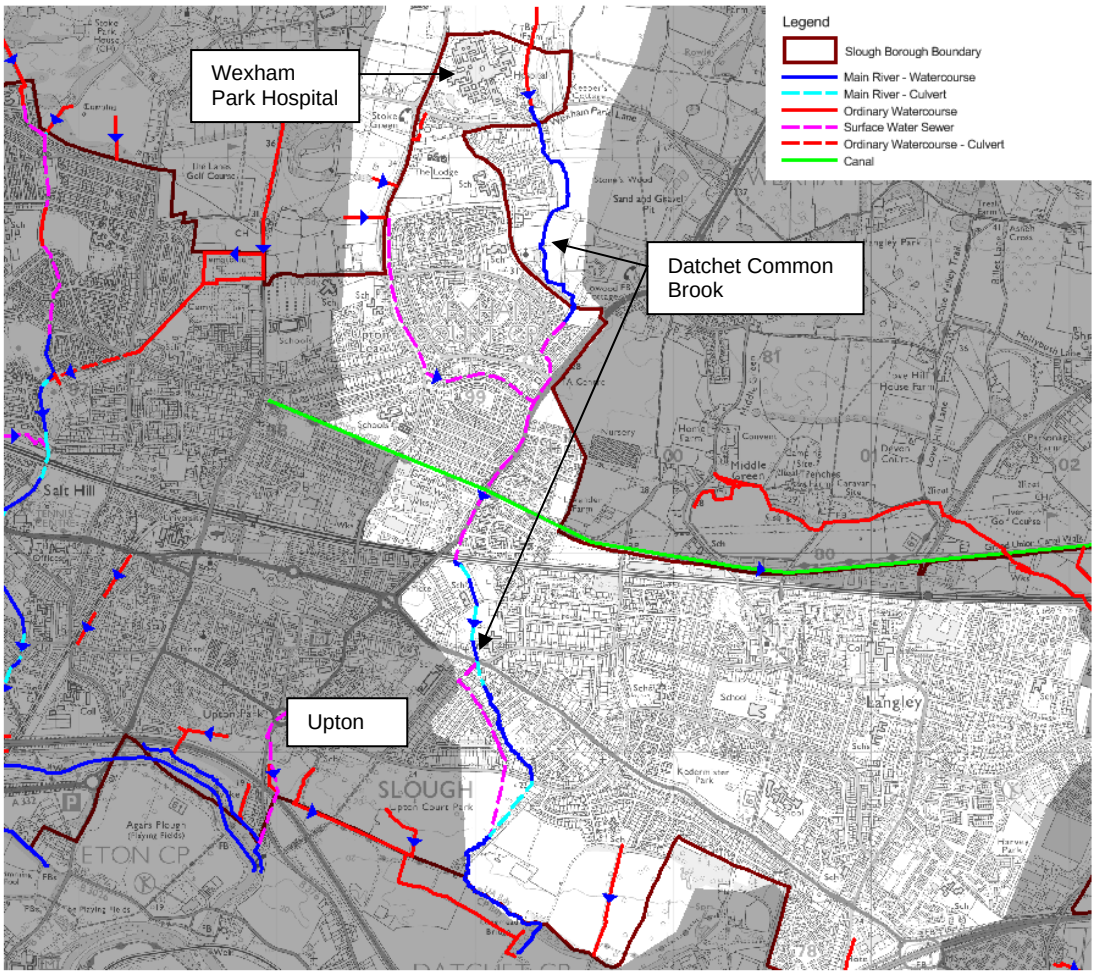

Figure E2 Route of watercourses for Datchet Common Brook

In addition to the water courses there are a number of routes that surface water flooding can take. These are shown for Datchet Common Brook in figure E3. The pathways for flooding are currently in this area, along roads, footpaths and between buildings.

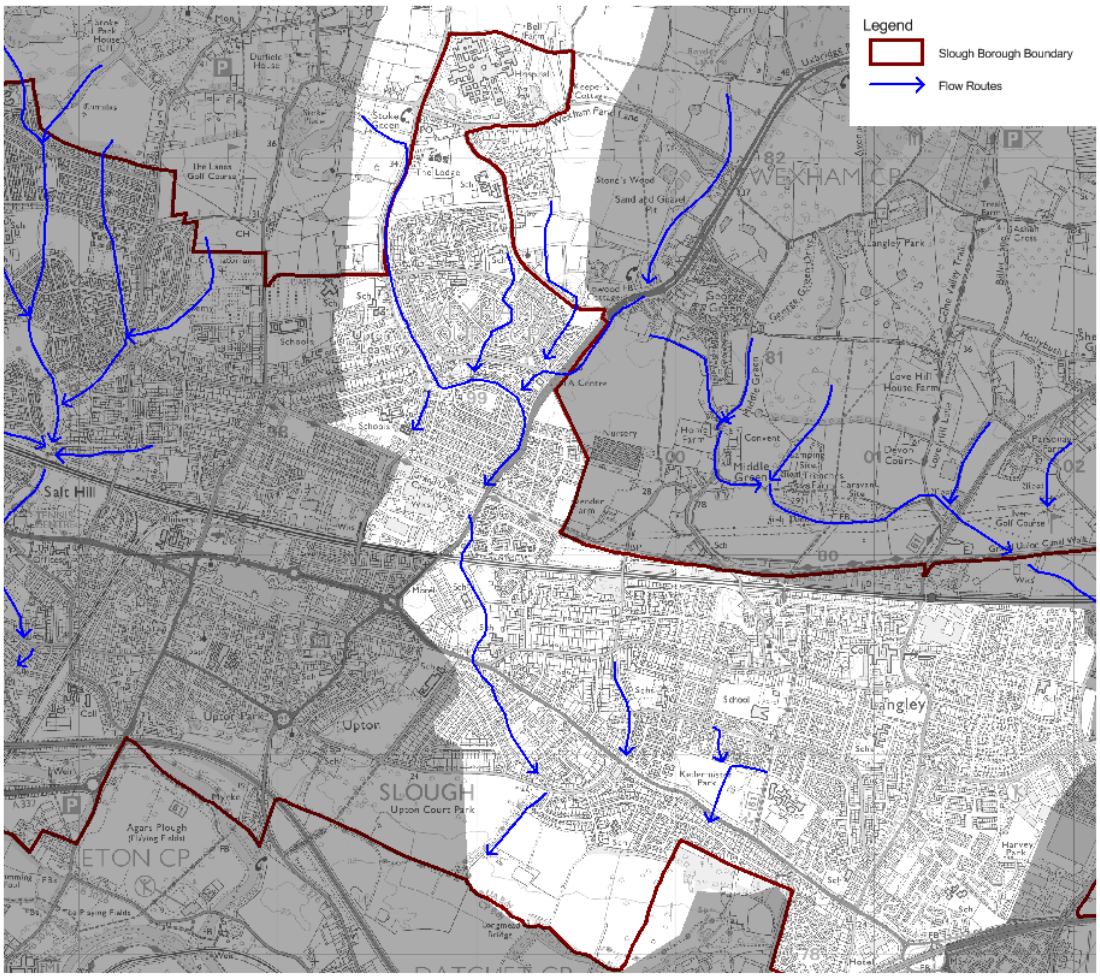

Figure E3 Flow routes – Datchet Common Brook catchment

2.3 Receptors of flooding

The receptors of flooding are the areas where the flood water reaches or areas which are affected by flooding. The areas at risk from surface water and fluvial flooding are shown in figure E1. These at risk areas can be residential properties, commercial properties, and critical infrastructure. Roads, public open spaces such as parks and people are also the receptors of the flooding.

At present the main receptors of flooding are areas which are low lying and receive flood waters overland and surface water flooding from north of the borough boundary or from blockages to culverts or screens.

3. Options and measures for managing flood risk

Based on the principles mentioned above in Part B section 5, a number of structural measures are being considered for the Datchet Common Brook catchment. These measures are now part of a flood assessment being undertaken in a partnership between EA, SBC and TW and known as the Slough Flood Alleviation Study (FAS). The project will assess a number of flood options in the Salt Hill, Chalvey Ditch and Datchet Common Brook catchment in a feasibility study.

The options being addressed for Datchet Common Brook will be along the following lines.

3.1 Structural measures

Attenuation of flood water in the upper catchment

Opportunities for planting and change of land use in the upper catchment can be explored with South Bucks District Council, Environment Agency and land owners. This may help to slow down the flow coming off the catchment through tree planting, management of runoff from roads and fields.

Creation of flood storage in open spaces

Among the feasible technical options identified for detailed analysis was the construction of detention basins or flood storage areas. The worst historical flooding incident had been experienced downstream of the Church Lane part of the catchment so the ideal locations for any storage would be in locations upstream of this area on open land.

There are possible locations in the area of Wexham Park hospital where there is an existing pond which could be extended or to the north of the Church Lane area.

In these locations there is potential to achieve Water Framework Directive aspirations such as an increase in in-channel morphological diversity and link into improved landscape ideas for the parks and open spaces alongside provision of improved flood management.

