QM

Issue/revision	Issue 1	Revision 1	Revision 2	Revision 3
Remarks	1st Draft	2nd Draft	Final	
Date	August 2009	October 2009	February 2010	
Prepared by	Clare Ashford	Clare Ashford	Clare Ashford	
Signature				
Checked by	Wietske Hill	Brian Cafferkey	Brian Cafferkey	
Signature				
Authorised by	Brian Cafferkey	Brian Cafferkey	Brian Cafferkey	
Signature				
Project number	11012465	11012465	11012465	
File reference	N:\Thatcham Defra SWMP Pilot\TEXT\REPORTS\Final Report\Thatcham SWMP Work in Progress.doc			

WSP Development and Transportation
Mountbatten House
Basing View
Basingstoke
Hampshire
RG21 4HJ

Tel: +44 (0)1256 318800
Fax: +44 (0)1256 318700
http://www.wspgroup.com

Contents

FIGURES

TABLES

APPENDICES

Appendix G Identified Options

Short-listed measures

Appendix H Option Assessment

Figures 20-23 Options 2, 3, 4 and 5 Layouts

Figures 24-29 Option 2 Detention Basins

- Figure 24 Tull Way Detention Basin
- Figure 25 Little Copse and Cold Ash Detention Basin
- Figure 26 Memorial Field Detention Basin
- Figure 27 Dunston Park Road Detention Basin
- Figure 28 Dunston Green Detention Basin
- Figure 29 Francis Baily Detention Basin

Options 2, 3 and 4 Schedule of Mitigation Works

Options 2, 3 and 4 Modelling Results

Figures 30-44 Flood Depth and Extent Maps, Options 2, 3 and 4 (5yr, 30yr, 100yr, 100yr+CC and 237yr)

Figures 45-47 Options 2, 3 and 4 Flood Impact Maps

Figure 48 Rural and Urban Overland Flow Routes

Results of Cost Benefit Analysis

Appendix I Implementation & Review

Figure 49 Essential Infrastructure and Operational Ownership

Action Plan

Communication Strategy

Appendix J WinDes Model

Modelling DVD

Acknowledgements

The authors would like to thank members of the Thatcham Surface Water Management Plan Steering Group for their support and assistance during the SWMP project:

Stuart Clark	West Berkshire Council
Keith Woodhams	West Berkshire Council
Sue Everett	Thatcham Town Council/Thatcham Flood Forum
Lee Dillon	Thatcham Town Council/Thatcham Flood Forum
Owen Jeffrey	Thatcham Town Council
Leo Pieri	Thatcham Flood Forum
Brian Woodham	Cold Ash Community Partnership
Lewis Purbrick	Environment Agency
Simone Esler	Environment Agency
Mark Dickinson	Thames Water Utilities Ltd
Wietske Hill	WSP
Clare Ashford	WSP
Brian Cafferkey	WSP

We are also grateful to the following individuals for their contributions and taking part in discussion throughout the project:

Bryan Lyttle	West Berkshire Council
Carolyn Murison	West Berkshire Council
Dawn Reid	West Berkshire Council
David Harding	Thames Water Utilities Ltd
Elaine Hare	Thatcham Town Council
Julien Blavignac	WSP
Landmark	
Micro Drainage	
Neil Jaques	WSP
Paul Davies	Met Office
Revai Baloyi	WSP
Steve Kelly	Thatcham Weather Station

Thanks must also be given to all of the residents who provided information on their individual experiences of flooding which proved invaluable.

Executive Summary

On 20 July 2007 Thatcham suffered widespread surface water flooding, with initial estimates of approximately 1100 houses flooded, resulting in economic losses to both residents of the area and businesses. The flooding was caused by a combination of runoff from the rural catchment to the north of the town and urban overland flows.

In November 2008 West Berkshire were one of six local authorities awarded funding from Defra to undertake a Pilot Surface Water Management Plan (SWMP) to investigate further the mechanism of flooding in Thatcham and identify options to reduce the risk of surface water flooding.

A SWMP is a framework through which key local partners with responsibility for surface water and drainage in their area work together to understand the causes of surface water flooding and agree the most cost effective way of managing surface water flood risk.

The main document in terms of planning policy which addresses surface water flood risk is Planning Policy Statement 25 (PPS25). PPS25 sets out the need for Local Planning Authority's to direct development to areas of low flood risk and undertake sequential and exception testing for development in areas at risk of flooding. PPS25 also identifies Strategic Flood Risk Assessments (SFRAs) as the mechanism by which Local Planning Authorities can assess all forms of flood risk and thereby undertake informed sequential and exception testing of proposed allocated sites. SFRAs also identify Critical Drainage Areas and the need for a SWMP.

Ideally the SFRA should be completed prior to undertaking a SWMP, as the SFRA is one of the key triggers which identify the need for a SWMP. There is a degree of interaction between activities in SFRAs and SWMPs, and information from the SFRA should be used to inform parts of the SWMP. Similarly, outputs from a SWMP can be used to revise and inform the SFRA when it is next updated.

At present, the SWMP, is not part of the statutory spatial planning system, however, it is proposed that the SWMP will allow for sustainable urban surface water management decisions to be made. SWMPs can also be used to coordinate and strategically plan future drainage provision as well as providing a framework for the management of urban water quality.

The Thatcham SWMP includes the following partners:

- West Berkshire Council
- Thatcham Town Council
- Thames Water
- Environment Agency

The following stakeholders are also involved in the Thatcham SWMP:

- Thatcham Flood Forum
- Cold Ash Community Partnership

West Berkshire Council has taken the lead role in this Pilot Study.

To ensure the successful working of the partnership, each of the partners has been designated roles and responsibilities on the project in line with their general responsibilities as well as a defined level of engagement

The objectives for the study were to:

- Establish a successful working relationship between all partners during and most importantly, after the Pilot Study;
- Identify clear roles of responsibility and lines of communication;
- Identify link between SWMP and other plans (SFRA, CFMP, RBMP, Emergency Incident Plan, Multi Agency Flood Plan, Local Development Framework and Land Use Plan etc);
- Understand the mechanism of flooding and the inter-connection between rural and urban drainage;
- Establish an understanding of current and future flood risk in Thatcham and who is at risk of flooding and to what level;
- Identify and review various mitigation options (taking account of climate change) and prioritise the options through cost benefit analysis;
- Improve public awareness of the risks and ensure engagement of the public on the actions to take; and
- Develop an action plan to reduce flood risk in Thatcham and identify how this will be taken forward.

The study was carried out in three stages: preparation, assess risk and options.

To select a modelling approach with respect to undertaking a risk assessment, an understanding was required of the mechanism of flooding within Thatcham. A data gathering exercise was undertaken with all steering group members and third parties providing information to assist in the desk top study.

Following discussion within the steering group, together with the above findings and available information, a modelling approach was agreed ('Fully Integrated' method). This method of modelling would best address the study objectives in terms of assessing the interaction of flows in the urban and rural areas, undertaking a detailed Cost Benefit Analysis and producing hazard maps.

Communicating risk to both professional stakeholders and the public as part of the risk assessment was considered to be an important element of the study.

The SWMP project steering group meetings included representation from the public at all stages of the project.

The first step in assessing the various options to manage surface water flood risk in line with the SWMP objectives was to identify the range of measures that could be taken. The measures that have been considered were broken down into the following categories:

- Technical;
- Maintenance;
- Development, Building Control and Policy;
- Awareness;
- Resilience/resistance;

- Agricultural Land Use; and
- Other.

TECHNICAL AND RESISTANCE MEASURES

Four technical options were considered, with Option 1 being the do nothing scenario and Options 2, 3 and 4 including a combination of constructing new detention basins and surface water sewers, upsizing select surface water sewers and diverting runoff from the rural area directly to the River Kennet. The modelling work has identified Options 2, 3 and 4 as viable technical options with respect to protecting Thatcham from flooding. However, these options will not remove urban flooding completely; therefore a further option (Option 5) has been considered which is a combination of Option 2 (construction of detention basins with some surface water sewers) and retro-fitting resistance measures to residential properties.

A Cost Benefit Analysis was undertaken which identified Option 5 (Option 2 - construction of detention basins and a number of surface water sewers with retro-fitting resilience measures) as the most cost beneficial technical option in terms of Cost Benefit Ratio.

It is likely that in addition to either Option 2, 3, 4 and 5 a combination of measures including maintenance, potential changes to development building control and policy, awareness and agricultural land use will be required.

MAINTENANCE

The assessment undertaken highlighted that a database of all assets (sewers, ponds, inverted siphons, drains etc.) which have an impact on surface water conveyance will need to be provided and responsible parties identified. In addition, a maintenance regime associated with the above assets needs to be identified and agreed. This will also assist West Berkshire Council with its new duties as the Lead Local Flood Authority under the forthcoming 'Floods and Water Management Bill'.

DEVELOPMENT AND BUILDING CONTROL POLICY

The assessment indicates that the most preferable measure is to continue to enforce the existing policies that are in place (PPS 25). In addition proposing new policies on greater restrictions on surface water runoff, as well as developing a planning mechanism whereby existing developments undergoing resurfacing works of large paved areas, need to reduce the runoff to existing sewers or watercourses. However, it is clear that these new local policy proposals will require a change of policy at national level. The assessment also indicates that avoiding development in high risk areas in accordance with PPS25 is a preferable measure

AWARENESS

The assessment highlighted the preferable measures in terms of awareness as implementing a Multi Agency Flood Plan and a flood awareness campaign. However, it is likely that any of the options that are taken forward will also include a public awareness campaign to raise the profile of surface water flooding within Thatcham. This will involve outlining the role that residents can play on an individual basis to reduce the risk of surface water flooding to their own properties.

AGRICULTURAL LAND USE

The assessment highlights this as an option that requires further review outside the scope of the SWMP, but one that could have high potential benefits. Further assessment of this option is required, in co-operation with land owners.

FUNDING STREAMS

As part of the review of potential measures to reduce the risk of surface water flooding, potential funding streams to provide financial assistance for the measures were identified. These include:

- Defra – Government grants to local authorities for household-level flood risk mitigation;
- Environment Agency Flood Defence Grant in Aid (FDGiA) funding – this would only be applicable to the historical watercourse flooding experienced within the study area rather than the purely surface water runoff flooding;
- Local Authority Investment Plan;
- Environment Agency Capital Works Programme;
- Thames Water Investment Plan;
- Regional Flood Defence Committee;
- Developer's Section 106 contribution; and
- Potential Community Infrastructure Levy

WAY FORWARD

An Action Plan has been produced which is a stand alone document that has been set out to identify the SWMP actions, target commencement and completion dates, what needs to be done to make this happen and who is responsible for the action.

To ensure a successful implementation and review of the Surface Water Management Plan, all parties must contribute to the process. Clear lines of communication and defined responsibilities together with ongoing dialogue are critical to the success of the Surface Water Management Plan.

In summary, there is no one option that will resolve the risk of flooding in Thatcham but it is recommended that a combination of technical options, retro-fitting resistant (flood proofing) measures to individual properties in addition to potential planning policy changes in the future, emergency planning and increased public awareness now and in the future be undertaken. These proposals will reduce the current and future risk and impact of surface water flooding within Thatcham.

Glossary

Annual Average Damages (AAD)	The average flood damages that are predicted to occur annually, and could include damages to people, property and the environment
Benefit-Cost Ratio (BCR)	A ratio of the present benefits and costs of an option. A BCR of >1 indicates benefits are greater than costs
Biodiversity Action Plan (BAP)	Each Local Biodiversity Action Plan works on the basis of partnership to identify local priorities and to determine the contribution they can make to the delivery of the national Species and Habitat Action Plan targets.
British Waterways	British Waterways is the organisation responsible for 2200 miles of Britain's canals and rivers.
Catchment Flood Management Plan (CFMP)	A strategic planning tool through which the Environment Agency works with other key decision-makers within a river catchment to identify and agree policies for sustainable flood risk management.
Chance of flooding	The chance of flooding is used to describe the frequency of a flood event occurring in any given year, e.g. there is a 1 in 100 chance of flooding in this location in any given year. This can also be described as an annual probability, e.g. a 1% annual probability of flooding in any given year. The report uses the chance of flooding with the annual probability of occurring.
Core Strategy	A Development Plan Document setting out the spatial vision and strategic objectives of the planning framework for an area, having regard to the Community Strategy.
Cost Benefit Analysis (CBA)	Analysis which quantifies in monetary terms the costs and benefits of a proposed scheme, including items which the market does not provide a readily available monetary value for. Sometimes referred to as Benefit-Cost Analysis.
Critical Drainage Area	An area identified in the Strategic Flood Risk Assessment based on recorded and anecdotal historical flood events.

Department for Environment, Food and Rural Affairs (Defra)	Department that brings together the interests of farmers and the countryside; the environment and the rural economy; the food we eat, the air we breathe and the water we drink.
DG5 Register	A water company held register of properties which have experienced sewer flooding (either internal or external flooding) due to hydraulic overload, or properties which are 'at risk' of sewer flooding more frequently than once in 10 years.
Digital Elevation Model (DEM)	A model of the elevation of the ground surface and includes building, vegetations etc.
Digital Terrain Model (DTM)	A model of the terrain of the earth's surface ('bare earth').
Direct Rainfall Method	Applying rainfall events directly to hydrology and hydraulic models using DEM/DTM data directly.
Discounting	A method used to convert future benefits or costs to present values, using the discount rate.
Environment Agency	The Environment Agency is the leading public body for protecting and improving the environment in England and Wales today and for future generations. The organisation is responsible for wide-ranging matters, including the management of all forms of flood risk, water resources, water quality, waste regulation, pollution control, inland fisheries, recreation, conservation and navigation of inland waterways. It will also have a new strategic overview for all forms of inland flooding.
Essential Infrastructure	Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk. Essential utility infrastructure which has to be located in a flood risk area for critical operational reasons, including electricity generating power stations and grid and primary substations; water treatment plants; and sewage treatment plants if adequate measures to control pollution and manage sewage during flooding events are in place. Wind turbines. (As defined in the proposed amendments to Planning Policy Statement 25: Development and Flood Risk, 2009).

European Floods Directive	The European Floods Directive aims to reduce and manage the risks that floods pose to human health, the environment, cultural heritage and economic activity.
Flood Hazard map	Mapping of characteristics (such as flood extent, depth and velocity) of flood events with or without an indication of the flood probability. A flood hazard has potential to result in flood impacts if there are receptors present that have vulnerability to the hazard (in this case, the primary hazard is loss of life or injury).
Flood Risk Assessment (FRA)	An assessment of the likelihood and consequences of flooding in a development area so that development needs and mitigation measures can be carefully considered.
Flood Risk Regulations (2009)	These Regulations transpose Directive 2007/60/EC (EU Floods Directive) of the European Parliament and of the Council on the assessment and management of flood risks for England and Wales.
Floods and Water Bill	The Floods and Water Bill is currently going through parliament, and will clarify the legislative framework for managing surface water flood risk in England.
Flood Zones 1,2 and 3	Flood Zone 1 - less than 1 in 1000 annual probability of river or sea flooding in any year. Flood Zone 2 - between a 1 in 100 and 1 in 1000 annual probability of river flooding or between a 1 in 200 and 1 in 1000 annual probability of sea flooding. Flood Zone 3 - 1 in 100 or greater annual probability of river flooding or a 1 in 200 or greater annual probability of flooding from the sea.
Fully Integrated Method	Method based around the interaction between different components of the surface water (2D domain) before it enters the underground drainage system (1D) via gullies and manholes.
Grant in Aid	Grant in Aid funding is provided by Defra to the Environment Agency to invest in flood risk management schemes.
Green Book	The Green Book sets out the core principles on which all public sector economic assessment is based.
Green Infrastructure Plans	These Local Authority plans seek to provide improved green infrastructure within urban environments, such as parks, woodlands etc.

Greenfield runoff rate	The rate of runoff which would occur from a site that was undeveloped and undisturbed.
Groundwater flooding	Caused by raised groundwater levels, typically following prolonged rain. High groundwater levels may result in increased overland flow flooding (see below Figure A).
Highways Act 1980	An Act relating to Highways, consolidating Highways Acts 1959 to 1971.
Joint Probability	Joint probability analysis gives the probability of two or more conditions which affect risk occurring at the same time. For example, high river levels can impede sewer outfalls.
Land Drainage Act 1991	An Act relating to internal drainage boards, and to the functions of such boards and of local authorities in relation to land drainage.
LiDAR	Light Detection and Ranging - high accuracy, high resolution elevation data derived from airborne sources.
Local Development Framework	A non-statutory term used to describe a folder of documents which includes all the local planning authority's Local Development Documents (LDDs). The local development framework will also comprise the statement of community involvement, the local development scheme and the annual monitoring report.
Local Planning Authority	The local authority (LPA) or council that is empowered by law to exercise planning functions. The Local Planning Authority for the area covered by the SWMP is West Berkshire Council.
Major System	The system of above ground flood pathways, including both open and culverted watercourses.
Measure	A measure is defined as a proposed individual action or procedure intended to minimise current and future surface water flood risk.
Minor System	The formal or designed drainage system.
Multi-Coloured Manual (MCM)	A common name for "The Benefits of Flood and Coastal Risk Management: A manual of Assessment Techniques".
Multi-Criteria Analysis (MCA)	MCA is a tool to assist decision-making where there are a number of different factors to consider. Each factor is scored and weighted to weigh up the benefits of different intervention options.

