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WATFORD AND ST ALBANS SURFACE WATER MANAGEMENT PLAN

Review and Update of Surface Water Management Plans for Watford and St Albans

On behalf of Hertfordshire County Council

February 2015

Quality Management

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WATFORD AND ST ALBANS
SURFACE WATER MANAGEMENT PLAN

Review and Update of Surface Water Management Plans for Watford and St Albans

February 2015

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1 Executive Summary

1.1.1 WSP UK Limited has completed a mapping review of the existing Surface Water Management Plans (SWMP) for Watford and St Albans on behalf of Hertfordshire County Council in light of the Environment Agency's updated Surface Water Flood Maps. The study has been undertaken in consultation with key local partners and stakeholders who are responsible for surface water management and drainage in the area.

1.1.2 The partners worked together to understand the causes and effects of surface water flooding and agree the most cost effective processes of managing surface water flood risk for the long term. The process of working together as a partnership is designed to encourage the development of innovative solutions and practices as well as identifying funding streams to assist in the delivery of the outcomes of the SWMP.

1.1.3 This report is an addendum to the existing SWMPs conducted for Watford and St Albans.

2 Introduction

2.1 Background Information

2.1.1 Hertfordshire County Council (HCC) as Lead Local Flood Authority (LLFA) for Hertfordshire is required to develop a Local Flood Risk Management Strategy (LFMS) which sets out how local flood risk will be managed.

2.1.2 The intention of HCC is to assess, prioritise and make recommendations for management of local flood risk through development of Surface Water Management Plans (SWMPs) for each district authority in Hertfordshire.

2.1.3 Of the proposed SWMPs that are to be delivered for the Hertfordshire's districts, two have already been prepared; the SWMP for Watford in May 2011 and the SWMP for St Albans in May 2010.

2.1.4 Since the production of the draft SWMPs the Environment Agency (EA) in December 2013 produced updated Flood Maps for Surface Water (uFMfSW). These were created from:

- the Environment Agency's new nationally produced surface water flood mapping; and
- appropriate locally produced mapping from LLFAs.

2.1.5 The uFMfSW, now referenced as the "Risk of flooding from Surface Water Mapping" (RfSWM) provide a single source of information on surface water flooding for England and Wales, it also enables LLFA to use the maps as an interactive tool, and to update the maps with local information as it becomes available.

2.1.6 With the emergence of the RfSWM and other potential additional information since the production of the Watford and St Albans SWMPs, HCC require a review of these two SWMPs to ensure that the areas at risk remain understood and suitably prioritised.

2.2 Surface Water Management Plans

2.2.1 A SWMP is described as a framework through which key local partners with a responsibility for surface water and drainage in their area work together to identify, prioritise and develop options for managing local flood risk.

2.3 Study Area

2.3.1 Watford and St Albans are district authorities in the county of Hertfordshire.

2.3.2 Watford is a town and borough situated 17 miles northwest of central London and inside the circumference of the M25; it is located to the south west of the county. The watercourses of the River Colne and the River Gade are located to the East and West of the town, respectively.

2.3.3 St Albans is a city and district located 19 miles north of London. The watercourse of the River Ver is located to the west of the town.

2.3.4 Within the district boundary of St Albans lies the villages and towns of Chiswell Green, London Colney, Redbourn, Wheathampstead and Harpenden.

3 Methodology

3.1 Key tasks for the SWMP Review

3.1.1 In February 2014 HCC commissioned WSP to undertake a review of the Watford and St Albans SWMP and to carry out the following activities:

1) *Review all SWMP schemes, 27 for Watford and 19 for St Albans, against the uFMfSW. Where significant discrepancies are found between the models and, or historical data, carry out further investigations to ascertain if the schemes remain valid. Where schemes do not qualify and are found to have become invalid propose relevant solution options and recommend which is the most economically advantageous.*

2) *Assess the validity of all scheme solutions.*

3) *Engage with the lead body for each scheme to investigate its status. Lead bodies are likely to be Hertfordshire County Council as Highways Authority, Thames Water, Watford Borough Council as local planning authority (LPA) and St Albans District Council as LPA. Schemes that are not led by one of these should be listed as priorities for HCC's flood risk management (FRM) team, who should be consulted as the lead body.*

4) *Ascertain whether the approach taken by the lead bodies remains appropriate for each scheme.*

5) *For the priority schemes list, the expected annual damage (EAD), costs, and cost benefit analysis (CBA) should be reviewed and bought up to date. These should be estimated using the methodology set out in the Flood and Coastal Erosion Risk Management: A Manual for Economic Appraisal (Multi-coloured Manual 2013). From a planning perspective the appropriate level of detail should be applied for early stage project assessment, as a guide this should be no more involved that the Royal Institute of British Architects (RIBA) Stage Two Concept Design. Specific details regarding the level of assessment will be agreed with HCC at the project inception meeting.*

6) *Recommend a programme for implementation of projects which have the potential to be commenced within a 5 year period.*

3.1.2 This report is an addendum to existing draft SWMPs produced by Mouchel on behalf of Hertfordshire County Council (HCC) for Watford and St Albans dated May 2011 and May 2010 respectively.