Re-sectioning of the channel

This can be effective in creating a smaller low flow channel which needs less maintenance and a larger flood channel by creating a “two-stage channel”. This can be created by re-profiling the existing channel and provides good habitat enhancement opportunities. There are limited opportunities to use this measure on Datchet Common Brook as much of the channel is culverted but it may be possible to undertake this measure through some of the upper sections through Wexham Park Hospital area.

Creation of swales and infiltration ponds from development

Opportunities for creating storage or attenuation of surface water through swales and infiltration ponds within development sites will be encouraged.

3.4 Non-structural measures

Develop asset register

SBC are developing and asset register which will provide an ongoing understanding of the assets and identification of the risks within the fluvial system and flooding risk if that asset failed or blocked.

Investigation of Flood Incidents

Commitment to this duty from the FWMA (2010) provides an ongoing picture of the flood risk on the catchment.

Communication and engagement with residents and stakeholders

A plan will be developed to communicate the flood risk and proposed options to residents and stakeholders in the catchment.

Flood Warning

Flood warnings will be issued by the Environment Agency as Datchet Common Brook in SBC area is a main river. However currently there are no telemetry points within the Datchet Common Brook catchment to provide information for issuing flood warnings. SBC will work with EA to assess where and when telemetry can be

provided within the catchment and how a flood warning system can then be established. Once engagement has been made with community and the structural measures have been agreed on the catchment, SBC will work with the Environment Agency and local communities to ensure that residents are aware of the process of flood warning.

Individual Property Protection (IPP) to properties at risk of flooding
Door barriers, air brick covers and other measures can be considered for individual properties to protect from flooding. The use of IPP is dependent on the residents having sufficient warning to be able to implement the measures. In this catchments there are currently no Environment Agency flood warnings available and so IPP is not suitable at this time as flood warnings are not able to be given to alert householders to the danger. This option will be considered further once flood warning is in place. It is noted that providing resistance/resilience measures may need to be given further consideration should it not be possible to sufficiently reduce the risk of flooding through other options. SBC will work with communities, where appropriate, to assess and determine the most appropriate funding for IPP.

Continue to enforce existing policies
Continue to work closely with planning department with SBC to work on new planning applications ensuring that they are compliant with existing policies on drainage and runoff and encourage the use of SUDS, see below.

Education on updated policies
Encourage use of SUDS for new developments as laid out in Appendix J. Move towards the establishment of a SUDS Approval Board within SBC to be ready for the implementation of SUDS legislation under FWMA 2010.

4. Cost, benefits and funding possibilities

There is currently a Flood Alleviation Study being undertaken by Environment Agency with support from SBC to look at a number of flood options across three catchments: Chalvey Ditch; Salt Hill Stream; and Datchet Common Brook. The study will involve a combined fluvial/surface water model study for all three catchments and will assess the costs and benefits for all options individually and combined. The options for funding for all options will depend on the benefit cost ratios. The options may be put forward for DEFRA GiA funding and contributions will be sought from other sources such as Thames Water and SBC, Water Framework Directive funding will be sought for parts of the options which will enhance and develop habitats.

5. Recommendations

- Proceed with exploring structural options with Environment Agency through Slough Flood Alleviation Study programme
- Develop environmental options alongside the structural options
- Continue with development of asset register, ongoing maintenance of screens and investigation of flood incident.
- Develop a programme for communicating flood risk to stakeholders with the other Risk Management Authorities
- Discuss and explore flood warning options for the catchment with Environment Agency
- Continue to explore possibilities for funding options for resistance/resilience measures.
- Continue to explore possibilities for funding options for all flood management options

F. Myrke catchment

1. Description of catchment

The Myrke catchment is an area which covers the town centre of Slough and south of the town centre down to the Jubilee River. The catchment covers Herschel Park and part of Upton court Park. There is an ordinary watercourses which flow from Herschel Park and two from Upton Court Park which flow into main river channels. The main river water courses of the Myrke catchment flow into the Jubilee River. The catchment is predominantly urban except for Herschel Park and part of Upton Court Park which sit in the catchment.

2. Current issues on flooding

There are currently 6 residential properties at risk of greater than 1 in 100 year (flood zone 3) fluvial flooding and 70 at risk of 1 in 100 to 1 in 1000 year (flood zone 3) fluvial flooding in the Horton Brook catchments within SBC area.

Catchment	Fluvial flooding		Surface water flooding	Both fluvial and surface water	Total
	Zone 2 (1:100 – 1:1000)	Zone 3 (Greater than 1:100)	1 in 100 year	1 in 100 year	1 in 100 year
Myrke catchment	70	6	566		572

The risk from surface water flooding in the area of the Myrke catchment was assessed in the Surface Water Management Plan and there are 566 properties at risk in a 1 in 100 year event. The surface water flooding is around the town centre and south of the town centre where there is almost 100% coverage of paved and road areas.

The total extent of the estimated surface and fluvial flooding for a 1 in 100 flood is shown in Figure F1 below.

There have been some historical flood events within the area especially in residential area of The Myrke. The watercourses of the Myrke catchment are particularly susceptible to ‘flash’ flooding as a result of localised intense rainfall, combined with a high density, urban catchment.

Flooding in Herschel Park and the surrounding residential area to the south west corner has occurred in the recent past – 2012, due to the surcharging of a foul sewer into the ordinary water course. In addition this created a pollution incident in the ordinary watercourse through Herschel Park.

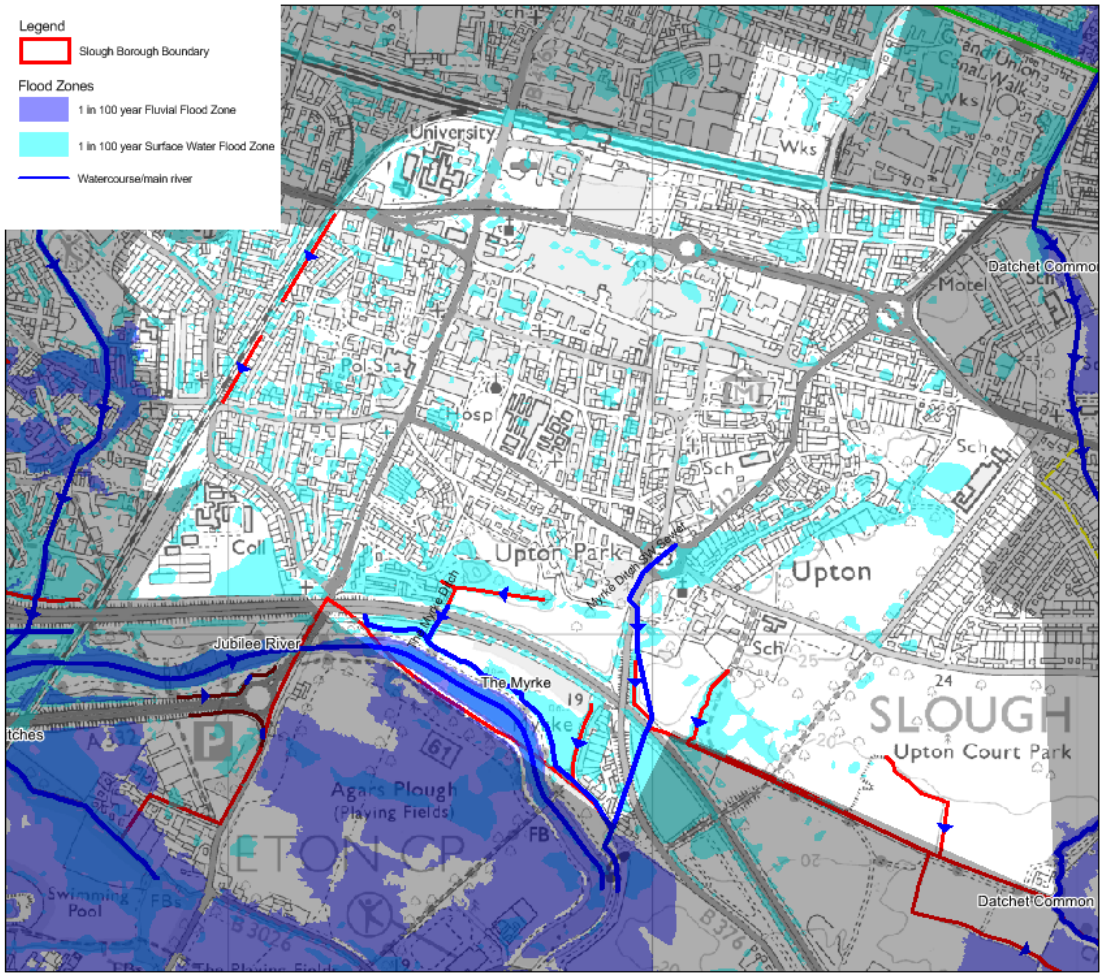

Figure F1 Estimated surface and fluvial flooding for a 1 in 100 flood

Whatever the source, and depth, of flooding the consequences are disruptive and upsetting. SBC is committed to understanding the sources, pathways and receptors of flooding so that the risk can be managed and reduced wherever possible.