Net Present Value (NPV)	The discounted value of a range of costs and benefits. NPV is used to describe the difference between the present value of costs and benefits in future years.
Option	An option is made up of a single, or a combination of previously defined measures.
Ordinary Watercourse	An ordinary watercourse is any other river, stream, ditch, cut, sluice, dyke or non-public sewer which is not a Main River. The local authority or Internal Drainage Board has powers over such watercourses.
Overland Flow/Surface Water Runoff	Water flowing over the ground surface that has not reached a natural or artificial drainage channel (see Figure A below).
Partner	Defined as someone with responsibility for decisions or actions. They share joint responsibility for these decisions/actions.
Pipe Roughness Coefficient (Ks)	Surface roughness, measured in mm.
Pitt Review	An independent review of the 2007 summer floods by Sir Michael Pitt, which provided recommendations to improve flood risk management in England.
Planning Policy Statements (PPS)	Set out the Government's national policies on different aspect of planning. The policies in these statements apply throughout England and focus on procedural policy and the process of preparing local development documents. PPS25 deals with Development and Flood Risk and describes the purpose of site-specific Flood Risk Assessments (FRA) and Strategic Flood Risk Assessments (SFRA).
Pluvial flooding	'Pluvial' flooding (or surface runoff flooding) is caused by rainfall and is that flooding which occurs due to water ponding on or flowing over the surface before it reaches a drain or watercourse (see Figure A below).
Project Appraisal Guidance (PAG)	A series of five guidance notes issued by Defra which aim to integrate project appraisal, including economic and environmental appraisal, and approach to assessing risk from flooding.
Resilience measures	Resilience measures are designed to reduce the impact of water that enters property and businesses, and could include measures such as raising electrical appliances.

Resistance measures	Resistance measures are designed to keep flood water out of properties and businesses, and could include flood guards for example.
Risk	In flood risk management risk is defined as the probability of a flood occurring *x* consequence of the flood.
River Basin Management Plans (RBMP)	A management plan for all river basins required by the Water Framework Directive. These documents will establish a strategic plan for the long-term management of the River Basin District, set out objectives for water bodies and, in broad terms, what measures are planned to meet these objectives, and act as the main reporting mechanism to the European Commission.
Significant Drainage Areas	In this report Significant Drainage Area refers to areas where the depth of flooding is in excess of 100mm.
South East Plan	A broad development strategy for a region for a 15 to 20 year period prepared by the South East England Partnership Board.
Special Protection Areas (SPA)	Strictly protected sites classified in accordance with Article 4 of the EC Birds Directive.
Stakeholder	Defined as anyone affected by the problem or solution.
Strategic Flood Risk Assessment (SFRA)	A SFRA provides information on areas at risk from all sources of flooding. The SFRA should form the basis for flood risk management decisions, and provides the basis from which to apply the Sequential Test and Exception Test (as defined in PPS25) in development allocation and development control process.
Surface water flooding	In the context of this report, surface water flooding describes flooding from sewers and ordinary water courses that occurs as a result of heavy rainfall (see Figure A below).
Sustainable Drainage Systems (SUDS)	Sustainable drainage systems or sustainable (urban) drainage systems: a sequence of management practices and control measures designed to mimic natural drainage processes by allowing rainfall to infiltrate and by attenuating and conveying surface water runoff slowly compared to conventional drainage. SUDS can operate at different levels; ideally in a hierarchy of source control, local control and regional control.
Volumetric runoff coefficient (Cv)	The percentage of the precipitation that appears as runoff.

Water Authority	Set up under the Water Industry Act 1991 in which ten regional water and sewerage companies (WaSCs) are licensed for England and Wales. Ten regional water and sewerage operators provide sewerage services in England and Wales. The Water Authority for the area covered by the SWMP is Thames Water.
Water Industry Act 1991	An Act relating to the supply of water and the provision of sewerage services.
Water Resources Act 1991	An Act relating to the National Rivers Authority/Environment Agency and the matters in relation to which it exercises functions.

Figure A Types of Flooding

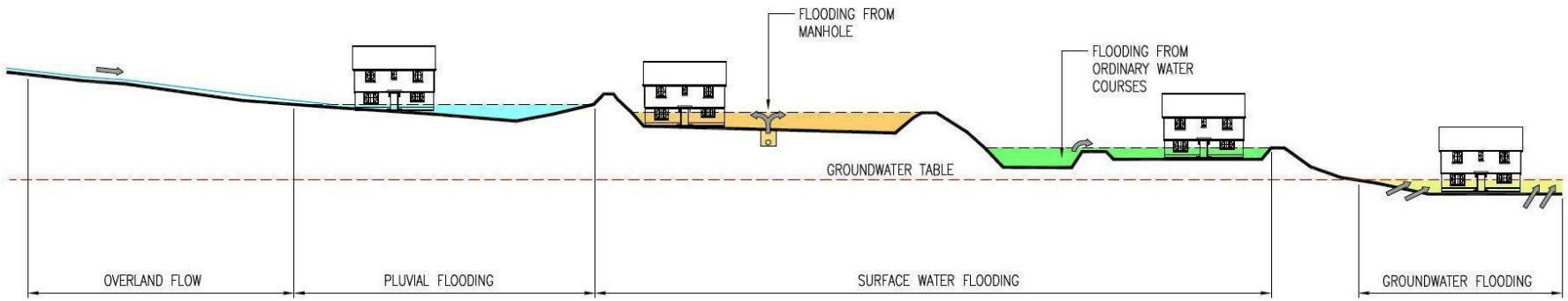
Definitions:

1. Overland Flow
Water flowing over the ground surface that has not reached a natural or artificial drainage channel.

2. Pluvial Flooding
'Pluvial' flooding (or surface runoff flooding) is caused by rainfall and is that flooding which occurs due to water ponding on or flowing over the surface before it reaches a drain or watercourse.

3. Surface Water Flooding
In the context of this report, surface water flooding describes flooding from sewers and ordinary water courses that occurs as a result of heavy rainfall.

4. Groundwater Flooding
Caused by raised groundwater levels, typically following prolonged rain. High groundwater levels may result in increased overland flow flooding.



1 Introduction

1.1 BACKGROUND TO PROJECT

1.1.1 Thatcham (population estimated at circa 25,000) is within West Berkshire and is located approximately 3 miles east of Newbury and 15 miles west of Reading in the Kennet Valley. Thatcham is a town that along with Newbury forms part of what is described as the Newbury/Thatcham Urban Area. It is separated from Newbury by a thin wedge of farmland. Thatcham has seen rapid growth over the past 40 years, which has put pressure on the infrastructure within the town.

1.1.2 On 20 July 2007 Thatcham suffered widespread pluvial and surface water flooding, with initial estimates of approximately 1100 houses flooded, resulting in economic losses to both residents of the area and businesses. In addition, wide-scale traffic disruption occurred, with some roads through Thatcham becoming impassable or experiencing traffic flows close to stationary.

1.1.3 The flooding occurred following a period of heavy rainfall which was exacerbated as a result of the rural catchment to the north being fully saturated due to extreme rainfall over a period of time prior to the 20 July 2007 event. This resulted in large overland flows from the rural catchment to the north of the town as well as generating overland flows within the urban area.

1.1.4 Overland flows and surface water flooding from minor watercourses from the rural area entered the surface water sewer system mainly to the north of the town. Flows from the rural area were such that they exceeded the capacity of the surface water sewer inlets to the north of Thatcham which resulted in rural overland flows passing into the urban area. Overland flows generated in the urban areas were also substantial and unable to enter the sewer water networks at key points within the town. As the capacity of the drainage system was surpassed, overland flows from the urban areas were observed.

1.1.5 The overland flows which resulted in pluvial and surface water flooding from sewers and watercourses appeared in most cases to follow the line of the historic (now culverted) water courses within the urban environment.

1.1.6 The flooding was further exacerbated by the fact that the surface water system was already experiencing blockages and damage due to debris from the rural catchment in addition to what appeared to be a general lack of maintenance within the surface water system as a whole. What distinguished Thatcham from many other flooded communities in 2007 was that water levels in the River Kennet were low and played a limited role in the flood event.

1.1.7 In November 2008 West Berkshire Council was awarded funding from Defra to undertake a Pilot Surface Water Management Plan to investigate further the mechanism of flooding in Thatcham and identify options to reduce the risk of surface water flooding.

1.1.8 During the Thatcham flood of July 2007 (a 1 in 237 year rainfall event), it was clear that, while the relevant stakeholders had been taking their own measures to manage flood risk on an individual basis, there was limited joined-up thinking and hence a disjointed approach to address the problem. This resulted in poor communication and co-ordination of efforts between the relevant stakeholders throughout the flooding event and afterwards. The lack of resilience within the area was also highlighted.

1.1.9 A number of individual organisations commissioned their own investigations into the Flood Events of July 2007 (refer to Appendix C) and implemented follow up actions of these investigations. However, no one organisation proposed to undertake a holistic and co-ordinated approach in assessing and addressing surface water management issues affecting Thatcham.

1.1.10 Following the award of the Defra Pilot Study for a Surface Water Management Plan to Thatcham, a number of partners and key stakeholders came together to address surface water flooding. These stakeholders included West Berkshire Council, Thatcham Town Council, Thames Water and the Environment Agency. A steering group was set up with the aim of working together to reduce the risk of similar flood events re-occurring in Thatcham. The SWMP provided the vehicle which allowed the process to occur and established a successful working environment for all parties to work in.

1.1.11 Whilst the SWMP for Thatcham has been developed as a Pilot Study, the aim of the plan was clearly set out at the beginning of the project by the steering group; which was to assure that a tangible action plan be identified and could be taken forward with the aim of reducing the risk and damages caused by pluvial and surface water flooding in Thatcham.

1.1.12 This document has been developed using the guidance published by the Department for Environment, Food and Rural Affairs (Defra, 2009).

1.2 STUDY AREA

1.2.1 Thatcham is located on the southern edge of West Berkshire, 3 miles east of Newbury and 15 miles west of Reading. Refer to Figure 1-1 for the location of Thatcham within the UK. The village of Cold Ash is located approximately 1.5 miles north and Upper Bucklebury 3 miles north east of the town respectively.

Figure 1-1 Location of Thatcham

1.2.2 The River Kennet, a chalk tributary of the River Thames, runs west to east and forms the southern boundary of Thatcham's built up area. The Kennet and Avon Canal follows the line of the River Kennet, flowing from west to east. The main railway line between Newbury and London runs immediately south of Thatcham's built up area, following the line of the River Kennet.

1.2.3 The M4 motorway runs between London and South Wales approximately 4 miles north of Thatcham's built up area and the A34 Trunk Road runs approximately 4 miles to the west. The A4 runs through the centre of Thatcham and the North Tull Way Ring Road forms the northern boundary of the built up area. Refer to Figure 1-2 for the location of the study area.

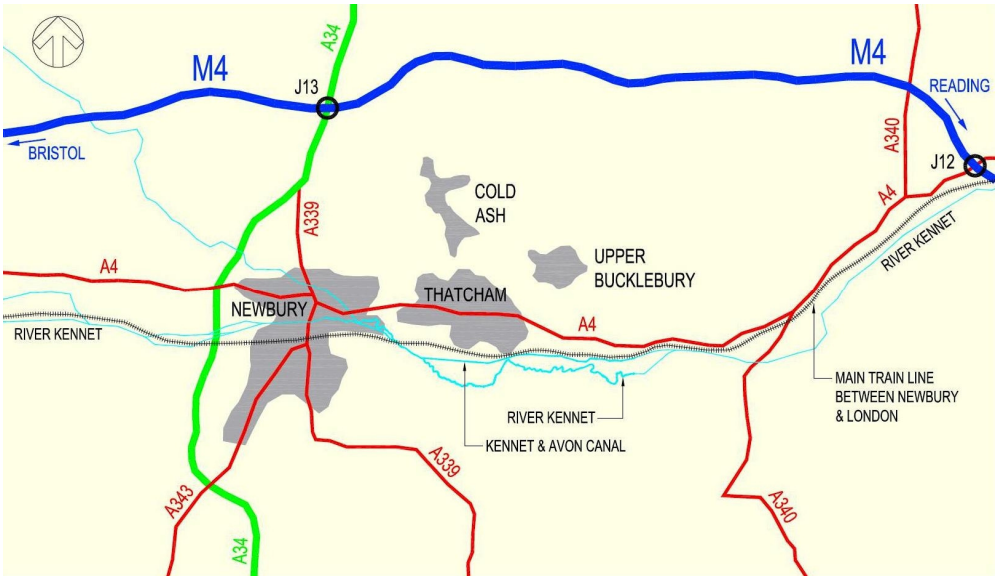


Figure 1-2 Study Area Location

1.3 SURFACE WATER MANAGEMENT PLANS AND THE PLANNING PROCESS

1.3.1 SWMPs are referred to in Planning Policy Statement 25 (PPS25) as tools to manage surface water flood risk on a local basis by improving and optimising coordination between relevant stakeholders.

1.3.2 Recommendation 18 of the Pitt Review states that "*SWMPs should provide the basis for managing all local flood risk".*

1.3.3 The European Floods Directive was transposed into English law as the Flood Risk Regulations in December 2009. The regulations define a Flood Risk Management Plan as '*a plan for the management of a significant flood risk*'. The forthcoming Floods and Water Management Bill will provide a vehicle for implementing the Flood Risk Regulations.

1.3.4 Thatcham SWMP is one of six Defra Pilot Studies in the UK. The SWMP follows the format of the Defra guidance. Figure 1-3 below sets out the key elements of the SWMP, as taken from the guidance.

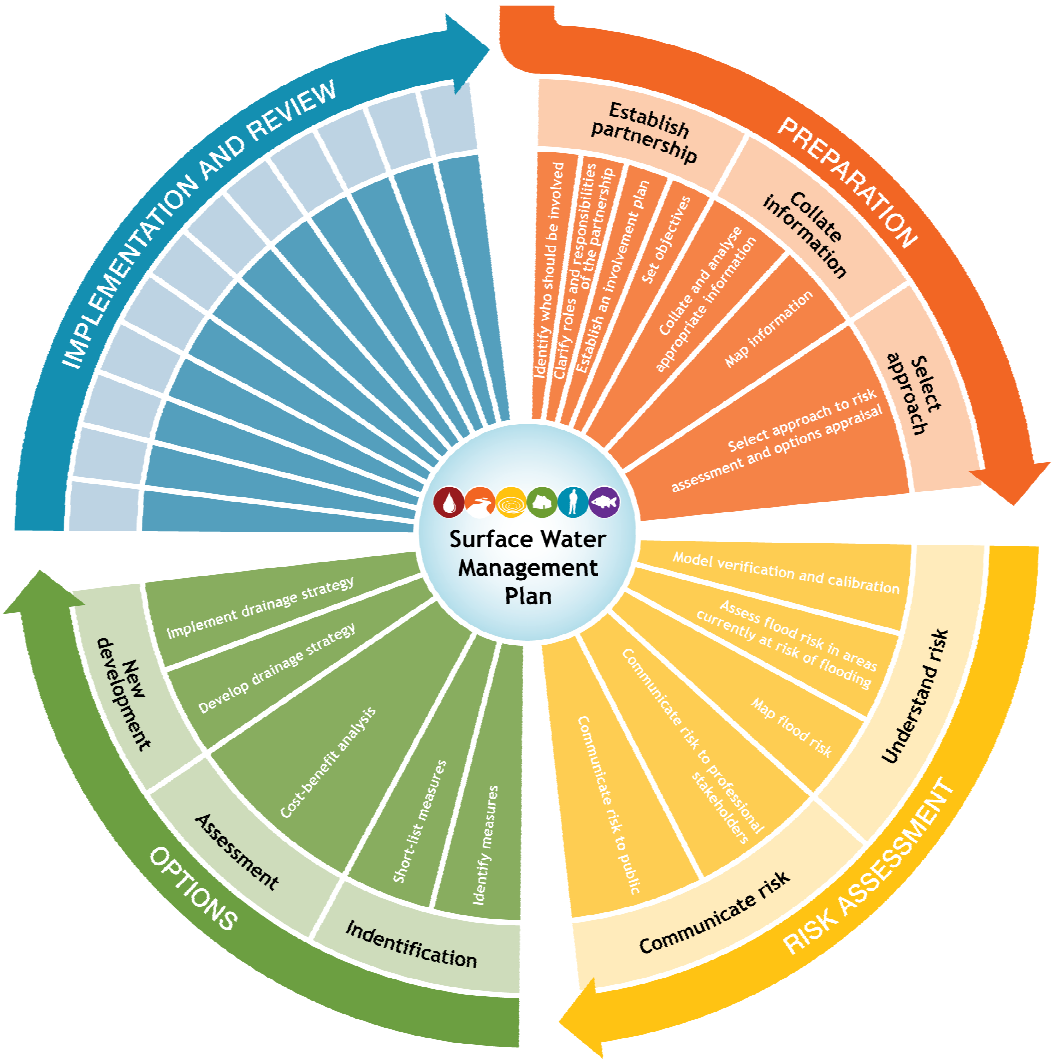


Figure 1-3 Key Elements of the SWMP[1]

1.3.5 A SWMP is a framework through which key local partners with responsibility for surface water[2] and drainage in their area work together to understand the causes of surface water flooding and agree the most cost effective way of managing surface water flood risk.

1.3.6 The purpose of the SWMP is to make informed and sustainable surface water management decisions. However, SWMPs can also be used to coordinate and strategically plan future drainage provision as well as providing a framework for the management of urban water quality.

1.3.7 SWMPs use existing evidence from Strategic Flood Risk Assessments (SFRAs) and Catchment Flood Management Plans (CFMPs). The scale of the SWMP should be appropriate to consider the sources, pathways and receptors of flooding.

[1] Defra Surface Water Management Plan Guidance, Version 1, February 2009

[2] Surface water flooding describes flooding from sewers and ordinary water courses that occurs as a result of heavy rainfall.

1.3.8 The West Berkshire Strategic Flood Risk Assessment was completed in May 2008 and identified "Critical Drainage Areas". In addition, the SFRA also recommended that additional Flood Risk Assessments be undertaken for any development in a Flood Zone in line with PPS 25.