3.1.3 The report follows the requirements of the activities listed 1 to 6 above and comments made by partners and stakeholders as part of the SWMP review.

3.1.4 This document should be considered as an intermediate assessment (in terms of the Defra SWMP guidance) identifying broad locations of areas vulnerable to surface water flooding and providing recommendations for further investigations. The review informs Hertfordshire County Council in their role as Lead Local Flood Authority to facilitate funding for 5 priority sites that have been selected as part of the above activities.

3.2 Key Partners / Stakeholders, Roles and Responsibilities

Identifying Partners & Stakeholders

3.2.1 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. Under the legislative framework, involvement in a SWMP by all partners is voluntary. The Flood and Water Management Act (FWMA) 2010 requires LLFAs to take the lead role for local flood risk management, and have a coordination role in the development of SWMPs.

3.2.2 A partner is defined as someone with responsibility for decisions and/or actions, and they share joint responsibility for these decisions/actions. The Watford and St Albans SWMPs include the following partners:

- Hertfordshire County Council (as Lead Local Flood Authority);
- Environment Agency; and
- Thames Water.

3.2.3 A stakeholder is defined as anyone affected by the problem or solution. The stakeholders include organisations whose assets or networks can be affected by surface water flooding, local authorities and the general public. The following stakeholders were invited to be involved and make comments for the future Watford and St Albans SWMP:

- Watford Borough Council (WBC);
- St Albans Borough Council (SABC);
- Highways Authority (HCC); and
- Local Parish Councils.

Responsibilities of Partners

3.2.4 The Flood and Water Management Act, 2010 puts in place many of the changes recommended in the Pitt Review completed following the 2007 floods. It aims to provide better, more comprehensive management of flood risk for people, homes and businesses, partly through designating county/unitary councils as Lead Local Flood Authorities (LLFAs) and giving them new powers and duties, as well as extending their previous responsibilities for flood risk management

3.2.5 **Hertfordshire County Council** as Lead Partner for the SWMP has the following new responsibilities under the provisions of the Act:

- A duty to cooperate with and provide information to other risk management authorities;
- Ability to pass flood functions onto another risk management authority when agreed by both sides e.g. consenting works in ordinary watercourses;
- Development, maintenance, application and monitoring of a strategy for local flood risk management across Hertfordshire, for example through the “The Local Flood Risk Management Strategy for Hertfordshire document 2013 - 2016.”
- Strategic leadership of local risk management authorities;
- Powers to request information from any person in connection with the authority’s flood risk management functions;
- A duty to investigate and publish reports on flooding incidents within Hertfordshire (where appropriate or necessary) to identify which authorities have relevant flood risk management functions and what they have done or intend to do;

- A duty to maintain a register of structures or features which have a significant effect on flood risk in Hertfordshire, in the view of the LLFA;
- Power to undertake works to manage flood risk from surface runoff or groundwater sources including ordinary watercourses;
- Power to designate structures and features that could affect flooding and are considered to be significant when assessing local flood risk;
- Decision-making responsibility for whether works on ordinary watercourses by third parties that may affect water flow can take place;
- A duty to exercise flood risk management functions in a manner consistent with the national strategy;
- A duty to aim to contribute towards the achievement of sustainable development in the exercise of flood or coastal erosion risk management functions and to have regard to any Ministerial guidance on this topic.

3.2.6 The **Environment Agency** is an essential partner to the SWMP and has a wide range of responsibilities. Those applicable to SWMPs are as follows:

- Communicate with residents regarding all sources of flooding and issuing flood alerts applicable to river and sea;
- Working with other partners / stakeholder to prepare for emergencies;
- Respond to changes from climate change and the impacts of this to flooding;
- Investment in flood risk management projects; and
- Use SWMPs to help plan operations and maintenance regimes.