2.1Source of flooding

The Surface Water Management Plan indicates significant flooding of over 500 properties from a 1 in 00 year event. This flooding is from runoff and inability of the surface water sewers to carry the heavy rainfall. Most of the town centre area is hard surface so runoff is quick especially in intense rainfall conditions.

The ordinary water course running alongside The Myrke residential area has created flooding problems in the past (date?). When the water level in this watercourse gets too high there are pumps which cut in to lift the water into the Jubilee River. The pumps are operated by Environment Agency. The Myrke pumping operational procedure is based on data provided by the telemetry on the Thames downstream of Black Potts weir.

2.2 Pathways of flooding

The routes of flooding in the catchment are all along roads and overland flow routes. Figure F2 shows the catchment routes of the watercourses.

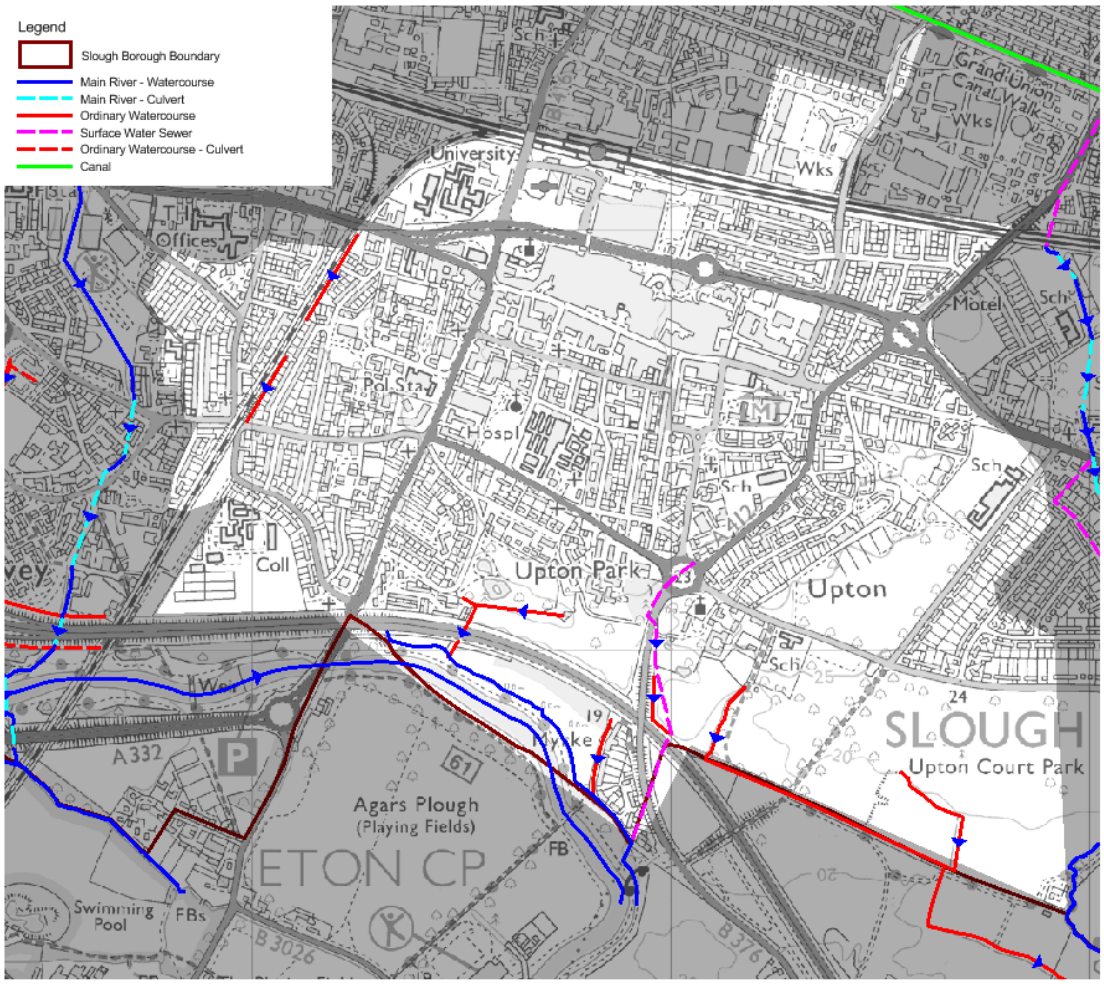

Figure F2 Route of watercourses for Myrke catchment

The surface water flooding finds its ways along roads and between buildings.

2.3 Receptors of flooding

The receptors of flooding are the areas where the flood water reaches or areas which are affected by flooding. The areas at risk from surface water and fluvial flooding are shown in figure F1. These at risk areas can be residential properties, commercial properties, and critical infrastructure. Roads, public open spaces such as parks and people are also the receptors of the flooding.

At present the main receptors of flooding are areas which are low-lying and receive flood waters overland and surface water flooding from north of the borough boundary or from blockages to culverts or screens.

3. Options and measures for managing flood risk

Based on the principles mentioned above in Part B section 5, a number of measures could be considered for the Myrke catchment.

The options being addressed for Myrke catchment will be along the following lines.

3.1 Structural measures

Creation of flood storage in open spaces

If there are possible locations for flood storage these will be identified in the catchments where there are open spaces. This may be inside or outside the SBC area but would have an impact on flooding within the SBC area. It will be important to work with other adjoining LLFAs and the Environment Agency to discuss possibilities for the storage of flood water within the catchment.

In these locations there is potential to achieve Water Framework Directive aspirations such as an increase in in-channel morphological diversity and link into improved landscape ideas for the parks and open spaces alongside provision of improved flood management.

Creation of swales and infiltration ponds from development

Opportunities for creating storage or attenuation of surface water through swales and infiltration ponds within development sites will be encouraged.

3.2 Non-structural measures

Develop asset register

SBC are developing and asset register which will provide an ongoing understanding of the assets and identification of the risks within the fluvial system and flooding risk if that asset failed or blocked.

Investigation of Flood Incidents

Commitment to this duty from the FWMA (2010) provides an ongoing picture of the flood risk on the catchment.

Communication and engagement with residents and stakeholders

A plan will be developed to communicate the flood risk and proposed options to residents and stakeholders in the catchment. Ensure that the Myrke operational pumping procedure is clear to all RMAs and residents.

Flood Warning

There is currently no flood warning system in the Myrke catchment, although there is telemetry available for the operation of the pumps at the Myrke. Once engagement has been made with the local community SBC will work with local stakeholders to assess how telemetry can be used within the catchment and how a flood warning system can then be established.

Individual Property Protection (IPP) to properties at risk of flooding

Door barriers, air brick covers and other measures can be considered for individual properties to protect from flooding. The use of IPP is dependent on the residents having sufficient warning to be able to implement the measures. In this catchment there are currently no Environment Agency flood warnings available and so IPP is not suitable at this time as flood warnings are not able to be given to alert householders to the danger. This option will be considered further once flood warning is in place. It is noted that providing resistance/resilience measures may need to be given further consideration should it not be possible to sufficiently reduce the risk of flooding through other options. SBC will work with communities, where appropriate, to assess and determine the most appropriate funding for IPP.

Continue to enforce existing policies

Continue to work closely with planning department with SBC to work on new planning applications ensuring that they are compliant with existing policies on drainage and runoff and encourage the use of SUDS, see below.

Education on updated policies

Encourage use of SUDS for new developments as laid out in Appendix J. Move towards the establishment of a SUDS Approval Board within SBC to be ready for the implementation of SUDS legislation under FWMA 2010.

4. Cost, benefits and funding possibilities

There is currently a Flood Alleviation Study being undertaken by Environment Agency with support from SBC to look at a number of flood options across three catchments: Chalvey Ditch; Salt Hill Stream; and Datchet Common Brook. The study will involve a combined fluvial/surface water model study for all three catchments and will assess the costs and benefits for all options individually and combined. The FAS does not cover Myrke catchment but principles from it will be important.

At the current time any options for flood management in Myrke catchment will be considered for FDGiA funding which depends on the benefit cost ratios. Any options would be put forward for DEFRA GiA funding and contributions will be sought from other sources such as Thames Water and SBC. Water Framework Directive funding would be sought for parts of the options which would enhance and develop habitats.