1.3.9 Refer to Figure 1-4 for details of how the SWMP fits into the planning of other strategies, programmes and plans.

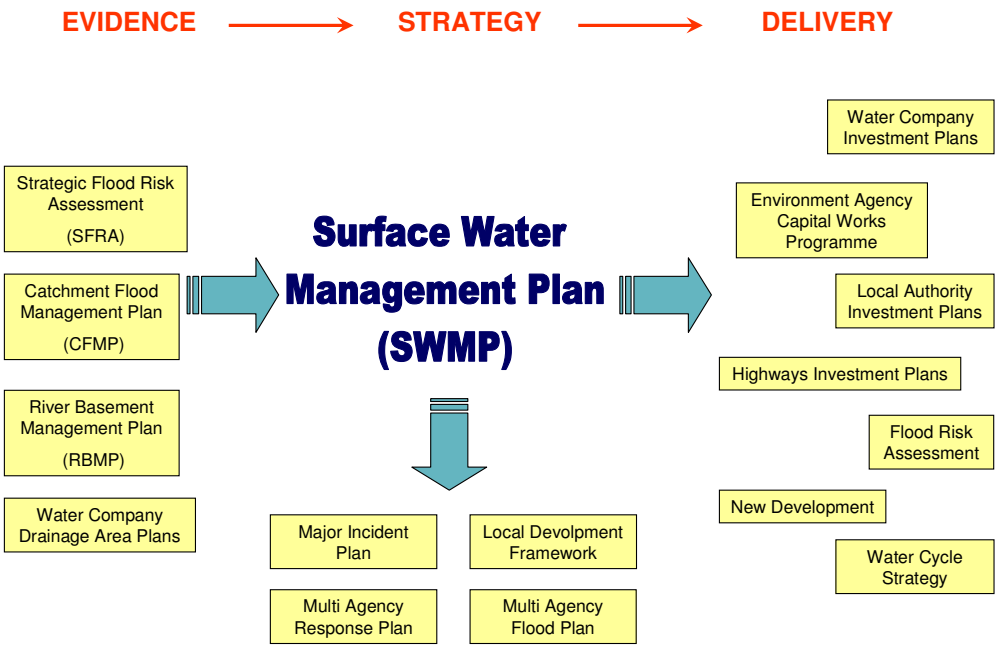


Figure 1-4 SWMPs and the Planning of other Strategies, Programmes and Plans

2 Preparation

2.1 ESTABLISH PARTNERSHIP

2.1.1 The Thatcham SWMP includes the following partners[3]:

- West Berkshire Council
- Thatcham Town Council
- Thames Water
- Environment Agency

2.1.2 The following stakeholders are also involved in the Thatcham SWMP[4]:

- Thatcham Flood Forum
- Cold Ash Community Partnership

2.1.3 West Berkshire Council has taken the lead role in this Pilot Study. The following departments within the council have been involved: Planning, Highways, Social Services, Education and Civil Contingencies. WSP is acting as the engineering consultant for the council.

2.1.4 An active resident's involvement has been encouraged to promote awareness and acceptance of the project amongst the local community. Thatcham Flood Forum represented the Thatcham community and ensured that local knowledge on flooding issues was identified and proposals during the various phases of the study disseminated. Residents of Cold Ash have been represented by Cold Ash Community Partnership.

2.1.5 To ensure the successful working of the partnership, each of the partners has been designated roles and responsibilities on the project in line with their general responsibilities as well as a defined level of engagement. Refer to Appendix A for further details on the roles and responsibilities of each of the partners.

2.1.6 The main objectives of the Thatcham Surface Water Management Plan were set out at the beginning of the project, which was to understand the risk of surface water flooding in Thatcham. Once the flooding mechanism had been understood, it was necessary to define and agree actions to mitigate against the flood risk to Thatcham.

OBJECTIVES

2.1.7 The following steps set out the main objective for Thatcham SWMP:

- Establish a successful working relationship between all partners during and most importantly after the Pilot Study;
- Identify clear roles of responsibility and lines of communication;
- Identify link between SWMP and other plans, polices and strategies;
- Understand the mechanism of flooding and the inter-connection between rural and urban drainage systems;

[3] A partner is defined as someone with responsibility for the decision or actions. They share joint responsibility of these decisions/actions.
[4] A stakeholder is defined as anyone affected by the problem or solution.

- Establish an understanding of current and future flood risk in Thatcham and who is at risk of flooding and to what level;
- Identify and review various mitigation options (taking account of climate change) and prioritise the options through cost benefit analysis;
- Improve public awareness of the risks and ensure engagement of the public on the actions to take;
- Develop an action plan to reduce flood risk in Thatcham and how this will be taken forward. All partners need to agree with this action plan; and
- Identify lessons learnt from the Partnership.

2.1.8 The project aimed to create a successful working platform from which all responsible bodies for drainage and emergency response could integrate their requirements and ensure that this process can continue after the Pilot Study. Quarterly meetings (to be formally agreed by all partners) with the project partners will ensure agreed actions are executed and new issues are discussed and reviewed.

2.1.9 The Surface Water Management Action Plan will be a living document that needs to be reviewed approximately every 3 to 5 years, to ensure the implications of the agreed actions and new issues are addressed. However, a review may be required following any future flood events, new data becoming available or new modelling techniques and change of policy in the catchment.

STRATEGIES, PLANS AND POLICIES

2.1.10 A review has also been undertaken of the various plans and policies that govern the area to identify the constraints to development and the management of surface water.

2.1.11 Refer to Appendix B for further details of the plans and policies that apply to Thatcham. A summary follows:

THE PITT REVIEW

2.1.12 Recommendation 16 of the Pitt Review states that 'Local authorities should collate and map the main flood risk management and drainage assets (over and underground), including a record of their ownership and condition.'

2.1.13 Recommendation 18 of the Pitt Review states that 'Local Surface Water Management Plans, as set out under PPS25 and coordinated by local authorities, should provide the basis for managing all local flood risk.'[5]

NATIONAL PLANNING POLICY

PLANNING POLICY STATEMENT 25

2.1.14 Planning Policy Statement 25 (PPS25) was published in December 2006. The aim of PPS25 with respect to development and flood risk is to ensure that flood risk is taken into account at all stages in the planning process so as to avoid inappropriate development in areas at risk of flooding and to ensure that new development is located in lower flood risk areas through a sequential test.

[5] The Pitt Review, Learning Lessons from the 2007 floods, 2008

2.1.15 Any new Greenfield or Brownfield proposed development within the Thatcham area needs to comply with the requirements of PPS25 and the SFRA for West Berkshire.

PLANNING POLICY STATEMENT 25: DEVELOPMENT AND FLOOD RISK PRACTICE GUIDE

2.1.16 Following publication of Planning Policy Statement 25: Development and Flood Risk Practice Guide in December 2009 opportunities for local authorities and other key stakeholders to develop surface water management plans were being explored as part of the 'Future Water' strategy. If critical drainage issues were identified then a SWMP should be commissioned (Para 3.77).

2.1.17 Planners at the strategic and development control levels can develop strategies to ensure effective surface water management in the future. The evidence base for the Local Planning Authority's strategic planning approach to surface water management will be the SFRA and it will be reflected in the Core Strategy. The SFRA will help identify Critical Drainage Areas, where a SWMP may be needed. The SWMP may contribute to the evidence to support the LDF policies on surface water drainage and provide the foundation for Supplementary Planning Documents (SPDs).

2.1.18 In addition, this would reduce the risk of the Core Strategy development plan documents being found unsound at public examination if flooding and drainage issues have not been properly addressed.

2.1.19 Currently however, SWMPs do not form part of the statutory spatial planning system but have important links with it.

CONSULTATION ON PROPOSED AMENDMENTS TO PLANNING POLICY STATEMENT 25: DEVELOPMENT AND FLOOD RISK

2.1.20 The proposed amendments to PPS25 are not proposing to change the policy approach in PPS25. Rather, the intention is to clarify how certain aspects of the policy are applied to ensure it works better and is more effective. The proposed amendments affect tables D.1 (Flood Zones) and D.2 (Flood Risk Vulnerability Classifications) in Annex D to PPS25.

2.1.21 The proposed amendments relate to how the 'functional' floodplain should be identified, and are relevant to development in flood risk areas involving essential (critical) infrastructure, including water treatment and sewage treatment works; base facilities for the emergency services; certain facilities requiring hazardous substances consent; and wind turbines.

2.1.22 The consultation period finished on the 3 November 2009. The proposals will not have an impact on this version of the SWMP. However, any amendments to PPS25 will be addressed in future revisions of the SFRA and SWMP.

PLANNING POLICY STATEMENT PPS1

2.1.23 Planning Policy Statement PPS1 sets out the overarching planning policies in terms of delivery of sustainable development through the planning process.

2.1.24 PPS1 on climate change supplements PPS1 by setting out how planning should contribute to reducing emissions and stabilising climate change and take into account the unavoidable consequences.

REGIONAL PLANNING POLICY

THE SOUTH EAST PLAN

2.1.25 The Regional Spatial Strategy (RSS) for the South East of England (known as the South East Plan) sets out the long term spatial planning framework for the region over the period 2006-2026. The plan is a key tool in helping achieve more sustainable development, protecting the environment and combating climate change. Government adopted the final South East Plan on 6 May 2009.

2.1.26 RSS POLICY NRM4: Sustainable Flood Risk Management states that “the sequential approach to development in flood risk areas set out in PPS25 will be followed”.

2.1.27 The South East Plan allocates a minimum of 10,500 houses in West Berkshire over the period 2006 to 2026. The spatial strategy for the South East is based on six spatial planning principles. In West Berkshire Principles 3 and 6 are perhaps the most relevant:

- "Pursuing a continuing strategy of urban focus and urban renaissance, by encouraging accessible mixed use development in the region's network of town centres and by seeking a high quality built environment in all areas (Policy SP3)";and
- "Supporting the vitality and character of the region's rural areas, whilst protecting the valuable natural and historic assets of the region".

2.1.28 Increased development will result in greater impermeable areas and hence larger volume of surface water runoff. This will create further pressure on the existing surface water infrastructure. The Environment Agency oversees the implementation of the government’s policy that floodplains be safeguarded from inappropriate development.

2.1.29 The publication of the South East Plan means that all the saved policies which had been extended by the Secretary of State in the Berkshire Structure Plan 2001-2016 are no longer in force.

LOCAL PLANNING POLICY

WEST BERKSHIRE LOCAL PLAN 1991 - 2006

2.1.30 The West Berkshire District Local Plan was adopted in June 2002. The plan sets out policies for development and land use.

2.1.31 Under the Planning and Compulsory Purchase Act 2004 all Local Plan policies were reviewed. A number of these policies have been saved by the Secretary of State until they are replaced by policies within the Local Development Framework Development Plan Documents

WEST BERKSHIRE LOCAL DEVELOPMENT FRAMEWORK

2.1.32 The Core Strategy will be the first development plan document (DPD) within West Berkshire’s Local Development Framework. It will set out a long term vision for West Berkshire to 2026 and translates this into spatial terms, by setting out proposals for where development will go, and how this development will be built.

2.1.33 The risk of flooding within West Berkshire is widespread, arising not only from rivers, but also from surface water and groundwater flooding. The plan will be in accordance with national and regional guidance, which sets out that a planning solution to flood risk management should be sought wherever possible and steers vulnerable development away from areas affected by flooding.

2.1.34 The majority of the proposed new development will take place in and around the urban areas of Newbury/ Thatcham and the Eastern Urban Area. An initial option of a strategic urban extension to the east of Thatcham for approximately 1,000 homes at Siege Cross Farm (refer to Figure 2-1 below) has been consulted on for the Core Strategy but this is not the only option for development in Thatcham. Potentially, development within the existing settlement boundary, or on previously developed land or on smaller sites adjacent to the existing settlement boundary could come forward as planning applications or sites for consideration via the local Development Framework process.

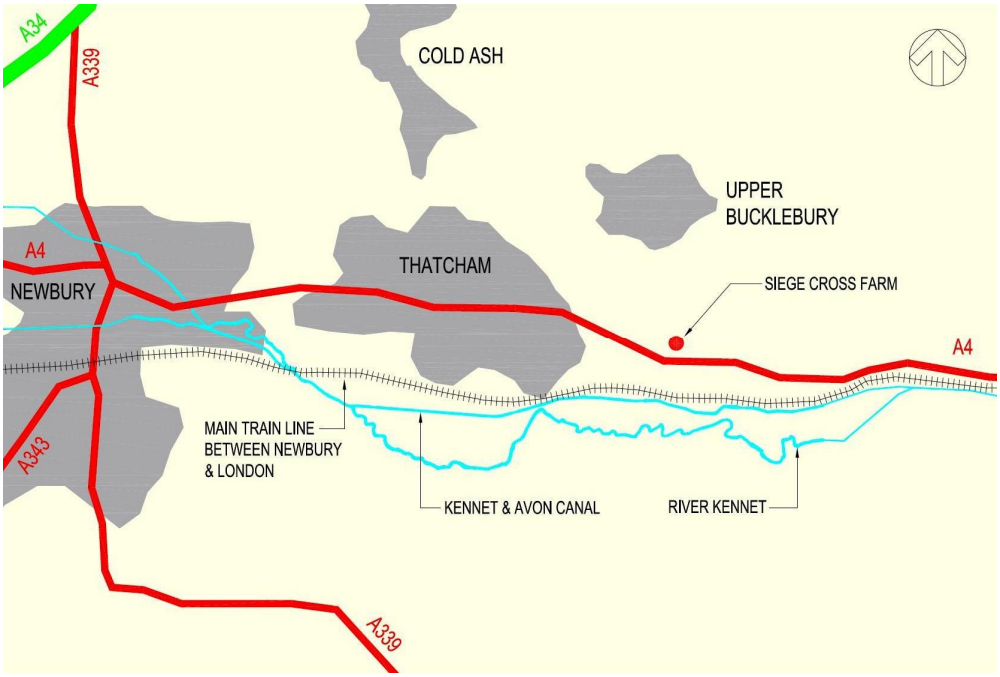


Figure 2-1 Siege Cross Farm Location

2.1.35 It is proposed that the SWMP can be used as part of the evidence along with other plans and policies to inform the decision making process for housing allocation in Thatcham.

CATCHMENT FLOOD MANAGEMENT PLAN FOR THE RIVER THAMES

2.1.36 The Thames Catchment Flood Management Plan (CFMP) was published in July 2008 by the Environment Agency and sets out the preferred plan for sustainable flood risk management over the next 50 to 100 years.

2.1.37 The CFMP identified that on the 19th and 20th July 2007 over 3,000 properties in the Thames catchment were flooded as a direct result of surface water.

2.1.38 A broad indication of the likelihood of surface water flooding in each policy unit in the Thames CFMP is shown in Figure 2-2 below (extract from the Thames CFMP).

This map was compiled using anecdotal evidence from previous flood events and also land use characteristics and topography.

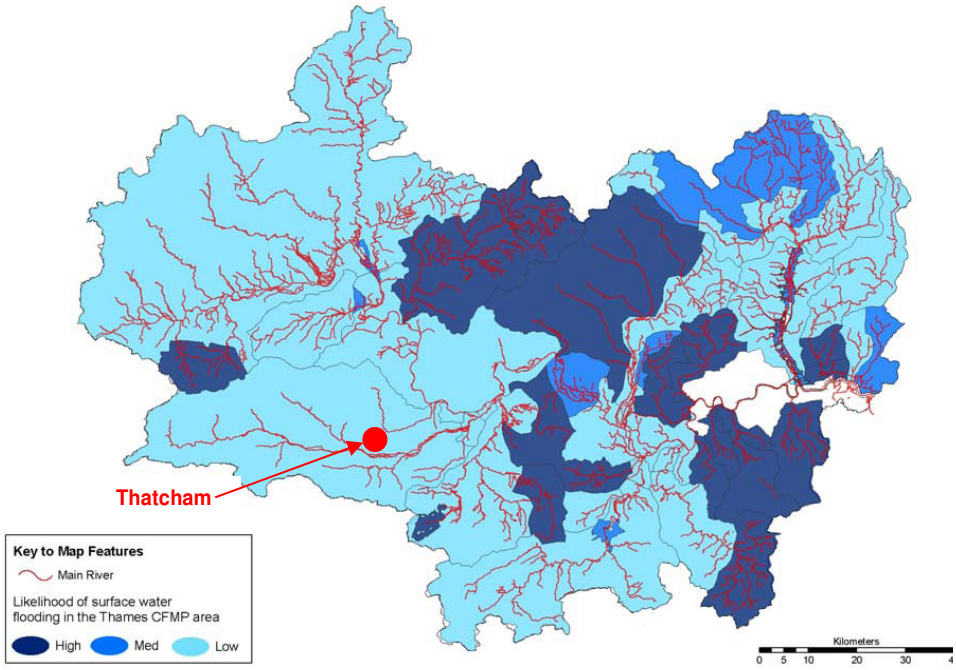


Figure 2-2 Likelihood of surface water flooding occurring in each policy unit in the Thames CFMP

2.1.39 The Environment Agency Kennet policy unit action plan encourages the development of a SWMP for Thatcham due to history of surface water flooding within the area (Action Ke7).

RIVER BASIN MANAGEMENT PLAN THAMES RIVER BASIN DISTRICT

2.1.40 The River Basin Management Plan (RBMP) for the Thames River Basin District was published in December 2009. In accordance with the Water Framework Directive, the RBMP contributes to the requirement of all countries throughout the European Union to manage the water environment to consistent standards. This plan focuses on the protection, improvement and sustainable use of the water environment.

2.1.41 The RBMP 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, and what actions will be taken to address the pressures as well as setting out what improvements are possible by 2015 and how the actions will make a difference to the local environment including the catchments, the estuaries and coasts, and groundwater.

2.1.42 The Rivers Kennet, Pang and Lambourn are chalks streams which flow through the Marlborough Downs. While surface water quality in the catchment is generally good it is understood that the Kennet has experienced considerable turbidity issues which can affect the gravels and the aquatic vegetation making it less suitable for fish communities and aquatic insects. Part of the source of this sedimentation is the numerous small streams which enter the River Kennet and Kennet and Avon canal, as well as land

practices. Runoff from land is directed to the river by tracks, roads, and the footpath network through roadside drains and gullies.