5. Recommendations

- Proceed with exploring structural surface water options with, Environment Agency and Thames Water.
- Develop environmental options alongside the structural options using opportunities such as Herschel and Upton Court Park
- Continue with development of asset register, ongoing maintenance of screens and investigation of flood incident.
- Develop a programme for communicating flood risk to stakeholders with the other Risk Management Authorities
- Discuss and explore flood warning options for the catchment with Environment Agency, other LLFAs and stakeholders
- Continue to explore possibilities for funding options for resistance/resilience measures.
- Continue to explore possibilities for funding options for all flood management options

G. Horton Stream/Tanhouse Stream

1. Description of catchment

The Horton Brook is a tributary of the River Colne. The Horton Brook catchment area is 10.5km^2. Horton Brook enters the borough via a culvert under the Slough Arm of the Grand Union Canal near the former Total Oil depot, and runs as an open watercourse south eastwards with the exception of culverts under the Great Western Railway and Market Lane. It then leaves the Borough at SU023795 and re-enters the Borough by a culvert under the M4 motorway, adjacent to Old Wood and runs as an open watercourse south to Colnbrook High street passing through a culvert under the Colnbrook Bypass on the way. Having passed under the High Street in a culvert it emerges along the side of Crown Meadow, flows through the meadow and then alongside the Horton Road where it leaves Slough Borough.

2. Current issues on flooding

There are currently residential properties at risk of greater than 1 in 100 year (flood zone 3) fluvial flooding and at risk of 1 in 100 to 1 in 1000 year (flood zone 3) fluvial flooding in the Horton Brook catchments within SBC area.

Catchment	**Fluvial flooding**		**Surface water flooding**	**Both fluvial and surface water**	**Total**
	Zone 2 (1:100 – 1:1000)	**Zone 3 (Greater than 1:100)**	**1 in 100 year**	**1 in 100 year**	**1 in 100 year**
Horton Brook	94	48	*	*	48

* *There are currently no values for the surface water risk – see below*

The risk from surface water flooding in the area around Horton Brook was not assessed in the Surface Water Management Plan as that area of Slough was not considered to be at serious risk from surface water flooding.

The total extent of the estimated surface and fluvial flooding for a 1 in 100 flood is shown in Figure G1 below

There have been some historical flood events within the area around Horton Brook in the Colnbrook and Poyle area in 2000, 2001, 2003 and 2009. These watercourses are particularly susceptible to ‘flash’ flooding as a result of localised intense rainfall, and high level of run-off from the London Clay to the north in South Bucks.

Recent, updated fluvial flood modelling of the River Colne and Colne Brook has included the Horton Brook and this has and will improve the accuracy of prediction of the flooded areas and the numbers in the table above. Figure G1 below shows the estimated fluvial flooding for the Horton Brook.

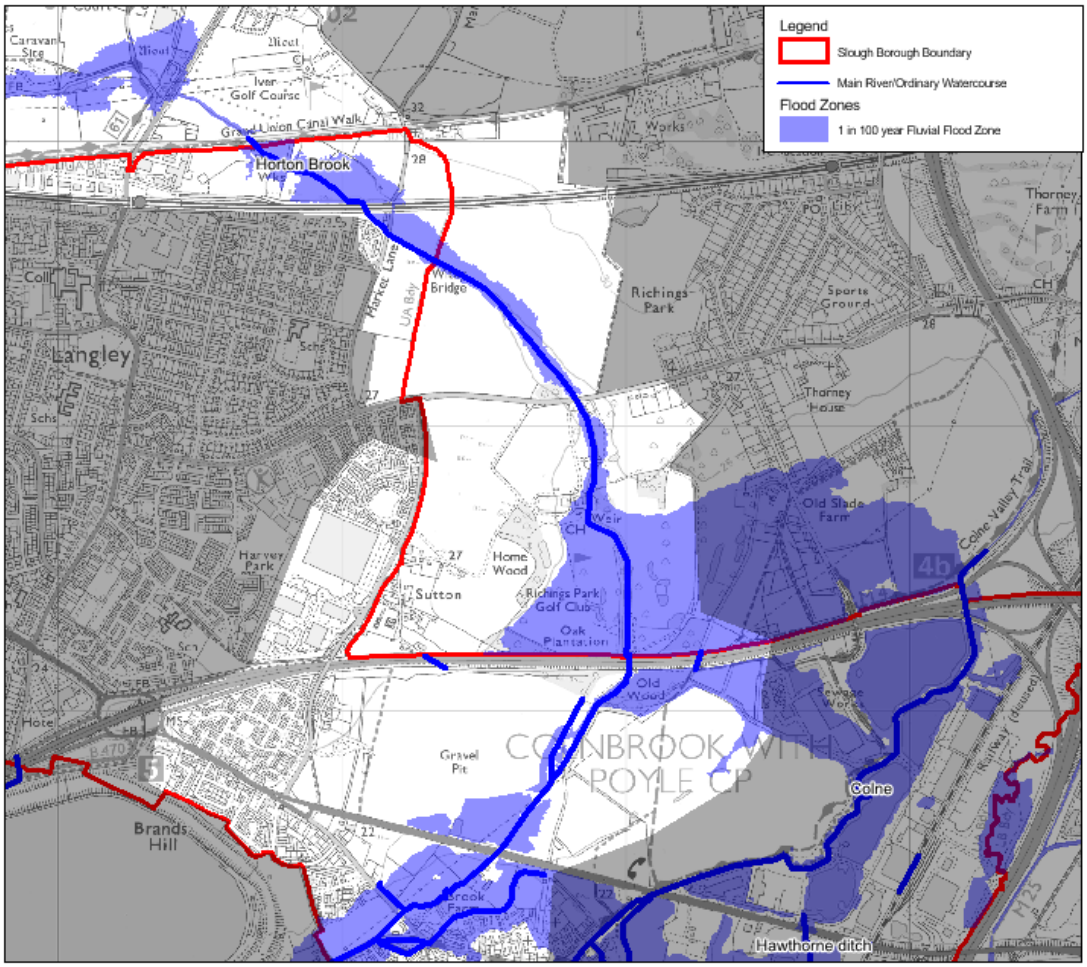

Figure G1 Estimated surface and fluvial flooding for a 1 in 100 flood

Whatever the source, and depth, of flooding the consequences are disruptive and upsetting. SBC is committed to understanding the sources, pathways and receptors of flooding so that the risk can be managed and reduced wherever possible.

2.1Source of flooding

The Surface Water Management Plan (SWMP) was not extended to this part of Slough so any surface water modelling has been from more general/national sources such as Areas susceptible to Surface Water Flooding Issued May 2009, or 'Flood Map for Surface Water (FMfSW)' issued November 2010.

There is no sewer network in this area to the east of Springfield Road. The high groundwater table in the area means that methods for dealing with surface water runoff are extremely restricted.

Groundwater flows can be altered, as has occurred in the Colnbrook and Poyle area, by the backfilling with wastes of sites excavated for sand and gravel, (and particularly those which are sealed, such as the land east of Sutton Lane), the construction of the Queen Mother and Wraysbury reservoirs, and development such as Thames Water's Iver South Sludge Treatment Works, as groundwater flows through these sites have been partially or totally blocked, thereby increasing the rate of flow and level of groundwater in the remaining 'gaps'.

Much of Colnbrook is prone to groundwater flooding and the Council is aware of groundwater flooding around Popes Close.

2.2 Pathways of flooding

The routes of flooding in the catchment are all along roads and overland flow routes. Figure G2 shows the catchment routes of the watercourses.