2.1.43 It is intended that any proposed works within Thatcham in terms of pluvial and surface water flooding mitigation works, will address, where possible, the requirements of the RBMP to prevent deterioration of the receiving water bodies (River Kennet and Kennet and Avon canal) in terms of their status of aquatic ecosystems and contribute to mitigating the effects of flooding.

STRATEGIC FLOOD RISK ASSESSMENT

2.1.44 The Level 1 Strategic Flood Risk Assessment (SFRA) was completed in May 2008 and had regard to the report produced by West Berkshire - 'A Review into the Flooding in West Berkshire' - when addressing surface water flooding issues throughout West Berkshire. The SFRA report identifies a number of Critical Drainage Areas, including areas within Thatcham

2.2 COLLATE INFORMATION

2.2.1 To undertake a risk assessment on pluvial and surface water flooding, an understanding was required of the mechanism of flooding within Thatcham. A data gathering exercise was undertaken with all steering group members and third parties providing information to assist in the desk top analysis.

2.2.2 Collating the appropriate information on flood risk and existing drainage in the study area is an important step in assessing and understanding the following[6]:

- The frequency, location and extent of previous flooding incidents;
- Potential flood mechanisms and interactions between different components of the urban drainage, and groundwater (where relevant);
- The existing assets and drainage infrastructure in the study area;
- The existing tools (models) used to predict performance of river systems and drainage networks, and
- Gaps in knowledge and data.

2.2.3 Consultation with partners and other bodies has been undertaken to obtain the required information. Table C-2 in Appendix C illustrates the extent of information obtained. It provides a breakdown of the information collated, with a data quality score assigned to each set of data. This data quality scoring is based on the SWMP guidance. Details of the scoring method used can be seen in Appendix C.

2.2.4 An analysis of the collated data was undertaken and the information was grouped under the following headings:

- Historical flooding records;
- Flood mechanisms (sources, pathways and receptors); and
- Existing modelling information.

[6] Defra Surface Water Management Plan Guidance, Version 1, February 2009

HISTORICAL FLOODING RECORDS

2.2.5 The information collated indicates that Thatcham has a long history of flooding, with records dating from 1947 to the present day. Whilst the best recorded event was the summer 2007 flood, records and anecdotal observations received from residents of Thatcham indicate many other flooding incidents. Refer to Appendix C for details of the historical records of flooding, which are indicated on Figure 1 in Appendix C.

Figure 2-3 Historical flooding in Thatcham – Station Road, looking north to junction with Stoney Lane, 20 July 2007

2.2.6 Review of the historical flood data indicates that increased development in the town has led to further capacity issues on an already under-capacity surface water sewerage system.

2.2.7 Following the floods of July 2007 West Berkshire Council carried out a study ('A Review into the Flooding in West Berkshire', refer to Appendix C) which was reviewed and acknowledged by Sir Michael Pitt during the compilation of the 'Pitt Review'. This report was based on evidence gathering which involved site investigation, photographic and anecdotal evidence. The objectives of the report in summary were to:

- Identify properties that had flooded;
- Provide a detailed overview of each area flooded in West Berkshire and establish where the problems originated ;
- Develop an understanding of the flooding mechanism and what can be done to prevent or mitigate the impact of future extreme events;
- Identify the critical areas and prioritise resources appropriately; and
- Identify mitigation options with their associated Benefit Cost Ratio and identify with whom the responsibility for their implementation rests with.

2.2.8 The West Berkshire report 'A Review into the Flooding in West Berkshire' equated to a Level 1 review of flooding in Thatcham. The report provided an excellent starting point with respect to understanding the mechanism of flooding in line with the Source-Pathway-Receptor model of analysis. Refer to Figure 2-4 for further details of the Source – Pathway - Receptor model.

2.2.9 Communication was undertaken with the Association of British Insurers (ABI) and a number of lost adjusters which covered the Thatcham area in an attempt to validate the anecdotal evidence on individual property flooding. Whilst not all parties contacted contributed, valuable information was received from a number of lost adjusters in terms of claim location and in some instances value of damages incurred. Again this exercise was not conclusive as not all loss adjusters contributed to the study.

EXISTING MODELLING INFORMATION

2.2.10 The existing hydraulic model of the River Kennet was obtained from the Environment Agency. In addition, Micro Drainage developed a coarse surface water model for the Thatcham area following the floods of the 20th July 2007. This was undertaken using the WinDes FloodFlow software. The model was based on the 'Direct Rainfall' method. While the model gave a good account of the flood extent, there were areas within the model where further investigation was required.

THATCHAM CATCHMENT

2.2.11 Thatcham is located within the River Kennet catchment. The overall Thatcham catchment size is 15.32km^2 of which approximately 7.03 km^2 (46%) is urban and 8.29 km^2 (54%) is rural.

2.2.12 The study area lies in part of the parishes of Thatcham, Cold Ash and Upper Bucklebury. It comprises:

- Commercial areas to the south east;
- The urban centre of Thatcham in the centre of the catchment;
- Rural areas to the north of Thatcham; and
- The villages of Cold Ash and Bucklebury to the north and north east of the catchment respectively.

2.2.13 The topography of the Thatcham catchment is such that the catchment falls in a southerly direction from Cold Ash to the north of the catchment at an elevation of 155m AOD to an elevation of 78m AOD at the lowest point, adjacent to the River. This equates to a slope of approximately of 1 in 38.

2.2.14 The geology in Thatcham includes gravel layers, overlain by clay. Investigations indicate that groundwater levels are high, although it is considered that groundwater did not contribute to the flooding experienced by Thatcham in 2007. The northern catchments above Thatcham are predominately impermeable clay; giving rise to a catchment that has a low permeability, but a quick response time in terms of surface water runoff / overland flows.

REVIEW OF DATA RECEIVED AND SCREENING EXERCISE

2.2.15 The work previously undertaken by West Berkshire Council and published in their report 'A Review into the Flooding in West Berkshire' was used to initially understand the mechanism of surface water flooding in Thatcham.

2.2.16 As part of the SWMP further work was undertaken to map and analyse historic flood data, physical characteristics of the area, drainage networks and census information and upload this information onto a GIS platform.

2.2.17 The steering group members provided additional information in the form of DG5 and asset records from Thames Water, Thatcham Town Council report on flooding following the July 2007 event 'Flooding in Thatcham, July 2007 – September 2008, A year in perspective' the Environment Agency's LiDAR, Groundwater and river model information and third party information (rain gauge data etc.). Refer to Table C-2 in Appendix C for a full list of data received.

2.2.18 A screening exercise was undertaken which removed some of the collated data. On completion of the screening exercise, a strategy was applied where the Source-Pathway-Receptor (SPR) model was applied to the data.

2.2.19 The outputs from this strategy quickly identified the mechanism of flooding, major overland flow routes and Significant Drainage Areas (Significant Drainage Areas refer to the location within Thatcham where the depth of flooding was in excess of 100mm). However, there were a number of locations within the study area where data gaps existed.

2.2.20 A number of site visits were undertaken to obtaining missing information. Refer to Figures 2 to 6 in Appendix C.

FLOOD MECHANISMS (SOURCES, PATHWAYS AND RECEPTORS)

2.2.21 An assessment has been made of the potential flood mechanisms in Thatcham using the Source, Pathway, Receptor model (SPR) shown in Figure 2-4 below (refer to Appendix C for details of the sources, pathways and receptors for Thatcham). The SPR model is used to understand the link between hazard and flood risk.

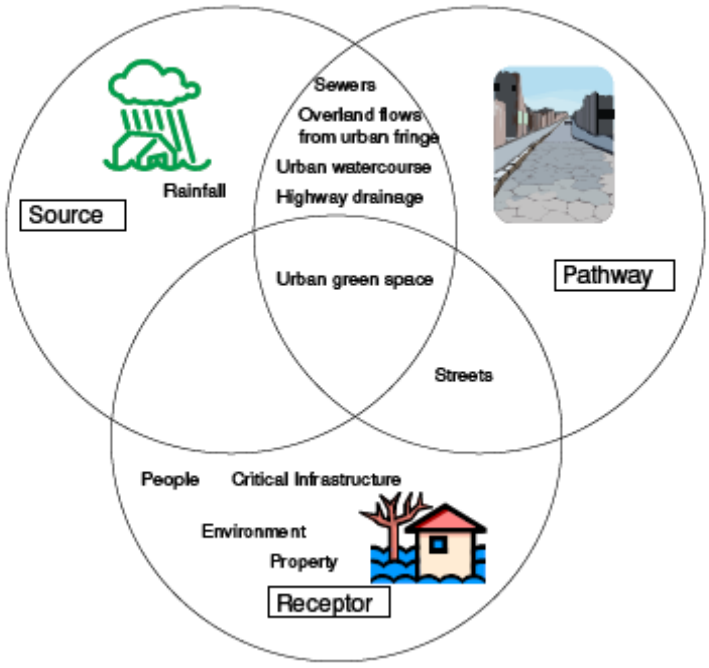


Figure 2-4 Source, Pathway, Receptor Model (SPR)

2.2.22 Flooding in Thatcham comes from a range of sources, including rainfall, overland flow, sewers, and groundwater (refer to Figure 7, Appendix C). As the historical flood events highlight, the main source of flooding in Thatcham is surface water runoff following periods of heavy rainfall. The pathways comprise existing culverted watercourses, existing highways and drainage systems. With regards to receptors, during the July 2007 floods, over 1100 properties were affected. Whilst this was an extreme event, analysis of historical information indicates that the receptors are mainly residential properties and a Site of Special Scientific Interest (SSSI) to the south of the urban centre of Thatcham. Refer to Figure 8 and SFRA extract in Appendix C for details of the vulnerable sites and fluvial flood zones within Thatcham. In addition, further details of the Source, Pathways and Receptors in Thatcham can be found in Appendix C.

2.3 SELECT APPROACH

2.3.1 Following receipt and review of the latest information, it was decided to update the original Micro Drainage model ('Direct Rainfall' model). The original model applied the July 2007 rainfall event to a Google Earth Digital Terrain Model (DTM). Following receipt of the 2m resolution filtered Light Detection and Ranging (LiDAR[7]) data from the Environment Agency a new DTM was built. Figure 2-5 shows an example of unfiltered LiDAR (DEM) with an aerial photo of the location.

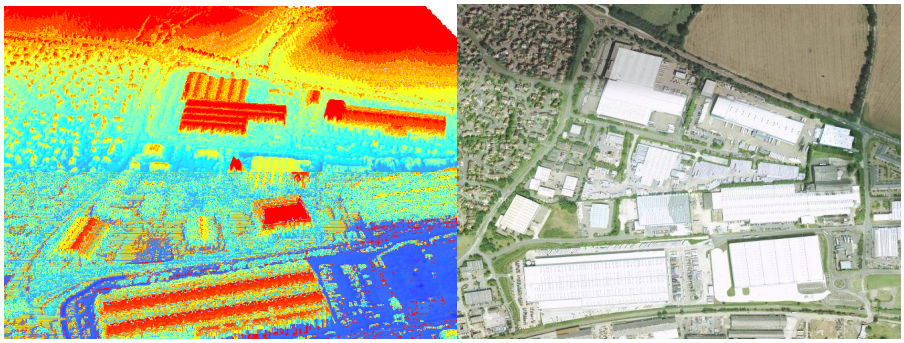


Figure 2-5 DEM Model and Aerial Photo

2.3.2 It was established from an early stage in the Pilot Study that, where possible mitigation be provided to address the July 2007 event. While other lower flood probability events were assessed, the main focus of the study was to address the July 2007 flood event (a 1 in 237 year event).

UPDATED 'DIRECT RAINFALL' MODELLING

2.3.3 The purpose of this approach was to improve on the accuracy of the original model. An overall catchment model was built utilising the latest DTM and the July 2007 rainfall event which was simulated over the catchment (the 'Direct Rainfall' model method).

[7] Lidar LiDAR data comes in two formats, unfiltered and filtered. Unfiltered LiDAR data identifies the heights of objects, such as vehicles, buildings and vegetation, are recorded as well as the terrain surface (Digital Elevation model DEM). Filtered LiDAR filters out the height of objects until you are left with the digital terrain model (DTM).

2.3.4 It became evident from this simple exercise that there were limitations with the software and hardware in terms of file size and simulation time (time to run the model) respectively. In an attempt to address the above issues a filtering of data within the DTM was undertaken. This exercise reduced the number of points within the DTM and resulted in a vertical accuracy of 0.10m within the urban areas and 0.50m in rural areas.

2.3.5 Following completion of the modelling exercise additional areas were identified as having flooded which was verified by the historic flood information.

MODELLING APPROACH - WAY FORWARD

2.3.6 Following discussion within the steering group, together with the above findings and available information, it was concluded that the modelling technique to be used to assess the options would be the 'Fully Integrated' method. This method of modelling would best address the study's objectives. In simple terms the 'Fully Integrated' method allows for the interaction of flows between the 1 dimensional system (1d sewer system – Minor System - underground) and the 2 dimensional system (2d overland flow – Major System – above ground). In addition, this method best lends itself to undertaking a detailed Cost Benefit Analysis based on the depth – damage curves in the Multi Coloured Manual (MCM) (refer to Section 4.3 for more information on Cost Benefit Analysis). This method also facilitates the production of hazard maps in line with Defra documents: Flood Risk Assessment Guidance for New Development Phase 2 FD2320, Flood Risks to People Phase 1 FD2321 and Supplementary Note on Flood Hazard Rating and Thresholds – May 2008.

FULLY INTEGRATED METHOD – INTEGRATED 1D AND 2D MODEL

2.3.7 Following completion of the 'Fully Integrated' model a number of issues were identified which were due to the size of data files and simulation time. To overcome these issues the Thatcham catchment was split into 3 sub-catchments aptly named the west, central and east catchments. The catchment sizes for the 3 sub-catchments are identified in Table 2-1 below along with their associated makeup in terms of urban and rural areas. The DTM for each sub-catchment was again filtered but to a lesser degree which provided an increased level of vertical accuracy of 0.05m in the urban area but retained the 0.50m level of accuracy in the rural areas. Refer to Figure 2-6 for Thatcham sub-catchments.

Table 2-1 Sub - Catchment Details - Thatcham

Sub-Catchment	Size sqkm	Urban %	Urban Area sqkm	Rural %	Rural Area sqkm
West	2.41	41	0.988	59	1.422
Central	7.32	49.7	3.638	50.3	3.682
Eastern	5.59	43	2.404	57	3.186
Total	15.32	46	7.03	54	8.29

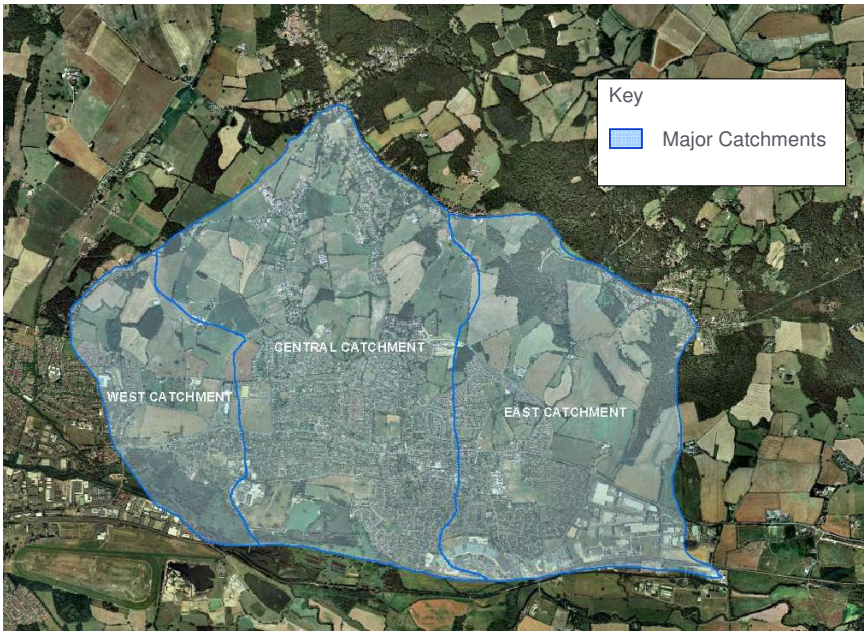


Figure 2-6 Thatcham Study Area Sub-Catchments

2.3.8 No foul or surface water sewer models were available for the Thatcham area. Thames Water, however, did provide a GIS layer containing all their assets they had a record of within the Thatcham area (refer to Figure 9 in Appendix D). This information was used to build the surface water model for each of the sub-catchments (refer to Figure 10 in Appendix D).

2.3.9 In order to model the complete drainage system, it is recommended that details of the highways drainage are included, however, no data was available on the highway drainage within the catchment. It is recommended that this data is obtained in order to accurately model the complete drainage system.

2.3.10 Rainfall data was obtained from the Thatcham Weather Station on Henwick Lane, West Thatcham and the Met. Office for the July 2007 event.

2.3.11 For the various flood events on the Kennet and Avon Canal water levels were supplied by the Environment Agency.

2.3.12 Refer to Appendix D for further details on the decision making process undertaken during the modelling phase.

MODELLING METHODOLOGY

BASE MODEL

2.3.13 The surface water system (1d domain minor system underground) is based on the Thames Water data provided.

2.3.14 A separate foul and combined water system exists within Thatcham. However it was decided that as 74% of these systems are comprised of 150mm diameter sewers or less, the foul system would have little impact on the overall result. Therefore the foul and combined sewer systems were not modelled.

2.3.15 As filtered LiDAR was used, leaving just the DTM, all houses needed to be digitised and incorporated into the DTM. The properties were digitised to ensure their impact was identified and flow routes around buildings picked up. This would allow for the identification of the major flow routes within the urban environment and enable flow paths around buildings to be accurately plotted. In addition the building type and age were added to the properties attribute which assisted with the Cost Benefit Analysis. Refer to Figure 2-7 for an example of overland flow routes.

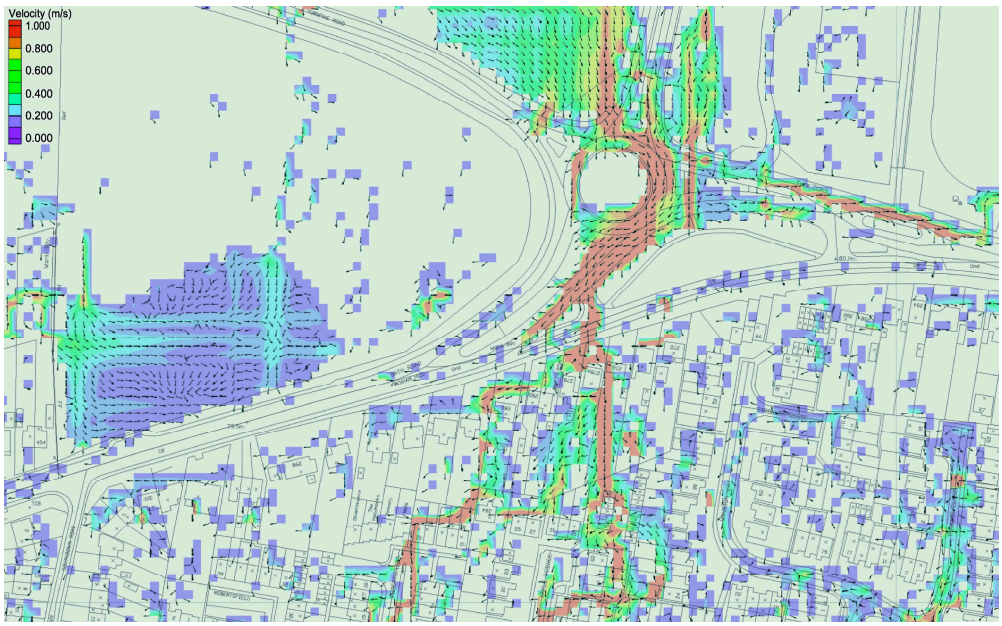


Figure 2-7 An example of overland flow routes

2.3.16 The 2d domain (major system - above ground) used a number of volumetric runoff coefficients (Cv) for paved and grasses areas. Refer to Appendix E for further information.

2.3.17 A grid size of 7.5m was used on each sub-catchment. This gave a sufficient level of accuracy upon which to base a decision making process.

2.3.18 All watercourses and sewer systems outfall to the south of Thatcham and are conveyed under the railway line. These flows eventually outfall to the Kennet and Avon Canal downstream of Monkey Marsh Lock.

2.3.19 During the flood of July 2007, normal water levels were observed within the Kennet and Avon Canal. Therefore the downstream boundary water levels were set at normal water levels within the canal.

3 Risk Assessment

3.1 UNDERSTAND RISK

3.1.1 An understanding of the risk associated with model predictions is required. In addition, as the outputs for the modelling feeds into the Cost Benefit Analysis, a level of confidence needs to be established in the results generated.

MODEL VERIFICATION AND CALIBRATION

3.1.2 In minor systems (1d Sewer System) validation of a model is generally based on flow measurements. In Thatcham's case photographic and flood depth evidence was obtained together with anecdotal evidence on flood depths and extents. In addition actual rainfall data was obtained from the Thatcham Weather Station and Met Office. Refer to Appendix E for more detail on rainfall data observed.

3.1.3 Verification is the process of comparing a model against independent data for three or more events to determine the accuracy of the model. In the case of Thatcham, only one extreme event was available. Therefore a degree of flexibility has been applied to the verification process.

RAINFALL DATA

3.1.4 Rainfall data from the Thatcham Weather Station was kindly provided to the Thatcham steering group.

3.1.5 To establish the probability associated with the rainfall event an analysis was undertaken of the raw rainfall data. This analysis was in line with the Flood Estimation Handbook criteria. A probability of 1 in 237 year (0.42%) chance of occurring was established for the 19 – 20 July 2007 rainfall event.

3.1.6 In addition, a detailed report from the Met. Office for the 20 July 2007 event was commissioned. This analysis was based on the rain gauge data at Newbury Sewage Works, Kingsclere Sewage Works, Newbury Racecourse and Chenies Radar Station. This analysis established the probability of the event to be a 1 in 169 event.

3.1.7 Further analysis was undertaken and an agreed probability of 1 in 237 year event was established for the July 2007 rainfall event. Refer to Appendix E for more detail on rainfall data observed and analysis undertaken.

MODEL RUN AND VERIFICATION EXERCISE

3.1.8 Based on the above criteria the base model was run for the flood event of 20 July 2007. An initial assessment of the model run flood extent was compared against the historical data obtained for the July 2007 event and showed good correlation.

3.1.9 However, to provide further confidence in the verification exercise, photographic evidence of flood depths in all 3 sub-catchments was obtained. These areas were to become control points (calibration reference points). A topographical survey of these areas was undertaken which established approximate observed flood depths. While it is understood that this exercise does not validate the model, it provides a level of confidence in the models results. Refer to Figure 3-1 below and Appendix E for calibration points in the sub-catchments.

Figure 3-1 Calibration point locations

3.1.10 The base model was run for the July 2007 event for the 3 sub-catchments and a comparison of modelled and observed flood levels was made. It was noted that generally modelled and observed levels were within ±50mm for 75% of the calibration points. For the remaining 25% of the area surveyed, modelled and observed levels were within 100mm to 300mm. Refer to Appendix E for Figure 11 and Table E-1 which locates the calibration points.

3.1.11 Figure 3-2 below shows a location plan, observed flood depth, site measurements and modelled depth for a calibration point. Refer to Appendix J for a copy of the WinDes model.

Figure 3-2 Location of model verification point, photograph of flooding in 2007, photograph of on-site measurements and modelled output

3.1.12 The model has not been verified against lower order rainfall events which leaves a certain amount of uncertainty with respect to the modelling of these events.

CALIBRATION

3.1.13 Prior to the calibration exercise being undertaken, it was observed that the initial base model results compared well against the measured calibration points.

3.1.14 The calibration exercise involved adjusting a number of model parameters to obtain a better model fit in terms of observed and modelled levels. This mainly involved adjusting Cv values for the paved and green areas, Ks values of the main surface water trunk sewers and blockage ratios on the trunk sewers. Following completion of the calibration exercise, it was concluded that the work undertaken made little difference with respect to improving the model's validation in terms of the July 2007 event.

SENSITIVITY TESTING

3.1.15 A sensitivity test of the model was also undertaken. This mainly concentrated on the above ground system, involving the adjustment of Cv values for the paved and green areas by ± 10% and ± 20% for the July 2007 event. It was observed that water levels generally varied between ±50mm. It can therefore be concluded that the catchment is sensitive to the Cv values used.

CONCLUSION OF THE VERIFICATION AND CALIBRATION EXTENT

3.1.16 A reasonable correlation between the measured and modelled water levels for the July 2007 was observed. There still remains some doubt with respect to the lower order events. However, it was concluded that the model was robust enough to take forward with respect to the decision making process.

ASSESSING CURRENT AND FUTURE FLOOD RISK

ASSESS CURRENT RISK AND ANNUALISING DAMAGES

3.1.17 Following completion of the verification and calibration exercises it was necessary to assess current risk for a number of probability flood events. Reference was made to the "Flood and Coastal Defence Project Appraisal Guidance 3' (FCDPAG3) where it is identified that the greater proportion of benefit generally arises from the lower probability events. Therefore the flood events run were the events with a probability of 1 in 1, 5, 10, 25, 50 and 100, 100 year plus climate change (100yr + 30%) and the July 2007 event.

3.1.18 The critical storm duration for each flood event (for the three sub-catchments) generally ranged between 4 and 6 hours. In the July 2007 event flooding occurred over a period of 6 hours. Flood water receded quickly in the upper and central part of Thatcham (within 2 - 4 hours); however, to the south of Thatcham, flood waters receded 1-2 days after the flood event.

JOINT PROBABILITY

3.1.19 The mechanism of flooding within Thatcham was a combination of overland flows from the rural and urban areas. These flows were eventually conveyed to the Kennet and Avon Canal downstream of Monkey Marsh Lock. During the flood of July 2007, normal water levels were observed within the Kennet and Avon Canal.

3.1.20 The topography of the Thatcham catchment is such that the catchment falls in a southerly direction from Cold Ash at an elevation of 155m AOD to an elevation of 78m AOD just north of the railway line.

3.1.21 To assess the implications of high water levels within the Kennet and Avon Canal, the downstream boundary (water level) was amended within the Thatcham model. Water levels for the various flood events up to the 50 year event on the Kennet and Avon Canal were extracted from the Environment Agency Section 105 model.

3.1.22 While there was localised change in level, its extent was limited due to the topography of Thatcham. Therefore the joint probability analysis was stopped at this point.

CALCULATING DAMAGES TO PROPERTY

3.1.23 To assess the damage to property a hybrid approach was taken which combined the depth-damage curves in the "Multi-Coloured Manual"[8](MCM) with the FCDPAG3[9] and The Green Book criteria[10]. This was used to establish a net present value and Benefit Cost Ratio. Refer to Section 4.3 for Cost Benefit Analysis.

3.1.24 A sensitivity analysis was undertaken based on Threshold Levels with respect to confirming the number of properties flooded. The analysis indicated that above a threshold level of 75mm (water depth greater than 75mm); properties were considered to have flooded internally. Flooding of residential properties at depths below 75mm were also included, in line with the MCM depth-damage curves to take account of the event that water does not enter the building, but damage is still caused.

ASSESS FUTURE RISKS

3.1.25 A design horizon of 100 years plus climate change impacts was assessed based on the current catchment to take account of urban creep, which includes windfall sites, extensions, etc. Local Planning policy which is explained in Section 2, currently takes account of surface water run off and climate change as detailed in PPS1 and PPS25.

3.1.26 The impact of new development on the existing foul and surface water system will need to be addressed by Thames Water. However for assessing surface water runoff for new developments the surface water system will need to comply with the requirements of PPS25 (PPS25 requires that the 100 year +30% event in relation to climate change and surface water runoff from new development be accommodated on site).

3.1.27 The UK Climate Projections 2009 (UKCP09) published its findings in June 2009. Key findings for the south east of England in terms of precipitation (2080s) under the high emissions scenario found that, the central estimate of change in winter mean precipitation is 30%. It is very unlikely to be less than 7% and greater than 67%.

3.1.28 Under the medium emissions scenario, the central estimate of change in winter mean precipitation is 22%. It is very unlikely to be less than 4% and greater than 51%.

3.1.29 Therefore based on the above, a 30% increase with respect to precipitation would seem reasonable.

3.1.30 In addition more stringent local planning policies may be implemented in the future in relation to surface water runoff from new development.

[8] The Benefits of Flood and Coastal Risk Management: A Handbook of Assessment Techniques
[9] Flood and Coastal Defence Project Appraisal Guidance, Economic Appraisal
[10] The Green Book, Appraisal and Evaluation in Central Government

MAP FLOOD RISK

3.1.31 Flood maps were produced which identified the depth and extent of surface water flooding within the study area. The flood maps show all flooding above a depth of 50mm. In addition hazards maps were also produced in line with the Defra guidance: Flood Risk Assessment Guidance for New Development Phase 2 FD2320: Flood Risks to People Phase 1 FD2321 and Supplementary Note on Flood Hazard Rating and Thresholds – May 2008.

3.1.32 Flood depth maps for the base model were produced for the 1 in 5yr, 30yr, 100yr, 100yr plus climate change and July 2007 events together with Flood hazard maps for the 1 in 100yr and 100yr plus climate change which cover the whole catchment. Refer to Figures 12 to 19 in Appendix E. These maps are used to identify Significant Drainage Areas in order to identify safe access and egress routes in terms of health and safety.

3.1.33 An extract of the flood depth and hazard map for the July 2007 event is shown in Figure 3-3 below.

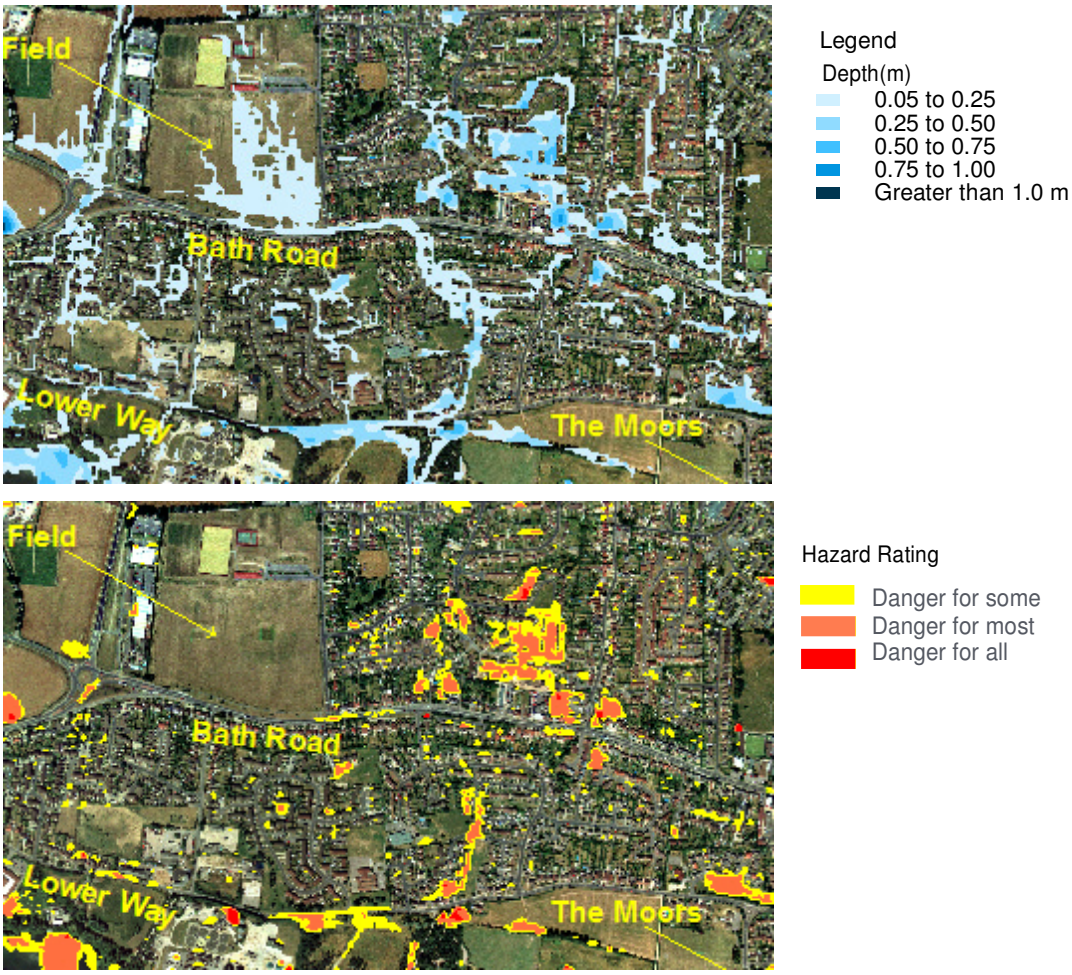


Figure 3-3 Extract of July 2007 Flood Depth and Hazard Map

3.1.34 The surface water flood and hazard maps can be used to inform the emergency and spatial planning process which complements the Critical Drainage Area information in the current SFRA.

3.1.35 The model has shown a high correlation with respect to anecdotal evidence on flood depth. However, there are a number of areas where further investigation is required.

3.1.36 The SWMP is not currently part of the statutory planning system. However, PPS25 states that if the SFRA identifies Critical Drainage Areas, there is a need to undertake a SWMP. In addition, this information will be used to inform emergency planning functions and the Multi Agency Flood Plan for West Berkshire.

3.2 COMMUNICATE RISK

3.2.1 The SWMP Guidance includes a section on communicating risk to both professional stakeholders and the public as part of the risk assessment. Refer to Figure 1-3, Section 1.

3.2.2 Due to the sensitive nature of residential property flooding and the extensive flooding experienced in Thatcham, particularly during the July 2007 floods, the SWMP project steering group meetings included representation from the public at all stages of the project. The general public were represented through Thatcham Flood Forum and Cold Ash Community Partnership, both of whom have had a representative present at the meetings.

3.2.3 The public have been informed of progress throughout the SWMP process through presentations at key milestones and results of the modelling through graphical interfaces and animations at project meetings. In addition, ongoing email communication between Thatcham Flood Forum and its members, progress of the project reported in the newsletter issued by Thatcham Town Council, presentations by various members of the steering group at council meetings, a roadshow held by West Berkshire Council and inclusion of the project on various websites was undertaken. Refer to Figure 3-4 below and Appendix F.

3.2.4 It was decided that once all partners and stakeholders had agreed to the flood extent and options to take forward, a more focused public consultation could take place.