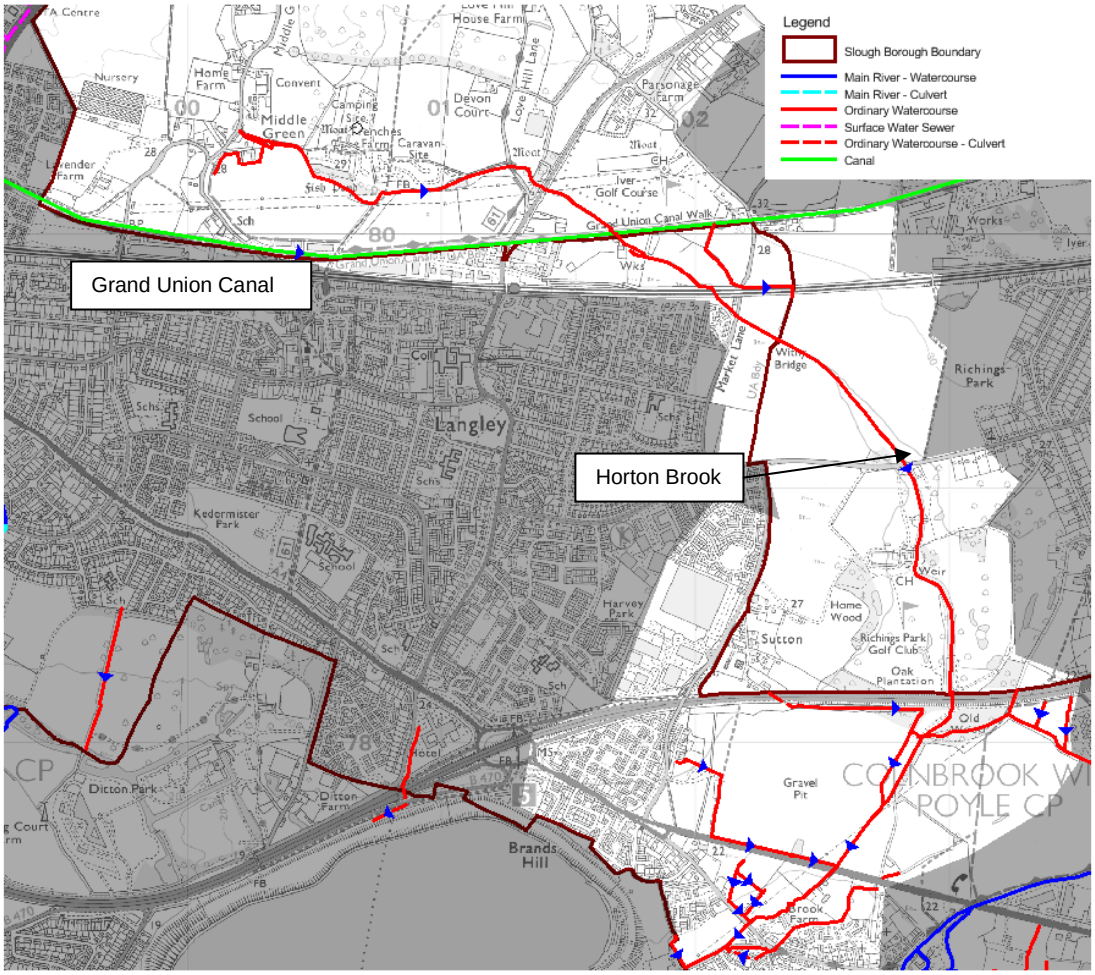

Figure G2 Route of watercourses for Horton Brook

The main flow routes are shown in Figure G3.

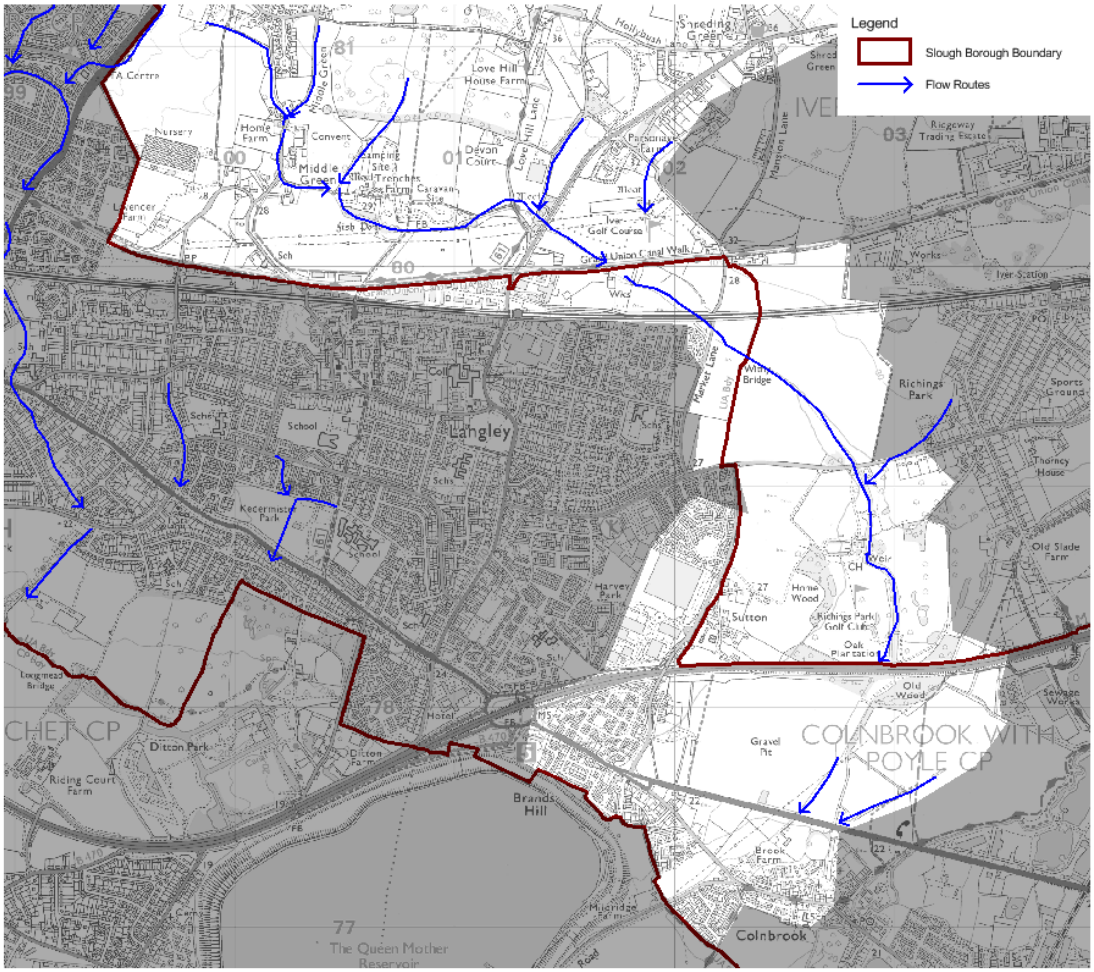

Figure G3 Flow routes –Horton Brook catchment

2.3 Receptors of flooding

The receptors of flooding are the areas where the flood water reaches or areas which are affected by flooding. The areas at risk from surface water and fluvial flooding are shown in figure G1. These at risk areas can be residential properties, commercial properties, and critical infrastructure. Roads, public open spaces such as parks and people are also the receptors of the flooding.

At present the main receptors of flooding are areas which are low-lying and receive flood waters overland and surface water flooding from north of the borough boundary or from blockages to culverts or screens.

Plate G1 Flooding at Crown Meadow, Horton Brook

3. Options and measures for managing flood risk

Based on the principles mentioned above in Part B section 5, a number of measures can be considered for the Horton Brook catchment.

The options being addressed for Horton Brook will be along the following lines.

3.1 Structural measures

Attenuation of flood water in the upper catchment

Opportunities for planting and change of land use in the upper catchment can be explored with South Bucks District Council, Environment Agency and land owners. This may help to slow down the flow coming off the catchment through tree planting and management of runoff from roads and fields.

Creation of flood storage in open spaces

If there are possible locations for flood storage these will be identified in the catchments where there are open spaces. It is likely that these will be outside the SBC area but would have an impact on flooding within the SBC area. It will be important to work with other adjoining LLFAs and the Environment Agency to discuss possibilities for the storage of flood water within the catchment.

In these locations there is potential to achieve Water Framework Directive aspirations such as an increase in in-channel morphological diversity and link into improved landscape ideas for the parks and open spaces alongside provision of improved flood management.

Re-sectioning of the channel

This can be effective in creating a smaller low flow channel which needs less maintenance and a larger flood channel by creating a “two-stage channel”. This can

be created by re-profiling the existing channel and provides good habitat enhancement opportunities. Work on the channel in the Crown Meadow area is a good example of this type of opportunity. In 2013 Groundwork Thames Valley with some monies from Grundon Waste Management Ltd are going to undertake some re-sectioning work with channel deflectors, bank work and tree work along the Horton Brook channel.

Creation of swales and infiltration ponds from development
Opportunities for creating storage or attenuation of surface water through swales and infiltration ponds within development sites will be encouraged.

3.3 Non-structural measures

Develop asset register
SBC are developing and asset register which will provide an ongoing understanding of the assets and identification of the risks within the fluvial system and flooding risk if that asset failed or blocked.

Investigation of Flood Incidents
Commitment to this duty from the FWMA (2010) provides an ongoing picture of the flood risk on the catchment.

Communication and engagement with residents and stakeholders
A plan will be developed to communicate the flood risk and proposed options to residents and stakeholders in the catchment.

Flood Warning
There is currently no flood warning system along the Horton Brook. Once engagement has been made with the local community SBC will work with local stakeholders to assess where and when telemetry can be provided within the catchment and how a flood warning system can then be established.

Individual Property Protection (IPP) to properties at risk of flooding
Door barriers, air brick covers and other measures can be considered for individual properties to protect from flooding. The use of IPP is dependent on the residents having sufficient warning to be able to implement the measures. In this catchment there are currently no Environment Agency flood warnings available and so IPP is not suitable at this time as flood warnings are not able to be given to alert householders to the danger. This option will be considered further once flood warning is in place. It is noted that providing resistance/resilience measures may need to be given further consideration should it not be possible to sufficiently reduce the risk of flooding through other options. SBC will work with communities to assess and determine the most appropriate funding for IPP.

Continue to enforce existing policies
Continue to work closely with planning department on new planning applications ensuring that they are compliant with existing policies on drainage and runoff and encourage the use of SUDS, see below.

Education on updated policies
Encourage use of SUDS for new developments as laid out in Appendix J. Move towards the establishment of a SUDS Approval Board within SBC to be ready for the implementation of SUDS legislation under FWMA 2010.

4. Cost, benefits and funding possibilities

There is currently a Flood Alleviation Study being undertaken by Environment Agency with support from SBC to look at a number of flood options across three catchments: Chalvey Ditch; Salt Hill Stream; and Datchet Common Brook. The study will involve a combined fluvial/surface water model study for all three catchments and will assess the costs and benefits for all options individually and combined. The FAS does not cover Horton Brook but it will take into account any flows moving between Datchet Common Brook and Horton Brook.

At the current time any options for flood management along Horton Brook will be considered for FDGiA funding which depends on the benefit cost ratios. Any options would be put forward for DEFRA GiA funding and contributions will be sought from other sources such as Thames Water and SBC. Water Framework Directive funding would be sought for parts of the options which would enhance and develop habitats.

5. Recommendations

- Proceed with exploring structural options with other LLFAs, Environment Agency, local stakeholders, Groundwork and Colne Valley Partnership possibly through the Colne Catchment Action Network.
- Develop environmental options alongside the structural options using opportunities such as Crown Meadows and the work which Groundwork are looking at undertaking
- Continue with development of asset register, ongoing maintenance of screens and investigation of flood incident.
- Develop a programme for communicating flood risk to stakeholders with the other Risk Management Authorities
- Discuss and explore flood warning options for the catchment with Environment Agency, other LLFAs and stakeholders
- Continue to explore possibilities for funding options for resistance/resilience measures.
- Continue to explore possibilities for funding options for all flood management options

H Colne Brook/Poyle Channel/Wraysbury River/County Ditch/Hawthorne Ditch/Cottesbrook Ditch

1. Description of catchment

The Colne Brook is a part of the River Colne catchment and runs from Uxbridge Moor to the River Thames at the downstream boundary entering the Thames just below Bell Weir Lockin Hythe End, Wraysbury.

The Colne Brook leaves the River Colne in the Colne Valley Regional Park and then flows south to West Drayton and passes under the M25 and M4 where it enters Slough Borough Council area. The open channel flows alongside a series of lakes north of the Colnbrook Bypass. After passing under the Colnbrook Bypass the channel splits and flows around the east and west side of the Tanhouse Farm industrial area. On the eastern arm the Colne Brook channel is joined by the County ditch. The inflow into the Colne Brook from the County Ditch is controlled by a weir. The controls and embankments around this are form part of a flood alleviation scheme installed by the EA in the1990s. The County Ditch runs from the north side of the Coln/Galleymead trading estates and is joined by the Hawthorn Ditch from the north around Hawthorn Avenue. The County Ditch can flow into an overflow channel via a lowered embankment at the Albany Park overflow which was constructed as part of the more recent flood alleviation scheme in 2004/2005. This overflow channel then connects to the Cottesbrooke Ditch which flows south and west and joins the Colne Brook south of Colnbrook village centre.

The Colne Brook east and west arms around Tanhouse Farm industrial area, join just north of Bridge Street and flows through the village of Colnbrook. South of Colnbrook village the Poyle Channel joins the Colne Brook having flowed through the Poyle industrial area. The Poyle Channel is an offtake from the Wraysbury River via a weir just inside the SBC boundary on the west side of the M25. The Wraysbury River itself branches off the River Colne at West Drayton upstream. It flows along the west side of the M25 within the SBC boundary before leaving the Borough by the Wraysbury reservoir.

2. Current issues on flooding

The areas around Colnbrook are generally low lying and have been impacted by flooding in the recent past in 2000, 2001, 2003 and 2009. The table below shows the number of properties believed to be at risk from figures taken from the SFRA, SBC 2012. These numbers come from fluvial flooding as there has been little surface water modelling undertaken in the Colnbrook area. These numbers are under discussion at the moment due to the changing nature of the fluvial flood maps – see below.

Catchment	**Fluvial flooding**		**Surface water flooding**	**Both fluvial and surface water**	**Total**
	Zone 2 (1:100 – 1:1000)	**Zone 3 (Greater than 1:100)**	**1 in 100 year**	**1 in 100 year**	**1 in 100 year**
Colne Brook	396	232	*	*	232

** There are currently no values for the surface water risk – see below*

The risk from surface water flooding in the area around Colnbrook was not assessed in the Surface Water Management Plan as that area of Slough was not considered to be at serious risk from surface water flooding.

Flood alleviation works were undertaken by the Environment Agency in early 1990s and 2005 in the Colnbrook area. Following that re-modelling of the River Colne including the Colne Brook has been ongoing with several different versions of the fluvial flood maps with and without areas benefitting from defences now being included in the most recent version. Much of the area of the Poyle industrial estate has now been removed from the Zone 3 floodplain and other areas are in areas benefitting from defences. The area south of Hawthorn Ditch is shown as being in zone 2 floodplain or removed completely from the floodplain. There are still ongoing discussions between EA and SBC as to the how well the fluvial flood maps represent the flooding situation on the ground.

The Council is concerned that some areas not within zone 3 floodplain may still be at risk of frequent flooding. For example, the Hellmann's site north of the Colnbrook Bypass is located to the north of the flood alleviation schemes and has not been afforded protection by any new defences. Similarly, land between the Colnbrook Bypass and the County Ditch is also shown outside the floodplain. These areas of land have been identified as "areas of known flooding" from local knowledge and experience.

In the area of Langley and Colnbrook/Poyle, the river terrace deposits are underlain by London Clay, which in turn are underlain by Reading Beds and then by the Upper Chalk. Because of this the whole of the Colnbrook and Poyle area is severely constrained by the high groundwater level, thereby restricting the use of soakaways. However there are no surface water sewers east of Springfield Road. The area around Colnbrook and Poyle is susceptible to groundwater flooding .Figure H1 below shows the estimated fluvial flooding for the Colne Brook catchment within Slough.

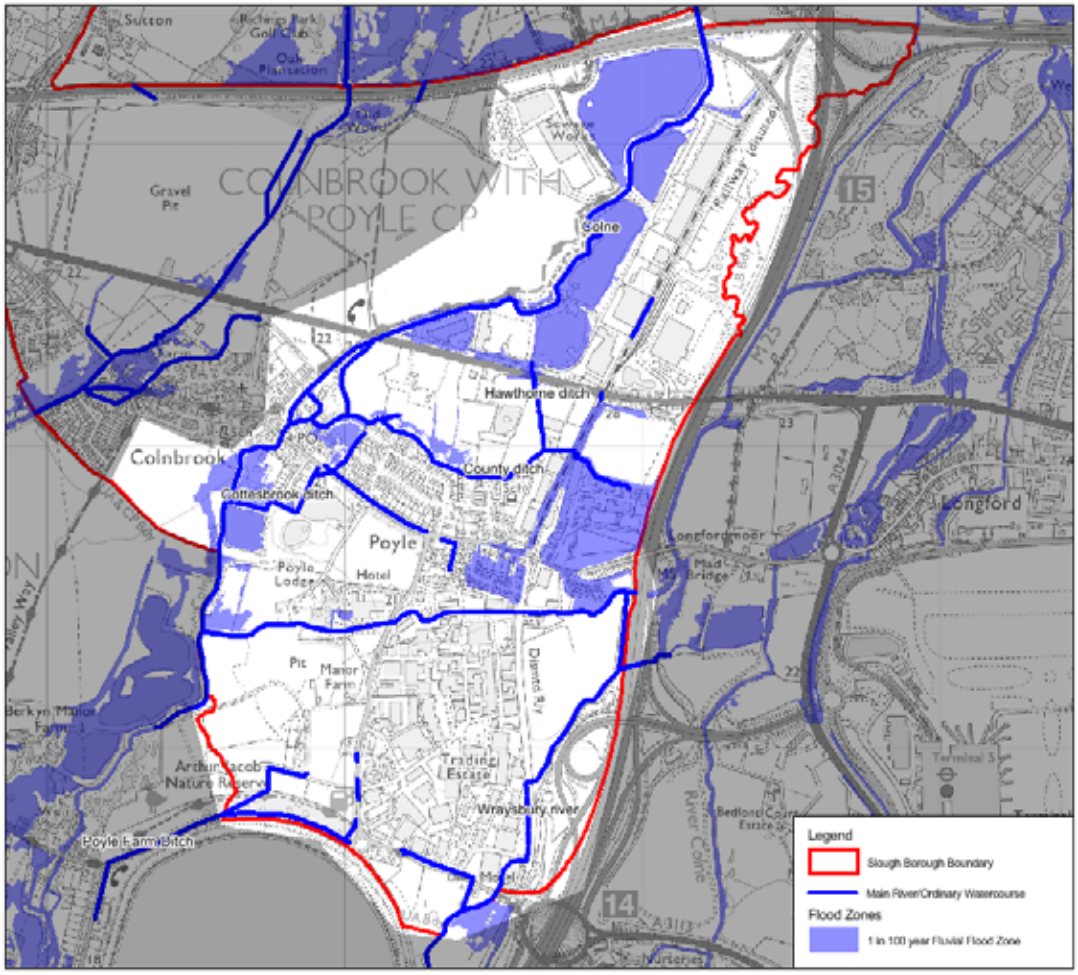

Figure H1 Estimated fluvial flooding for a 1 in 100 flood

Whatever the source, and depth, of flooding the consequences are disruptive and upsetting. SBC is committed to understanding the sources, pathways and receptors of flooding so that the risk can be managed and reduced wherever possible.