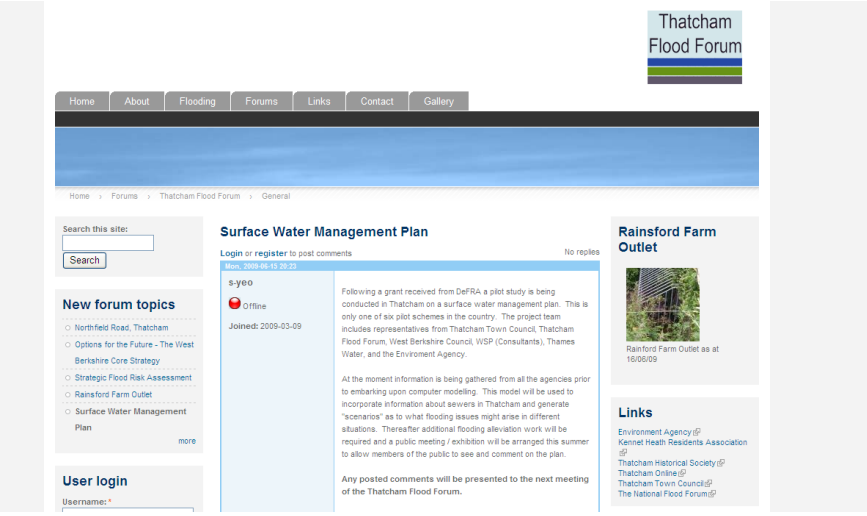


Figure 3-4 Extract from Thatcham Flood Forum Website

4 Options

4.1 IDENTIFICATION

4.1.1 The first step in assessing the various options to manage surface water flood risk in line with the SWMP objectives was to identify the range of measures[11] that could be taken. The measures that have been considered have been broken down into the following categories:

- Technical;
- Maintenance;
- Development , building control and policy;
- Awareness;
- Resilience/resistance;
- Agricultural land use; and
- Other.

TECHNICAL

4.1.2 An assessment was made of a number of technical measures. These included measures that require technical input in the form of flood mitigation measures. Measures that were identified included:

- Source control of surface water in the form of Sustainable Drainage Systems (SUDS);
- Construction of detention basins in the rural catchment reducing the volume of surface water runoff draining into the urban area;
- Diverting and controlling inflows directly to the River Kennet, through a series of linked detention basins in the rural catchment;
- Construction of a series of linked detention basins in the urban catchment;
- Blockage sensors on grilles/siphons/major assets - introducing warning systems into key locations in the surface water network, namely at the grilles at the head of the system to warn of blockages that could result in reduced capacity of the system;
- Flood routing through existing roads;
- Below ground storage;
- Upsizing sewers at identified 'pinch points' in system;
- Increasing number of outfalls to the River Kennet;
- De-culverting surface water sewers;
- Separation of foul and surface water sewers (cross connections); and

[11] A **measure** is defined as a proposed individual action or procedure intended to minimise current and future surface water flood risk. An **option** (or options) is made up of a single, or a combination of previously defined measures.

- Soil moisture - rainfall/ weather forecast warning system – working with the Met Office and Environment Agency Early Flood Forecasting Centre to utilise real time Met Office weather data together with soil moisture information collated from the rural catchments to the north of Thatcham.

4.1.3 A discussion on the technical measures taken into options for detailed analysis can be seen in Appendix G and Appendix H.

MAINTENANCE

4.1.4 The summer 2007 events highlighted that a number of the sewers within both the rural and urban areas of Thatcham were not being maintained on a regular basis. A number of measures to improve the maintenance were considered. These included:

- A database (supported by GIS) of all sewers/assets with responsible parties identified;
- A database/asset register (supported by GIS) highlighting sewers/assets maintenance regime to warn of sewers/assets that have not been maintained in accordance with their schedule;
- A change of approach from reactive to proactive maintenance;
- Enforcing maintenance of ditches on third party land using Local Authority powers under the Land Drainage Act;
- Undertaking maintenance of ditches on third party's land by West Berkshire Council; and
- De-silting of public sewers.

DEVELOPMENT, BUILDING CONTROL AND POLICY

4.1.5 Whilst surface water management is covered by national policy, there is the opportunity for local authorities to introduce additional local planning policy which would be tested through the development plan process. This was an area that the steering group concluded offered significant potential for Thatcham in terms of controlling surface water runoff. The measures considered were:

- Continued enforcement of existing policies (PPS 25);
- Code for Sustainable Homes (Category – Surface Water Runoff, Health and Wellbeing – flood resistant and resilient construction)
- New local policies to reduce surface water runoff including more stringent policy on surface water runoff (above the requirements of PPS25 – requires national policy change, although it is understood that a number of councils apply more stringent criteria than PPS 25) ;
- National Policy on paving of front gardens to extend to rear gardens. (This requires a change in national policy or West Berkshire Council may make a direction under article 4 of the 1995 General Permitted Development Order to remove permitted development rights for impermeable surfacing of gardens other than front gardens)
- The development of a planning mechanism whereby existing developments undertaking resurfacing of large paved areas need to reduce runoff to existing sewers or watercourses. (This requires a change in national policy);

- Implications of the forthcoming 'Floods and Water Management Bill' in terms of the adoption of SUDS on new development and automatic rights to connect to the sewer system;
- Council maintained GIS system to highlight areas at risk of surface water flooding to ensure proper consideration is given to potential development in these areas.

4.1.6 A comprehensive but not conclusive list of proposed National and Local Policy changes are identified in Appendix G.

AWARENESS

4.1.7 One of the issues highlighted in the 2007 floods was the lack of public awareness on how to react to flooding and lead in times with respect to warning of flooding. The SWMP has therefore reviewed a number of measures that would raise the profile of flooding within Thatcham and ensure that residents are more prepared. These measures are discussed further in Appendix G and include:

- Flood Emergency Plan;
- Flood Training Day;
- Call centre crib sheet for West Berkshire Council call centre staff;
- Flood awareness campaign; and
- Enforcing home information packs to address historic flooding (national change in policy).

FLOOD RESISTANCE AND RESILIENCE

4.1.8 Whilst a number of the measures aim to reduce flooding to Thatcham, it will not be possible to completely eradicate the risk of flooding in every location. In such areas, it may be possible to reduce the damage from flooding by incorporating resistance / resilience measures. Whilst these measures will not reduce the probability of flooding, their aim is to reduce the damage caused by the flooding when it does occur. The success of these measures will depend on the condition of the existing property and flood warning lead in time. The measures reviewed as part of the option identification process were:

- Retro-fitting resistance measures – including flood barriers, air brick caps and sealing external walls. Refer to Figure 4-1 below.

Figure 4-1 Examples of an air brick cover and a flood barrier[12] [13]

- Mobile pumps; and
- Essential infrastructure protection.

AGRICULTURAL LAND USE

4.1.9 This category identifies the potential to review the agricultural land use practices in the rural area north of Thatcham to reduce the overland flow from these areas into the town. This will involve changes in agricultural land practice (including using funding from the Environmental Stewardship Scheme).

OTHER

4.1.10 A number of other measures were identified that did not fit into any of the previously mentioned categories. These include:

- Continuing the project partnership after the completion of the SWMP;
- CCTV flood warning link; and
- Improvements to the flood warning system;

4.1.11 Refer to Appendix G for further details, including a break-down of each option.

4.1.12 A wide-range of potential mitigation measures was initially considered. This list was then short-listed to identify the most suitable measures to take forward. The criteria used for short listing the measures are set out in Table 4-1 below:

[12] Flood Products, Using Flood Protection Products – A Guide for Homeowners
[13] www.ukfloodbarriers.co.uk

Table 4-1 Short-List Scoring[14]

Criteria	Description	Score
Technical	Is it technically possible and buildable? Will it be robust and reliable?	U (unacceptable) – measure eliminated from further consideration - 2 severe negative outcome - 1 moderate negative outcome +1 moderate positive outcome +2 high positive outcome
Economic	Is it affordable and will benefits exceed costs?	
Social	Will the community benefit or suffer from implementation of the measure?	
Environmental	Will the environment benefit or suffer from implementation of the measure?	
Objectives	Will it help to achieve the objectives set at the beginning of the SWMP?	

4.1.13 Due to the ambiguity of potential benefits and costs, the non-technical measures were not subjected to Cost Benefit Analysis. However, they have been considered and assessed and recommendations made accordingly. Refer to Section 5.

4.1.14 The measures taken forward from the short-listing process were then developed into options to enable a more detailed assessment to be undertaken.

4.1.15 Although the non-technical measures did not undergo a detailed cost benefit analysis exercise, the short-listing process did identify the most suitable measures for the Thatcham SWMP. These measures underwent a second review process to determine what measures were to be taken forward as part of the SWMP Action Plan.

4.2 FUNDING STREAMS

4.2.1 As part of the review of potential measures to reduce the risk of surface water flooding, potential funding streams to provide financial assistance for the measures were identified. These include:

- Defra – Government grants to local authorities for household-level flood risk mitigation;[15]
- Environment Agency Flood Defence Grant in Aid (FDGiA) funding – this would only be applicable to historical watercourse flooding rather than purely surface water runoff flooding;
- Local Authority Investment Plan;
- Environment Agency Capital Works Programme;
- Thames Water Investment Plan;
- Regional Flood Defence Committee;
- Developers assistance in paying Section 106 on new developments; and
- Community Infrastructure Levy

[14] Defra Surface Water Management Plan Guidance, Version 1, February 2009
[15] http://www.defra.gov.uk/environ/fcd/adaptationandresilience/propertyresilience.htm

4.3 OPTION ASSESSMENT

MAINTENANCE

4.3.1 The assessment undertaken highlighted that a database of all surface water assets, with responsible parties identified scored high based on the criteria set out in Table 4-1. This could also assist West Berkshire Council, a future Lead Local Flood Authority under the forthcoming 'Floods and Water Management Bill' with their future responsibilities.

4.3.2 This database (supported by GIS) could also include details of the maintenance regime of each of the assets to enable the identification of assets that are behind on their maintenance schedule. It could also be used to identify areas that require maintenance on a more regular basis and would enable West Berkshire and Thames Water to focus their efforts on these areas. The database could also be used by West Berkshire Council to pick up critical drainage assets where responsibility rests with the riparian owner.

4.3.3 An initial start has been undertaken on an Asset Management Plan with relevant responsibilities. Refer to Appendix I, Figure 49. No Maintenance regime has been received from West Berkshire Council or Thames Water to complete the process. This Asset Management Plan is considered to be work in progress.

DEVELOPMENT, BUILDING CONTROL AND POLICY

4.3.4 Planning Policy Statement 25 (PPS25) was published in December 2006. The aim of PPS25 with respect to development and flood risk is to ensure that flood risk from all sources is taken into account at all stages in the planning process so as to avoid inappropriate development in areas at risk of flooding and to direct development away from areas at highest risk.

4.3.5 PPS25 sets out the need for Local Authorities to direct development to areas of low flood risk and undertake sequential and exception testing for development in areas at risk of flooding.

4.3.6 The SWMP is currently not part of the statutory spatial planning system, however it deals in more detail with the current situation in terms of pluvial and surface water flooding. As the SWMP complements the SFRA, the SWMP could be used to inform the decision making process with respect to local policy, strategies, plans etc.

CODE FOR SUSTAINABLE HOMES

4.3.7 The Code for Sustainable Homes[16] measures the sustainability of a new home against categories of sustainable design, rating the 'whole home' as a complete package. The Code also gives new homebuyers better information about the environmental impact of their new home and its potential running costs, and offers builders a tool with which to differentiate themselves in sustainability terms.

[16] The Code for Sustainable Homes, Setting the standard in sustainability for new homes, Communities and local Government, February 2008

4.3.8 The Code is a voluntary standard and since April 2007 the developer of any new home in England can choose to be assessed against the Code. However, since May 2008 all new homes are required to have a Code rating/certificate which will be included in the Home Information Pack (HIP). There are nine categories in the Code of which surface water runoff is one. Therefore, it is proposed that West Berkshire Council continue to ensure that the Code is implemented in all new Green/Brownfield developments in Thatcham to reduce the risk of surface water flooding.

POTENTIAL NEW PLANNING POLICY

4.3.9 Another improvement for new development would be the implementation of new planning policy imposing more stringent runoff restrictions on new development than is currently required in national guidance (PPS25). However this is likely to require a change in national policy (as discussed in section 4.1.5).

4.3.10 PPS25 will ensure that new developments do not increase the runoff from the pre-development state up to the 100 year plus climate change event. In addition, the West Berkshire SFRA covering Thatcham already recommends Greenfield runoff rates for new development which complies with PPS25 requirements. This will serve to reduce the risk of surface water flooding both to new developments and elsewhere within Thatcham.

FLOODS AND WATER MANAGEMENT BILL

4.3.11 The Floods and Water Management Bill (currently progressing through parliament at the time of writing) will promote the use of SUDS. If passed, it will end the automatic right to connect to public sewers for surface water drainage and require developers to put SUDS in place in new developments wherever practicable.

4.3.12 Connection to the public sewer system will be conditional on meeting new national standards on SUDS and drainage. This will further reduce the risk of flooding to Thatcham.

AWARENESS

4.3.13 The option assessment highlighted the preferred awareness measures which include implementing a Multi Agency Flood Plan and a flood awareness campaign. However, it is likely that any of the options taken forward will also include a public awareness campaign to raise the profile of surface water flooding within Thatcham. This also includes the role the residents can play on an individual basis to reduce the risk of surface water flooding to their own properties, as well as the establishment of local flood wardens.

FLOOD RESISTANCE AND RESILIENCE

4.3.14 This is an area where the assessment indicated there is significant potential to reduce the consequences of flooding to residential property. This measure was assessed in combination with Option 2 which looked at constructing detention basins, upsizing sewers etc. (Option 5).

4.3.15 West Berkshire currently have mobile pumps which can assist with reducing the risk of flooding in certain locations i.e. Pipers Way Balancing Pond on 20 July 2007

4.3.16 In addition the protection of essential infrastructure can be undertaken which looked at the following:

- electrical sub-stations in the commercial areas to the south east of Thatcham;
- the sewage treatment works to the south west; and
- the A4 Bath/London Road

4.3.17 If resistance measures are bypassed or if there is insufficient time to implement the resistance measures resilient measures may be used. In order to decide what relevant resilience measures would be effective, it is necessary to know the potential depth and duration of flooding that is likely to occur.

4.3.18 In Thatcham it is estimated that the majority of flooding damage occurred where water levels were 300mm or below (although it is acknowledged that this was not the case for all locations during the 20 July 2007 flood event).

4.3.19 Defra and the Environment Agency issued guidance in May 2007 on 'Flood resistance and resilience solutions' while the document 'Improving the flood performance of new buildings: flood resilient construction' was issued by the Communities and Local Government (CLG) also in May 2007. Guidance on flood proofing measures for different flood depths outside a building are identified within the guidance.

AGRICULTURAL LAND USE

4.3.20 The assessment highlights this as an option that requires further review outside the scope of the SWMP, but one that could have high potential benefits. Funding to change agricultural land use practices could be sought from Natural England via the Common Agricultural Policy modulation, using Environmental Stewardship schemes. The study is within an area that has been highlighted as a target for Higher Level Stewardship under the scheme, hence funding could be available for farmers to incorporate other land use measures that would reduce the surface water runoff from their land. Further assessment of this option is required, in co-operation with land owners.

OTHER

4.3.21 A number of measures were considered under the label of 'other'. The most preferable option was considered to be continuing the project partnership after the completion of the SWMP. It is recommended that quarterly meetings with the project partners will ensure that the agreed actions are executed and new issues are discussed and reviewed. It is recognised, however, that such meetings are likely to have a resourcing implication for some of the partners, and this would have to be assessed further.

4.3.22 Another area that could be utilised to reduce the impact of flooding is the CCTV system within Thatcham. This existing system could be used to redirect emergency services and enable safe and effective road closures. A further review of the existing CCTV system is required.

4.3.23 A flood warning system unique to Thatcham could also be set up which utilises the Met. Office and Environment Agency Early Flood Forecasting Centre (which opened in April 2009) and soil moisture readings in the rural area to the north of Thatcham. This option is outside the scope of the study but could be investigated further.

TECHNICAL ASSESSMENT

4.3.24 Following a review of flood data and the modelling undertaken, four options were put forward. A technical assessment of the options put forward was undertaken to determine which one gives the best Benefit Cost Ratio, whilst also providing social and environmental benefits and meeting the objectives of the SWMP.

4.3.25 The technical assessment was based on the July 2007 flood event.

4.3.26 Each of the technical options that were assessed are indicative only and further consultation, survey and study work together with detailed design will be required before any technical option can be taken forward. Further advice should be sought from the Environment Agency prior to the detailed design stage, as well as providing an allocated period for consultation with affected land owners and stakeholders.

OPTION 1

4.3.27 The Option 1 proposal was the do nothing scenario. This option was assessed utilising the calibrated base model.

OPTION 2

4.3.28 This option follows the initial recommendations of the West Berkshire Report of 2008 with some additional works identified. The mitigation works under Option 2 are as follows:

- Seven new detention basins with associated bunding and controls of which four address the main overland flow routes from the rural areas while the remaining three address urban flooding. The total area of detention basins equates to 15.46ha;
- One major road crossing along Cold Ash Hill;
- Proposed new ditch and swale; and
- Provision of new surface water sewers to be maintained by West Berkshire Council and Thames Water.

4.3.29 For Option 2 refer to Figure 4-2 below and detailed detention basin drawings, Figures 20 and 24 to 29 respectively in Appendix H.

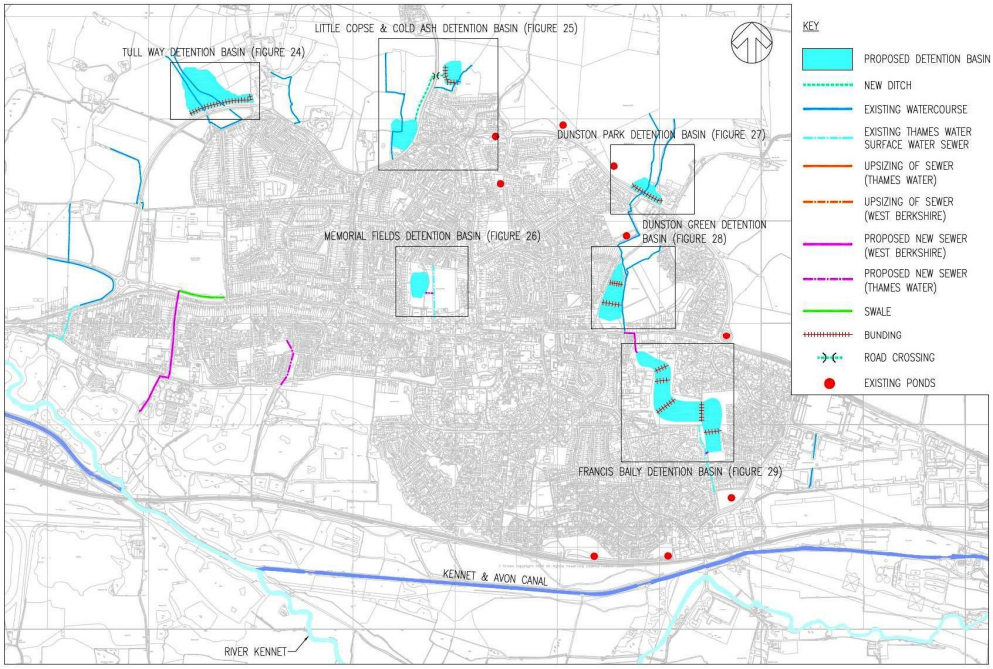


Figure 4-2 Option 2

OPTION 3

4.3.30 The proposed mitigation Option 3 retains the proposals identified in Option 2 together with additional mitigation measures. Option 3 comprises the following proposed works:

- 11 new detention basins with associated bunding and controls of which eight deal with all of the rural overland flow routes while the remaining three deal with urban flooding. The total area of detention basins equates to 19.79ha;
- Two major road crossings at Cold Ash Hill and Turnpike Road, together with a proposed new cut off ditch to the north of Thatcham and a swale; and
- Provision of new surface water sewers and up-sizing of existing sewers to be maintained by West Berkshire Council and Thames Water.

4.3.31 For Option 3 refer to Figure 4-3 below and Figure 21 in Appendix H.

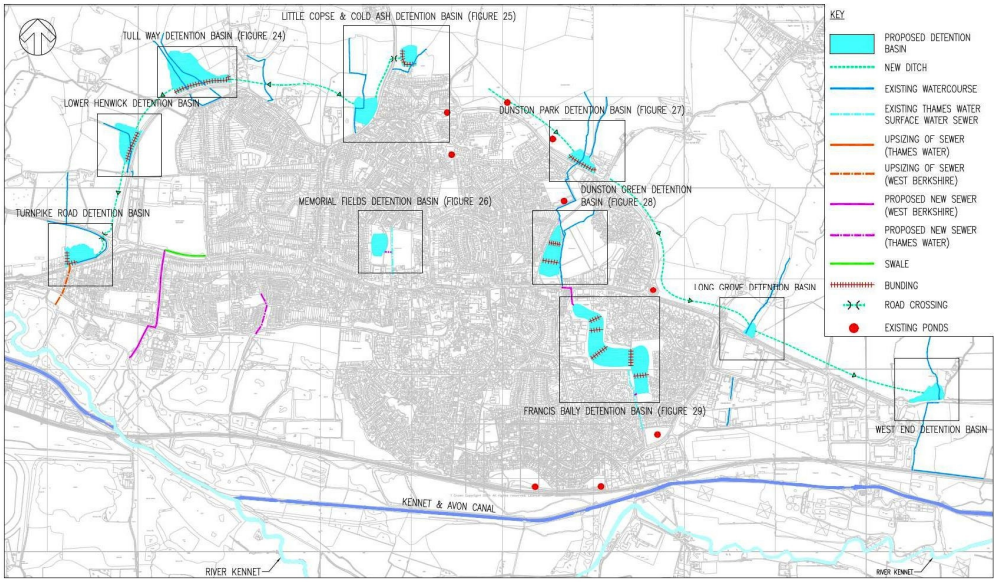


Figure 4-3 Option 3

OPTION 4

4.3.32 The proposals in Option 4 replicate the works put forward from Option 2 together with upsizing a number of critical sewers within Thatcham.

4.3.33 For Option 4 refer to Figure 4-4 below and Figure 22, Appendix H.

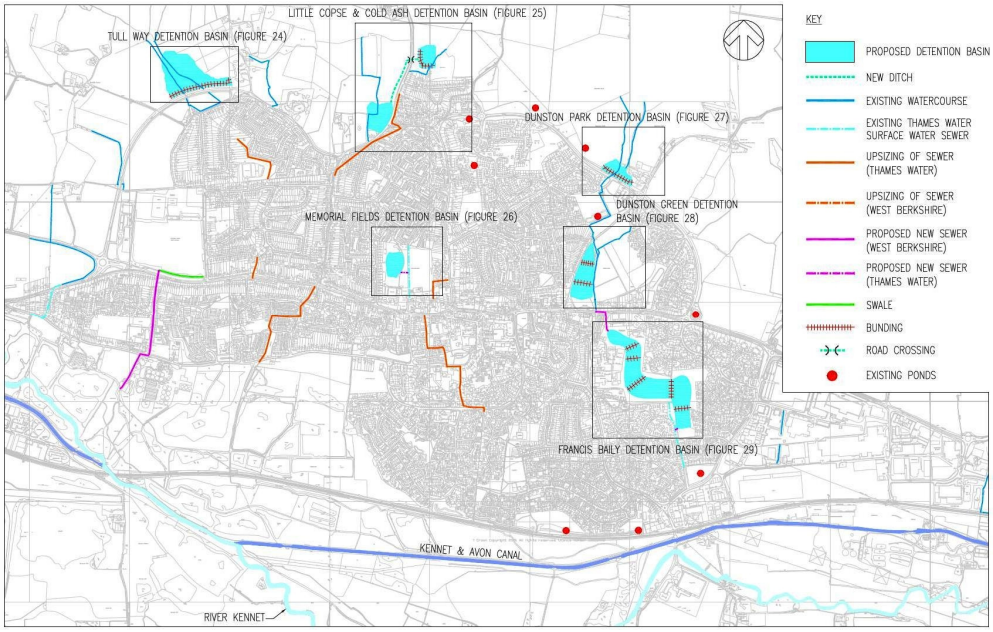


Figure 4-4 Option 4

4.3.34 For a detailed schedule of mitigation works put forward for the various options refer to Appendix H.

4.3.35 A detailed discussion of the modelling results for Options 2, 3 and 4 is located in Appendix H.

OPTION 5 (OPTION 2 PLUS RETRO-FITTING OF RESISTANCE MEASURES)

4.3.36 In addition to the Cost Benefit Analysis of the technical options, an analysis was also undertaken for the combination of Option 2 and retro-fitting resistance measures to residential properties (Option 5). For Option 5 refer to Figure 4-5 below and Figure 23, Appendix H.

4.3.37 These measures would include flood barriers, air brick caps and sealing of external walls etc and would require residents to sign up to an early flood warning system.

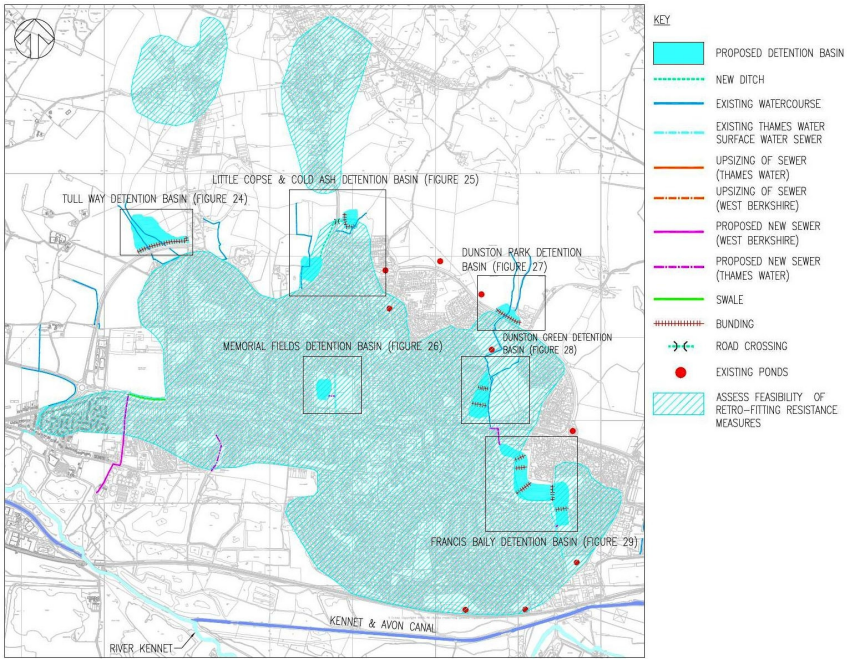


Figure 4-5 Option 5

ESSENTIAL INFRASTRUCTURE

4.3.38 In terms of essential infrastructure affected by the July 2007 event, Newbury Sewage Treatment Works (Lower Way) and the sub-stations to the south west and south east of Thatcham respectively came close to flooding.

4.3.39 During the 2007 event there was significant traffic disruption to Bath Road/London Road (A4) causing traffic to divert along the Tull Way Ring Road to the north of Thatcham. High velocity flows were also experienced along Stoney Lane, outside the Kennet School, causing a danger to the public.

4.3.40 Of the options put forward, Option 3 will offer the greatest protection to the essential infrastructure identified above.

DISCUSSION OF MODEL RESULTS FOR THE JULY 2007 EVENT

4.3.41 From the above work Options 2, 3 and 4 provide benefit in terms of removing properties from the surface water flood plain and reducing flood depth and extent (refer to Figures 30 to 44 in Appendix H). Option 2 deals with what is perceived as the main source-pathway-receptor in terms of rural and urban flooding within Thatcham. Option 3 however removes the majority of rural overland flow from the urban catchment and allows a portion of it to be discharged back into the urban catchment in a controlled manor. The remaining flows bypass Thatcham to the west and east and outfall to the Kennet and Avon Canal. It should be noted that flows into the Kennet and Avon Canal replicate the current situation and the options put forward do not increase flows downstream. Option 4 provides a similar level of protection to Option 2. Refer to Impact Maps, Figures 45 to 47 in Appendix H for a comparison of flood extents between the Option 1 scenario (do nothing) and Options 2, 3 and 4.

4.3.42 While the main rural overland flows routes have been addressed in Option 2, 3 and 4, it is the urban flooding that is of concern. Whilst efforts have been made to address this in terms of allowing public open spaces to flood, providing new sewers, upsizing existing sewers (Thames Water and West Berkshire Council), re-profiling of the road and retro-fitting resistance measures, further analysis will be required. The areas of particular concern are:

- Cold Ash
- Ashmore Green
- Benham Hill and Bath Road (A4);
- Ashbourne Way and Swansdown Walk;
- Loundyes Close and The Firs;
- Brownsfield Road, Bath Road and Meadow Close;
- Stoney Lane and Station Road;
- Wheelers Green Way;
- The Kennet Heath estate;
- Longcroft Road; and
- The Kennet Lea estate.

4.3.43 Refer to Figure 4-6 below and Figure 48 in Appendix H for overland rural and urban flow routes and Significant Drainage Areas identified by the modelling.

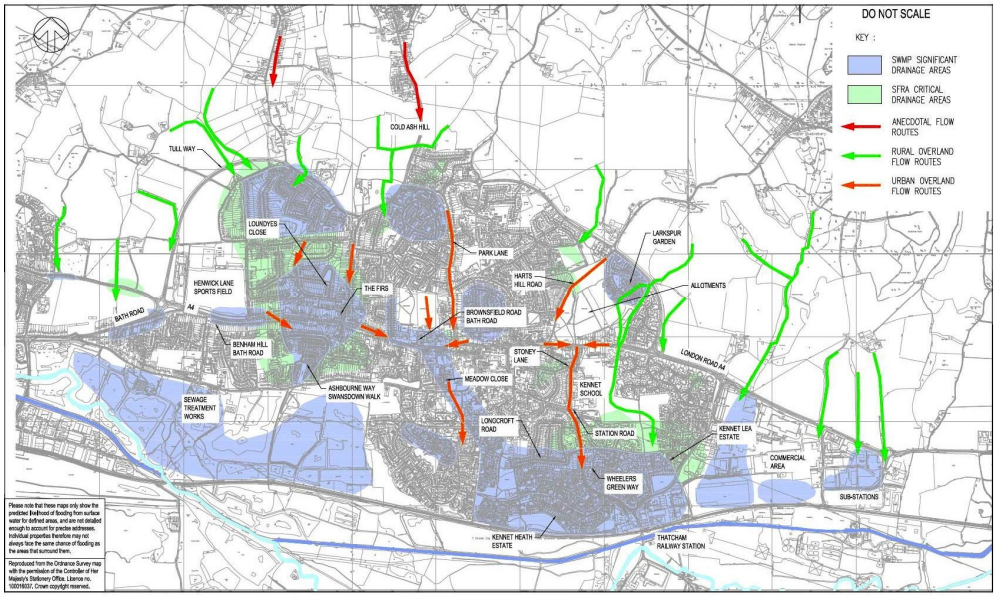


Figure 4-6 SWMP Rural and Urban Overland Flow Routes and Significant Drainage Areas

4.3.44 The Thatcham urban area is served by public surface water sewers and highway drainage (Thames Water and West Berkshire Council) which are designed to cater for storm event of up to 1 in 30 years frequency. Thames Water have a duty to provide a level of protection of 1 in 10 years within their existing sewer system and a 1 in 30 year level of protection on newly adopted sewers. West Berkshire Council also has a responsibility to ensure its highway drainage system provides a minimum of a 1 in 2 - 5 year standard of protection. Therefore, further investigation is required for the above areas in terms of alleviating the flooding by providing new sewers, upsizing sewers (note: it has not been proposed to provide new or upsized sewers in excess of the aforementioned criteria unless agreed otherwise), conveying overland flows, retro-fitting of existing properties and infrastructure or a combination of the above.

4.3.45 However, Options 2, 3 and 4 do provide a level of protection which will provide significant improvement in terms of properties protected and reduction in flood depths and extents. The base model indicated that approximately 1700 units flooded as a result of the July 2007 event. It became apparent that the majority of the residential property flooding in the 2007 flood (98%) was below 300mm. Options 2, 3 and 4 in addition to reducing flood depths and extents removed approximately 12% to 18% of properties from the surface water flood plain depending on the option put forward.

4.3.46 A number of advantages exist in terms of providing detention basins in the rural and urban catchments other than reducing flood risk which are as follows:

- The reduction of sediment and debris entering into the Thames Water sewer network by providing sediment bays within the basins and grills on the outlets from the basins;
- The above proposal will have the benefit of improving the quality of water discharging to the Kennet and Avon Canal which will comply with Article 4 of the Water Framework Directive and the requirements of the River Basin Management Plan for the Thames River Basin District, published in December 2009;
- The reduction in risk of contamination caused by combined and foul sewers flooding;

- The minimisation of detention basins depth (over a large area) so that the areas can retain their original function; and
- The opportunity to enhance biodiversity within the area by the creation of BAP habitats.

4.3.47 The proposed detention basins could all be classified as reservoirs under the forthcoming Flood and Water Management Bill and therefore, responsibility with respect to their upkeep will rest with West Berkshire Council.

4.3.48 In conclusion the above modelling work has identified Options 2, 3, 4 and 5 are all viable options with respect to protecting Thatcham from flooding. However, they will not remove urban flooding completely. It is therefore concluded that further investigation in the Significant Drainage Areas is required for the urban areas.

COST BENEFIT ANALYSIS

4.3.49 In order to provide an economic appraisal of the technical options, a cost benefit analysis was undertaken.

4.3.50 The Annual Average Damages (AAD) were calculated for each of the chosen options. This was undertaken through hydraulic modelling, as explained in Section 3.1. The baseline damages were first calculated to enable a comparison of each of the options against the 'do nothing' approach.

4.3.51 The assessment included the determination of the capital cost of implementing the improvement, together with the operational costs. This process included input from the stakeholders of the project.

4.3.52 Due to the financial constraints with regard to the implementation of any options, it was decided that Cost Benefit Analysis (CBA) was the most appropriate form of analysis as it quantifies in monetary terms as many of the benefits and costs of a proposal as feasible, including items for which the market does not provide a satisfactory measure of economic value. The alternative approach would have been a Multi-Criteria Analysis (MCA) which is a decision making approach developed for situations where multiple criteria influence the final outcome of a decision.

4.3.53 Cost benefit analysis can be undertaken by either:

- Selection by Benefit-Cost Ratio; or
- Selection by Net Present Value.

4.3.54 Upon interrogation of the results, it became apparent that selection by Benefit Cost Ratio was the most appropriate to determine the feasibility of the options proposed. This is in line with the SWMP and PAG guidance, which states that the Benefit Cost Ratio should be used to determine the sequence of investment if all options can be implemented and one option does not prevent others from being implemented.

4.3.55 The benefits were calculated based on the damage that each option avoided, relative to the baseline model.

4.3.56 Damages for the residential properties were based on the depth damage curves from the Multi Coloured Manual (MCM)[17]. These depth damage curves calculate the cost of the damage caused by flooding to a residential property based on the total

[17] The Benefits of Flood and Coastal Risk Management: A Handbook of Assessment Techniques

depth of water, the duration of flooding, the type of property, the age of the property and the social class of the residents. Table 4-2 below shows the criteria used in the depth damage curves.

Table 4-2 Residential Property Depth-Damage Criteria

Property Type	Age of property	Social class of resident	Depth of Flooding (m)		Duration of Flooding
Detached	Pre 1919	AB	-0.3	1.2	<12hr
Semi-detached	1919 - 1944	C1	0	1.5	>12hr
Terrace	1945 - 1964	C2	0.05	1.8	
Bungalow	1965 - 1974	DE	0.1	2.1	
Flat	1975 - 1985		0.2	2.4	
	Post 1985		0.3	2.7	
			0.6	3	
			0.9		

4.3.57 For the commercial property, the default values for cost of damages to flooding as set out in the MCM were used – this does not take account of depth of flooding as it was considered that the damages due to the commercial properties were small in comparison to the residential property.