3.4 Source of flooding

The Surface Water Management Plan (SWMP) was not extended to this part of Slough so any surface water modelling has been from more general/national sources such as Areas Susceptible to Surface Water Flooding Issued May 2009, or 'Flood Map for Surface Water (FMfSW)' Issued November 2010.

The high groundwater table in the area means that methods for dealing with surface water runoff are extremely restricted. Groundwater flows can be altered, as has occurred in the Colnbrook and Poyle area, by the backfilling with wastes of sites excavated for sand and gravel, (and particularly those which are sealed, such as the land east of Sutton Lane), the construction of the Queen Mother and Wraysbury reservoirs, and development such as Thames Water's Iver South Sludge Treatment Works, as groundwater flows through these sites have been partially or totally blocked, thereby increasing the rate of flow and level of groundwater in the remaining 'gaps'.

Much of Colnbrook and Poyle is prone to groundwater flooding and the Council is aware of groundwater flooding around Galleymead Road.

2.2 Pathways of flooding

The routes of flooding in the catchment are all along roads and overland flow routes. Figure H2 shows the catchment routes of the watercourses.

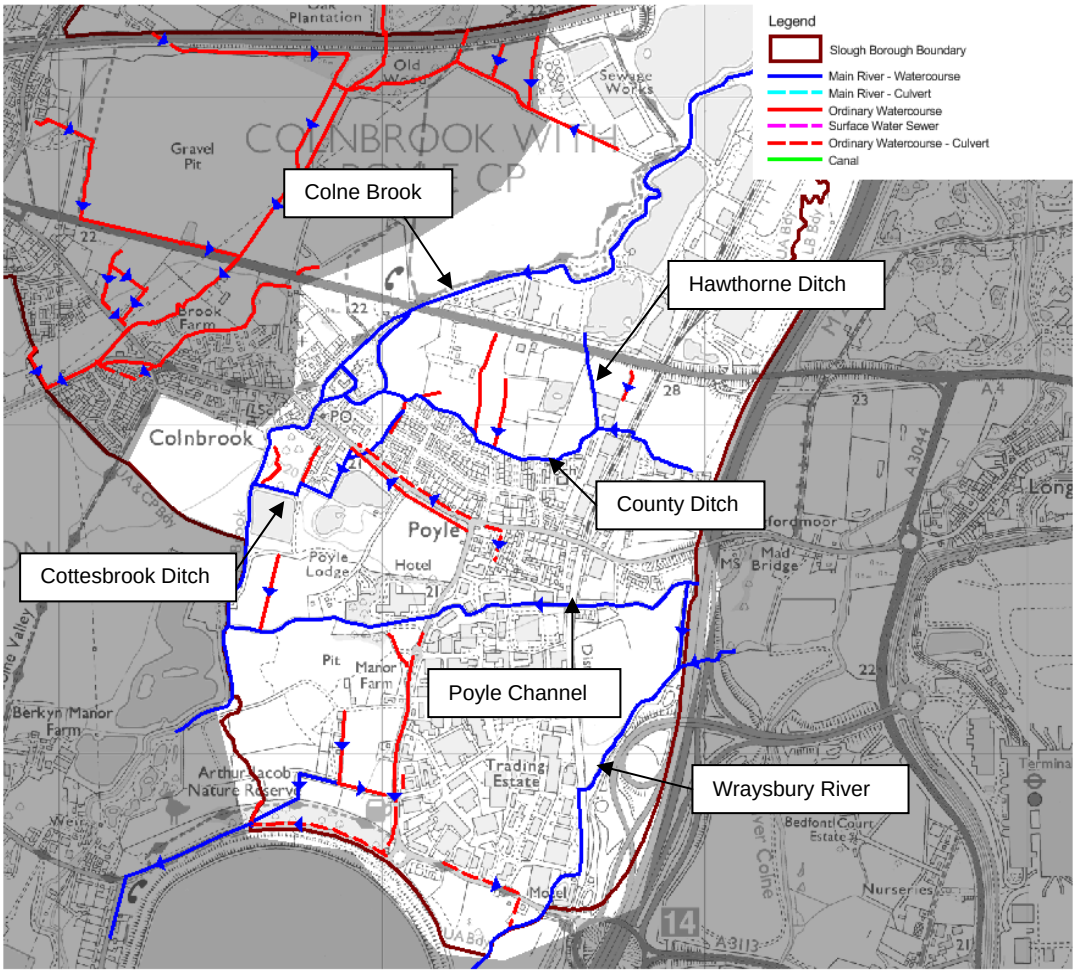

Figure H2 Route of watercourses for Colne Brook catchment

2.3 Receptors of flooding

The receptors of flooding are the areas where the flood water reaches or areas which are affected by flooding. The areas at risk from surface water and fluvial flooding are shown in figure H1. These at risk areas can be residential properties, commercial properties, and critical infrastructure. Roads, public open spaces such as parks and people are also the receptors of the flooding.

At present the main receptors of flooding are areas which are low lying and receive flood waters overland and surface water flooding from north of the borough boundary or from blockages to culverts or screens.

Plate H1 Flooding in the Colnbrook area

3. Options and measures for managing flood risk

Based on the principles mentioned above in Part B section 5, a number of measures can be considered for the Colne Brook catchment.

The options being addressed for Colne Brook within SBC area will be along the following lines.

3.1 Structural measures

Attenuation of flood water in the upper catchment

Opportunities for planting and change of land use in the upper catchment can be explored with South Bucks District Council, Environment Agency and land owners. This may help to slow down the flow coming off the catchment through tree planting, management of runoff from roads and fields.

Creation of flood storage in open spaces

If there are possible locations for flood storage these will be identified in the catchments where there are open spaces. It is likely that these will be outside the SBC area but would have an impact on flooding within the SBC area. It will be important to work with other adjoining LLFAs and the Environment Agency to discuss possibilities for the storage of flood water within the catchment.

In these locations there is potential to achieve Water Framework Directive aspirations such as an increase in-channel morphological diversity and link into improved landscape ideas for the parks and open spaces alongside provision of improved flood management.

Re-sectioning of the channel
This can be effective in creating a smaller low flow channel which needs less maintenance and a larger flood channel by creating a “two-stage channel”.

Creation of swales and infiltration ponds from development
Opportunities for creating storage or attenuation of surface water through swales and infiltration ponds for ongoing and new development will be encouraged.

3.2 Non-structural measures
Develop asset register
SBC are developing an asset register which will provide an ongoing understanding of the assets and identification of the risks within the fluvial system and flooding risk if that asset failed or blocked.

Investigation of Flood Incidents
Commitment to this duty from the FWMA (2010) provides an ongoing picture of the flood risk on the catchment.

Communication and engagement with residents and stakeholders
A plan will be developed to communicate the flood risk and proposed options to residents and stakeholders in the catchment.

Flood Warning
The flood warning system is currently operated by the Environment Agency along the Colne Brook. Once engagement has been made with community, SBC will work with the Environment Agency and local communities to ensure that residents are aware of the process of flood warning

Individual Property Protection (IPP) to properties at risk of flooding
Door barriers, air brick covers and other measures can be considered for individual properties to protect from flooding. The use of IPP is dependant on the residents having sufficient warning to be able to implement the measures. The flood warning and take up of the warnings by residents will be considered and encouraged further by SBC and the Environment Agency. It is noted that providing resistance/resilience measures may need to be given further consideration should it not be possible to sufficiently reduce the risk of flooding through other options.

Continue to enforce existing policies
Continue to work closely with planning department with SBC to work on new planning applications ensuring that they are compliant with existing policies on drainage and runoff and encourage the use of SUDs, see below.

Education on updated policies
Encourage use of SUDS for new developments as laid out in Appendix J. Move towards the establishment of a SUDs Approval Board within SBC to be ready for the implementation of SUDS legislation under FWMA 2010.

4. Cost, benefits and funding possibilities

There is currently a Flood Alleviation Study being undertaken by Environment Agency with support from SBC to look at a number of flood options across three catchments: Chalvey Ditch; Salt Hill Stream; and Datchet Common Brook. The FAS does not cover Colne Brook.

At the current time any options for flood management along Colne Brook are likely to be considered as part of a wider consideration of the River Colne catchment. Any

options would be put forward for DEFRA GiA funding and contributions will be sought from other sources such as Thames Water and LLFAs. Water Framework Directive funding would be sought for parts of the options which would enhance and develop habitats.

5. Recommendations

- Proceed with exploring structural options with other LLFAs, Environment Agency, local stakeholders, Groundwork and Colne Valley Partnership possibly through the Colne Catchment Action Network.
- Develop environmental options alongside the structural options using opportunities such as the work which Groundwork are looking at undertaking on the Colne catchment
- Continue with development of asset register, ongoing maintenance of screens and investigation of flood incident.
- Develop a programme for communicating flood risk to stakeholders with the other Risk Management Authorities
- Discuss and explore flood warning options for the catchment with Environment Agency, other LLFAs and stakeholders
- Continue to explore possibilities for funding options for resistance/resilience measures.
- Continue to explore possibilities for funding for all flood management measures

Appendix I – Policy on Flood Investigations

1. Background

The Flood & Water Management Act (FWMA) requires, Slough BC as Lead Local Flood Authority (LLFA), to investigate flood events that it considers necessary or appropriate to investigate.

2. Investigation

The investigation is to clarify which flood risk management authorities have responsibility for the source of the flooding.

The investigation should record the flood incident and which authority is responsible. The investigation should establish what actions the responsible authorities are taking or intend to take in response to the flood.

The findings of the investigation are to be published and notified to the relevant authorities.

Routes of communication for flooding incidents are currently through the call centre. This may need to be changed in the future to be diverted to Highways but this will require careful monitoring, a new system of a chain of communication and extra resources.

3. Requirement for investigation

The scale of flooding which will be investigated is where one or more of the following applies:

- Internal property flooding.
- Flooding of transport infrastructure sufficient to require closure or diversion of traffic.
- Flooding of utility plant resulting in loss of service to customers.
- Any other incident deemed appropriate.
- Flooding of any public area e.g. parks, cemeteries

4. Flood Risk Management Authorities

The principal flood risk management authorities in Slough area are:

- Environment Agency – ‘main’ river.
- Thames Water – public sewer network.
- Slough BC as LLFA - surface water, ground water or minor watercourses.
- Slough BC as Highway Authority – highway drainage.
- Bucks CC and RBWM as LLFA – cross border from Bucks.

It is recommended that a memorandum of understanding is established between different parties and RMAs. There needs to be an agreed process for reporting and/or referring the incidents between the different parties. Reporting of flood incidents should be in the same place and in the same format.

5. Publication of investigations

The findings of investigations will be held electronically within the Highway Engineering server and be available for viewing during the councils published office hours.

Consideration will be given to making these findings available on the website and from the Customer centre.

Appendix J SUDS Policy

The design of SUDS should aim to minimise both the rate and volume of surface water flow from a development. Where only the rate of flow (attenuation) is controlled longer retention times may be required to mitigate for the increased volume of water generated by the development.

The design of SUDS should progressively utilise the full potential of each individual curtilage and then the whole site, following the principle of source control, before any discharge to an external outfall is considered.

Where applicable the risk of flows from outside the site must be taken into consideration in the design. Exceedance flow routes should also be identified in the design.

The level of protection against pollution shall be appropriate to the contamination risk of the area drained. However, the use of permeable paving in adoptable SUDS should be avoided.

All designs should be capable of withstanding foreseeable structural loadings and be practically maintainable for the expected life of the development. The predicted lifetime maintenance requirements for the design proposal shall be submitted as part of the approval process.

Developers and subsequent property owners need to understand their responsibilities for maintenance and protection from damage of SUDS during the construction of a development and for the full duration of its life.

Advantages of suggested policy:
Maximises use of available space
Maximises private responsibility for own drainage
Maximises potential for future expansion of drainage capacity
Minimises corporate responsibility for maintenance
Avoids corporate responsibility for paving surfaces (outside adoptable highway)

Disadvantages
May require high level of oversight and enforcement for life of the development

Design Criteria

There are a number of criteria to be satisfied with regard to hydraulic performance of the design:

- The first 5mm of rainfall should be contained within the site.

- The rates of flow from the site should not exceed Greenfield rates for 1:1 and 1:100 events (6hr storm)
- The volume of discharge should not exceed that for the Greenfield volume. Where this cannot be achieved a flow rate not exceeding 2 L/sec/Ha is an acceptable alternative.

The minimum hydraulic design should be for a 100yr + 20% event with no surface flooding < 30yr event.

Preferred hierarchy

Initial 5mm rainfall

Where infiltration is not an option, containment of the initial 5mm of rainfall within the site, should be satisfied by using measures such as green roofs, irrigation of planters and water storage for reuse.

Single Curtilage

1. Infiltration within individual properties (remains private).
2. Infiltration within individual properties to maximum achievable standard with overflow to adoptable infiltration.
3. Attenuation within individual properties with controlled outlet to adoptable infiltration.
4. Attenuation within individual properties with controlled outlet to watercourse / sewer.

Shared space (if under management company needs clarification of curtilage status)

1. Adoptable infiltration
2. Adoptable attenuation

Use of permeable surfaces to be avoided where adoptable.

Public open space

1. Adoptable infiltration
2. Adoptable attenuation

Public Highway

1. Adoptable infiltration
2. Adoptable attenuation

General Notes

Adoptable Highway
Where practical Highway drainage is to remain separate
Adoptable SUDS in Highway are to be 'protected' with utilities confined to designated service strips.

Location of adoptable SUDS
Where appropriate adoptable SUDS shall be in accordance with the National Build Standards for sewers and lateral drains (DEFRA Dec 2011)
All adoptable SUDS should be located in accessible areas appropriate to the maintenance required.
No adoptable SUDS are to be located in enclosed gardens.

Restrictions
Infiltration features within 5 metres of structures require demonstration of 'no adverse' effect on foundations.
No planting of trees or shrubs within 3 metres of infiltration features without designed root barriers.

No structures or services may be laid through or under SUDS features without prior consent or above any SUDS structures in a location which restricts access for maintenance or replacement.
The design of SUDS features should take into account foreseeable vehicular loadings and maintenance access requirements.
SUDS features should be recorded and protected on the Land Charge Register.

Exceedance flows and control features
Physical water bars may be required between catchments to provide visual indication of failure and to retain/control exceedance flows.
Flow paths for exceedance flows may be required to be shown on high risk sites.
Flow control features should be located at the boundary of curtilages and where practical allow visual monitoring of performance.

Local Geology and ground conditions
Adequate investigation for disturbed ground, landfill and contamination must be made.
Perched watertables and high seasonal groundwater levels need to be considered in the design process.
Permeability testing must be specific to infiltration features both in location and depth. However, care should be exercised that measured permeability is not for a localised superficial deposit on a less permeable bedrock.

Typical types of feature and suggested suitability

Infiltration	Single curtilage	Shared areas	Public open space	Public highway
Soakaway (Accessible structure)	+++	++	+	+++
Soakaway (stone fill)	+	+	+	+
Wetland / ponds	+	+	+++	+
Swales / planted surfaces	+	++	+++	+
Permeable paving	+++	+	+	++
French drains / porous pipes	+++	++	+	+
Permeable sub base / ‘crates’	++	++	+	+

Attenuation	Single curtilage	Shared areas	Public open space	Public highway
Oversize pipework and chambers	++	+++	+	+++
Permeable sub base / ‘crates’ with impermeable membrane	++	++	+	+
Flooding of paved areas (>30yr events)	+	++	++	++
Lined Swales	+	++	+++	+
Storage ponds	+	++	+++	+

Conveyance	Single curtilage	Shared areas	Public open space	Public highway
Rills	++	++	+	+
Ditches / swales	+	++	+++	+
Permeable sub base	+++	+++	+	+
Pipes	+++	+++	++	+++
Surface flow (>30yr events)	+	++	+++	+++

This document can be made available on audio tape, braille or in large print, and is also available on the website where it can easily be viewed in large print.

Local Flood Risk Management Strategy for Slough

If you would like assistance with the translation of the information in this document, please ask an English speaking person to request this by calling 01753 477204.

यदि आप इस दस्तावेज में दी गई जानकारी के अनुवाद किए जाने की सहायता चाहते हैं तो कृपया किसी अंग्रेजी भाषी व्यक्ति से यह अनुरोध करने के लिए 01753 477204 पर बात करके कहें.

ਜੇ ਤੁਸੀਂ ਇਸ ਦਸਤਾਵੇਜ਼ ਵਿਚਲੀ ਜਾਣਕਾਰੀ ਦਾ ਅਨੁਵਾਦ ਕਰਨ ਲਈ ਸਹਾਇਤਾ ਚਾਹੁੰਦੇ ਹੋ, ਤਾਂ ਕਿਸੇ ਅੰਗਰੇਜ਼ੀ ਬੋਲਣ ਵਾਲੇ ਵਿਅਕਤੀ ਨੂੰ 01753 477204 ਉੱਤੇ ਕਾਲ ਕਰਕੇ ਇਸ ਬਾਰੇ ਬੇਨਤੀ ਕਰਨ ਲਈ ਕਹੋ।

Aby uzyskać pomoc odnośnie tłumaczenia instrukcji zawartych w niniejszym dokumencie, należy zwrócić się do osoby mówiącej po angielsku, aby zadzwoniła w tej sprawie pod numer 01753 477204.

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