4.3.58 An allowance of £200 per affected household was included to take account of the health and social impacts of flooding, as set out in the MCM. An allowance of 10.7% on the total commercial and residential damages was included to cover for emergency services costs, again as set out in the MCM.

4.3.59 The damages to the agricultural land were also considered based on the assumption that the land is used for dairy cattle, however, the total cost of these damages was minimal in comparison to the residential property damages and hence they were not included. Whilst the cost of traffic disruption was considered, it was apparent that these costs were small compared to other costs and hence they were also excluded from the analysis.

4.3.60 Detailed costing was undertaken for each of the options including initial construction costs and continuing maintenance costs.

4.3.61 The Cost Benefit Analysis was assessed over a period of 100 years, as set out in Defra Project Appraisal Guidance (PAG)[18]. An initial discount factor of 3.5% was used, reducing to 3.0% after 30 years and 2.5% after 75 years. This is in line with the HM Treasury Green Book[19]. Refer to Appendix H and Table 4-3 for the Cost Benefit Analysis for each of the options taken forward to detailed analysis.

18 Flood and Coastal Defence Project Appraisal Guidance, Economic Appraisal, FCDPAG3
19 HM Treasury, The Green Book – Appraisal and Evaluation in Central Government

Table 4-3 Results of Cost- Benefit Analysis

	Costs and benefits £k				
	Option 1	Option 2	Option 3	Option 4	Option 5
PV Costs		12,464	18,246	15,314	28,092
PV Damage	181,179	132,638	134,327	139,331	1,846
PV Damage avoided (Benefit)		48,541	46,852	41,848	179,333
Net Present Value, NPV		36,076	28,606	26,534	151,240
Benefit/cost ratio (PV benefit/PV cost)		3.89	2.57	2.73	6.38

PV: Present Value

4.3.62 The overall sustainability of each of the options was considered during the short-listing stage. The SWMP guidance recommends that carbon accounting is used to include monetised direct, indirect, embedded and supply chain emissions of CO_2. An initial assessment was undertaken and found to have little impact on the overall outcome.

4.3.63 Previous guidance by Defra on the social cost of carbon and the shadow price has carbon[20] was based on estimates of the lifetime damage costs associates with green house gas emissions drawn from the Stern Review. This approach has now been revised due to the considerable uncertainty that exists surrounding the estimates of the social cost of carbon. A reassessment of the cost of carbon has been undertaken and a report has been produced by the Department of Energy and Climate Change called 'Carbon Valuation in UK Policy Appraisal: A Revised Approach[21]. This approach is based on estimates of the abatement costs that will need to be incurred to meet specific emissions reduction targets. This revised approach will have the effect of helping to ensure that the policies the UK Government develops are consistent with the emissions reduction targets that the UK has adopted through carbon budgets and also at an EU and UN level.

4.3.64 Further guidance is required on this process and it is envisaged that a more detailed assessment will be undertaken once the chosen options has been confirmed.

4.3.65 Although the standard depth-damage curves from the MCM were used for the purposes of the economic appraisal, a comparison was made of a number of properties for which actual damages from the 2007 flood were received. The results are shown in Figure 4-7 below:

[20] The Social Cost of Carbon and the Shadow Price of Carbon: What they are, and how to use them in Economic Appraisal in the UK, Economics Group, Defra, December 2007

[21] Carbon Valuation in UK Policy Appraisal: A Revised Approach, Climate Change Economics, Department of Energy and Climate Change, July 2009

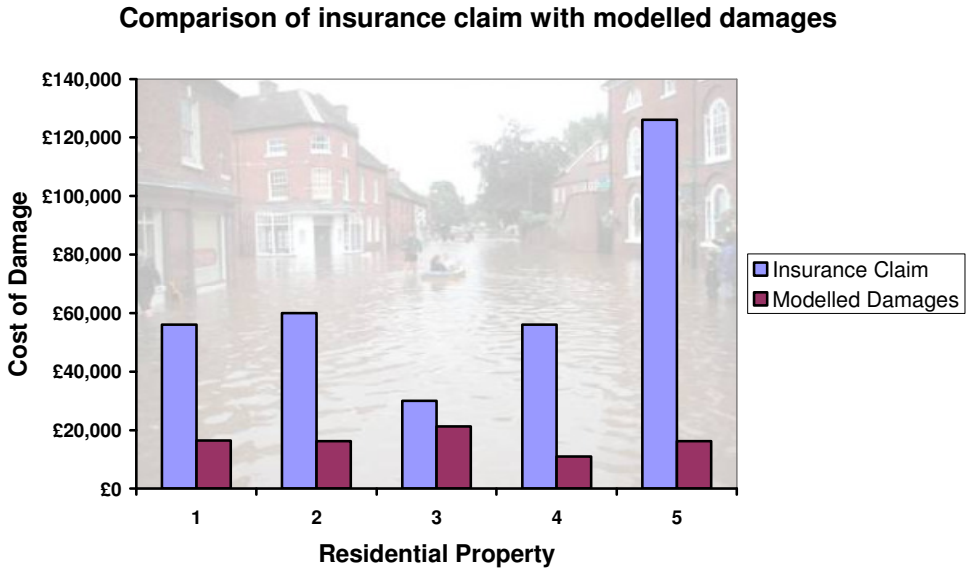


Figure 4-7 Comparison of actual insurance claims to modelled damages

4.3.66 The difference in the modelled damage and the actual damage is due to the fact that the depth-damage curves are based on national averages and consider the economic loss to the country rather than the financial loss to individual households. For example if a household has a new-for-old insurance policy and they claim for a ten year old television, the loss is counted as the market price of a new television – this is a financial loss whereas the real loss to the country is the depreciated value of a ten year old television – this is the economic loss.

4.3.67 As well as the measures taken forward into options for detailed analysis, an analysis was also made of the feasibility of retro-fitting SUDS into driveways of residential houses in the urban areas of Thatcham, compared to the construction of a detention basin.

4.3.68 Table 4-4 shows the result of this comparison. Whilst the analysis indicated that the construction of a detention basin is more cost-effective than replacing residential driveways with permeable paving, this option should not be dismissed, as national policy discourages the paving of front gardens unless it is in some sustainable manner. Refer to Section 4.

Table 4-4 Comparison of retro-fitting SUDS versus construction of detention basins

Description	Detention Basin at Tull Way	Detention Basin at Memorial Fields
Storage Volume (m^3)	28,550	14,260
Area of permeable paving required to remove detention basin (assuming 0.5m deep permeable paving with a void ratio of 0.3 (m^2)	190,333	95,067
Total number of driveways required to provide this area (assuming an average drive of 4m x 5m) (no.)	9,517	4,753
Total construction cost of permeable paving (assuming £5k-7.5k per driveway) (£)	£47.6-£71.4mil	£23.8-£35.6mil
Cost of Detention Basin (£)	£500k	£315k
Maintenance Regime of Detention Basin	Yearly maintenance	Yearly maintenance
Maintenance Regime of permeable paving	Requires complete reconstruction every 15-20 years and twice yearly maintenance as a minimum	

5 Conclusions and Recommendations

5.1 CONCLUSIONS

5.1.1 The flooding of Thatcham in July 2007 was the result of a storm event with an annual probability of 1 in 237 years (0.42%). The mechanism of flooding involved overland flows from the rural and urban areas. From the outset of the study one of the main objectives was to provide a standard of protection to Thatcham which would protect it against a similar storm event to that experienced in 2007. This objective was also in line with the original work undertaken by West Berkshire, outlined in 'A Review into the Flooding in West Berkshire'.

5.1.2 It was concluded from the work undertaken that no one option would deliver the objective of providing significant betterment in terms of reducing/eliminating surface water flooding within Thatcham. In order to deliver this objective, it is recommended that the way forward is to incorporate measures from a number of the categories identified in Section 4.

5.1.3 Cost Benefit Analysis was undertaken for the technical options put forward and Option 2 was initially shown to score the highest in terms of Benefit-Cost Ratio. However, the score for Option 2 is only 3.89. Taking this option forward on its own would require more detailed costing of the scheme and modelling analysis.

5.1.4 In order to assess the effects of Option 2 against the 1 in 237 year event, an impact map was produced to show a comparison of the extent of flooding in the 'do nothing' (Option 1) scenario versus Option 2. Refer to Figure 45 in Appendix H.

5.1.5 During the modelling phase of the project, it became apparent that the majority of the residential property flooding in the 2007 flood (98%) was below 300mm. The retro fitting resistance measures discussed in Section 4 are capable of providing protection to residential properties up to a level of 600mm.

5.1.6 In addition to the Cost Benefit Analysis of the technical options, an analysis was also undertaken on a combination of Option 2 and retro-fitting resistant measures to residential properties (Option 5). These measures would include flood barriers, air brick caps and sealing external walls etc and would require residents to sign up to an early flood warning system. The analysis indicates a Benefit-Cost Ratio of 6.38 for this option.

5.1.7 The implementation of Option 5 would result in an overall reduction in flood depth (and extent), duration and damage to properties. This reduction in depth also reduces the risk in terms of health and safety. There is also a social advantage to the reduction in flooding, as it has been shown that the effects of flooding have significant impacts on the health and wellbeing of flood victims long after the flood has gone.

5.1.8 In terms of protecting essential infrastructure Option 5 results in less flooding at key locations. These locations include the hospital to the west of Thatcham (West Berkshire Community Hospital), the sewage treatment works to the south of Thatcham (Newbury Sewage Treatment Works), the electricity sub-stations to the south east of Thatcham, off Pipers Way and the Bath Road/London Road (A4) and the Tull Way Ring Road.

5.2 RECOMMENDATIONS

5.2.1 It is therefore recommended that Option 5 should be put forward as a viable Option in terms of reducing flood risk in Thatcham.

5.2.2 The construction of the detention basins proposed in Option 5 will also have a number of environmental benefits, as the ponds will capture a large proportion of the silt that would otherwise be washed into the surface water sewerage network in Thatcham. This will reduce the likelihood of blockages, improve water quality of the receiving watercourse and serve to reduce the risk of flooding from the existing network in the future. In the urban areas the proposed detention basins will retain their original functions while providing a secondary function as a flood attenuation area. In addition, an opportunity to enhance the BAP potential of the Thatcham area is also provided within this option.

5.2.3 A number of policy options have been proposed which utilise the planning process to assist in the reduction of risk with respect to surface water flooding. This includes continuing to implement PPS25 policy in terms of restricting surface water runoff from new development. It is also recommended that the SWMP informs the Multi Agency Flood Plan. In addition, a review of more stringent policies with respect to surface water runoff from new development is proposed, although it is recognised that a change in national policy will be required to facilitate this.

5.2.4 As well as the technical and resilience/resistance measures, flood risk can also be reduced by implementing a number of other options reviewed in Section 4 and Appendix G.

5.2.5 The SWMP also recommends that a detailed maintenance regime be prepared, to include details of the essential public and private infrastructure requiring maintenance and a detailed record of when this maintenance is to be undertaken and who is responsible. It is recommended that this data is held on a central GIS supported database within West Berkshire Council. This information should include Thames Water and West Berkshire Council owned assets as well as private assets together with their associated maintenance regimes, which are critical to the operation of the surface water system.

5.2.6 As part of the SWMP a review was undertaken into the feasibility of introducing warning systems into key locations in the surface water network, namely at the grilles at the head of the system to warn of blockages that could result in overland flows. This was also considered in line with a scheme to work with the Met Office and Environment Agency Early Flood Forecasting Centre, which was opened in April 2009. The local early flood warning system would utilise real time Met Office weather data together with soil moisture information collated from the rural catchments to the north of Thatcham. It was felt that this was outside the scope of the SWMP, however, it is recommended that a detailed study be undertaken to determine the feasibility of such a scheme.

5.2.7 With regards to public awareness and perception in terms of flood risk, public consultation has been undertaken during the preparation of the SWMP. This consultation will have already increased the public's awareness of flood risks within Thatcham. However, it is recommended that further effort is undertaken to highlight ways in which the public can reduce the impact of flooding on their property and themselves.

5.2.8 A number of funding streams exist which will assist with the procurement of the above proposals. It is proposed that all parties work together to ensure a holistic approach is taken and as such maximise the potential of the funding streams.

5.3 SUMMARY

5.3.1 In conclusion there is no one option that will resolve the risk of flooding in Thatcham to the desired level of protection. Therefore, it is recommended that a combination of technical and retro fitting flood resistant (flood proofing individual properties) measures be put in place (Option 5) together with implementing planning policy changes, establishing emergency planning procedures and increasing public awareness be undertaken. The provision of a maintenance regime and an asset register together with utilising the early Flood Forecasting Centre information is also recommended. The above measures will reduce the current and future risk of flooding within Thatcham.

6 Implementation and Review

6.1 INTRODUCTION

6.1.1 The Surface Water Management Plan will be a living document that needs to be reviewed approximately every 3 to 5 years, to ensure the implementation of the agreed actions are correct and that any new issues are addressed. However a review may be required following any new flood events, new flood data becoming available or new modelling techniques and change of policy in the catchment.

6.2 ACTION PLAN

6.2.1 A stand alone Action Plan has been set out to identify the SWMP actions, target commencement and completion dates, maintenance regime, how the preferred option is going to be funded, what needs to be done to make this happen and who is responsible for an action. Refer to Appendix I for the Action Plan.

6.2.2 The Action Plan identifies the items that need to be taken forward which are as follows:

- Continue existing partnership;
- Continue to apply, and review existing policy and look to influence national policy;
- Set up asset register and maintenance schedule for critical drainage infrastructure;
- Investigate environmental options – Environmental Stewardship;
- Complete Multi Agency Flood Plan;
- Secure funding and implement Option 5; and
- Continue with public awareness campaigns.

6.3 ADVICE TO WEST BERKSHIRE COUNCIL

6.3.1 West Berkshire Council is currently undertaking their core strategy. As part of this process West Berkshire Council has completed their Strategic Flood Risk Assessment which has identified Critical Drainage Areas. The emerging SWMP will complement the SFRA and has identified in more detail the following Significant Drainage Areas with a depth of flooding in excess of 100mm:

- Cold Ash
- Ashmore Green
- Benham Hill and Bath Road (A4);
- Ashbourne Way and Swansdown Walk;
- Loundyes Close and The Firs;
- Brownsfield Road, Bath Road and Meadow Close;
- Stoney Lane and Station Road;
- Wheelers Green Way;
- The Kennet Heath estate;
- Longcroft Road; and
- The Kennet Lea estate.

6.3.2 The SFRA identified Critical Drainage Areas as areas considered particularly at potential risk of groundwater and/or surface water flooding. The risk assessment was developed on the basis of district geology and topography, mapping steep sided valleys, overland flow routes, and areas overlaying chalk aquifers. The SWMP identified Significant Drainage Areas as areas with a depth of flooding in excess of 100mm. The SFRA states that for all new development sites within Zone 1 and Critical Drainage Areas (CDA), a Flood Risk Assessment is required in line with PPS25.

6.4 ADVICE TO EMERGENCY PLANNING

6.4.1 The findings from the SWMP will be used to inform the Major Incident Plan, the Thames Local Resilience Forum, the Environment Agency's Berkshire Plan and the Multi Agency Flood Plan.

6.4.2 West Berkshire Council is in the process of undertaking their Multi Agency Flood Plan which will assess flood risk in terms of Health, Social, Economic and Environmental issues.

6.5 COMMUNICATION STRATEGY

6.5.1 The SWMP project steering group meetings included representation from the public at all stages of the project. The general public were represented through Thatcham Flood Forum and Cold Ash Community Partnership, both of whom have had a representative present at the meetings.

6.5.2 It was decided that once the flood extents and Action Plan have been signed off by the steering group, a formal public conclusion period should be undertaken. It is assumed it would take the following format:

- Inform the public of the findings of the SWMP via the following mediums:
  - media via West Berkshire Public Relations department
  - email dissemination
  - local papers and TV/radio
  - Newsletters
  - Thatcham Flood Forum

6.5.3 Once the above action has taken place a number of open days/evening meetings will take place where public feedback can be addressed. In addition, targeted feedback questionnaires will be provided and these will be sent back to the steering group to be addressed.

6.5.4 The responses to this feedback, if appropriate, can be fed back into the SWMP final document.

6.5.5 The above communication strategy can continue to be used after the completion of the SWMP.

6.6 FURTHER WORK

6.6.1 A number of issues arose during the study where further work will be required to take any proposals to the next stage. These items of further work are as follows:

- Additional survey work to fill the gaps in the data supplied by Thames Water and West Berkshire in terms of sewer records;
- More detailed analysis of the Critical Drainage Areas and Significant Drainage Areas identified within the SFRA and SWMP, respectively within Thatcham;
- Further review into the flood forecasting and warning system;
- Obtain additional information from the ABI or Lost Adjusters covering the Thatcham area;
- Confirm information in relation to undertaking detail design;
- Ensure relevant funding applications are progressed with Defra and Environment Agency in addition to the other funding sources identified;
- Continue communication with the general public throughout the project, via regular updates and meetings; and
- Undertake a more detailed assessment on carbon accounting.

6.7 SCRUTINY OF THE ACTION PLAN

6.7.1 West Berkshire Council as the lead partner will take forward the Action Plan with input from the steering group.

6.8 FURTHER GUIDANCE

6.8.1 Guidance on the following may be required to undertake the follow up actions:

- New funding streams;
- Implementation of a planning mechanism for surfacing existing large paved areas which will require a national policy change;
- Further guidance and consultation during the detailed design stage of the technical measures;
- Continuing partnership and sharing information; and
- Continuing communication.

6.9 THE NEXT STEP

6.9.1 To ensure a successful implementation and review of the Surface Water Management Plan, all parties must contribute to the process. Clear lines of communication and defined responsibilities together with ongoing dialogue are critical to the success of the Surface Water Management Plan.