3.2.7 **Thames Water** is an essential partner to the SWMP process. They are responsible for public sewer systems and the reduction of sewer flooding in accordance with the Water Industry Act 1991. Their key responsibilities in accordance with the SWMPs are as follows:

- Communicate with residents regarding sewer flooding;
- Working with other partners / stakeholder to prepare for emergencies;
- Undertake Drainage Area and Sewerage Management Plans;
- Plan investment for the existing sewer systems; and
- Plan for future growth and respond to changes in population.

3.3 Mapping

3.3.1 The mapping shown within this report identifies broad areas which are more likely to be vulnerable to surface water flooding. This allows partners and stakeholders to undertake a more detailed analysis in areas which are identified as being the most vulnerable to flooding.

3.3.2 The maps shown within the report only illustrate the predicted extent and likelihood of flooding for defined areas. Due to the coarse nature of the source data used, the maps are not detailed enough to define risk for individual properties. Therefore individual properties may not face the same risk as the areas that the property is located in.

3.3.3 The mapping within this SWMP can be used to inform future spatial planning documents to ensure surface water flooding is appropriately considered when allocating land for future development.

3.3.4 There could be future occasions where flooding may occur, which do not relate to the predicted outline within the maps attached to this report. This is due to the limitations and uncertainties in the mapping and data along with the complexities of the mechanisms of flooding.

3.4 Key Task - Activity 1

3.4.1 A high level overview was initially undertaken to understand the number of properties predicted to be at potential risk within the latest RfSW and to undertake a comparison with the mapping previously produced for the SWMPs.

3.4.2 An overview for each district has been undertaken to illustrate the differences in the surface water mapping and to inform the high level overview, which included:

(a) Any discrepancies, at borough wide level (not study area level) from the previous SWMP extent;

(b) Additional sites that should be considered for inclusion within the updated SWMP; and

(c) Previous mitigation review from stakeholder meeting.

3.4.3 The overview of the study areas shows that there is a reduction in the number of properties when compared with the previous Watford and St Albans SWMP map outputs. Drawings included in Appendix B show the SWMP sites and comparison of properties predicted to be at potential risk. This reduction in flood extents is in line with what had been experienced in other urban LLFA areas, where the latest approach on the modelling is considered to better represent several parameters and flow paths such as the capacity of the surface water sewers.

3.4.4 In the instances where the latest maps have shown additional sites in the flood plain these have been illustrated within the attached drawings in Appendix A and also include recommended extensions and combinations of sites for assessment.

3.4.5 New additional areas have been identified as part of a high level overview. These are areas that are shown as being potentially significantly affected by surface water flooding and should be considered for further assessment within the SWMP.

3.4.6 In addition to the high level overview a consultation meeting was held with the key partners and the stakeholders consisting of the Watford Borough and St Albans District Councils and the Highway Authority. The draft SWMPs were reviewed by partners and stakeholders with comments made on the listed mitigation solutions and additional sites to be included within the SWMP review. The additional sites mentioned at the meeting included as follows:

- Alexander Road, Colney (which is adjacent to Site 27 of the draft SWMP);
- Rose Acre, Redbourn (new site not covered by the draft SWMP, 12 properties reported as flooded);
- Derwent Road, Harpenden (new site not covered by the draft SWMP).

3.4.7 Also referenced at the stakeholder meeting was Watford High Street; however this site has already been included within the draft SWMP and is therefore included within this SWMP review process.

3.4.8 The Combining sites has also been undertaken, where feasible, as part of the review process. This allows for proposed mitigation measures to benefit a wider area and also gives a greater understanding on the actual number of properties predicted to be at potential risk. It also means that they are likely to be more viable in economic terms. The sites that have been combined within the study and the reasons for combining them are listed in Table 1 below:

Table 1 – Site review

Site Reference	Location	Methodology
25 & 26	Watford	Site 26 forms part of the upper catchment affecting SW flooding within Site 25. The proximity of the sites is strategically close and mitigation measures would therefore benefit the wider combined site catchment.
38, 39 & 40	St Albans	The three sites are part of the same hydrological catchment with surface water falling from each site consecutively to site 40. Proximity of the sites is close and mitigation measures therefore proposed for any of the sites would help towards alleviating flooding within the catchment.
49 & 51	St Albans	The uFMfSW and LiDAR survey show overland flows would be directed from the upstream catchment of site 49 towards site 51. The proposed mitigation measures for site 49 would likely help reduce the impact to site 51.
1, 2, 3, & 5	Harpenden	Flooding is shown to affect the highway route of the A1081 (Luton Road). This route has a number of sites located along its extent. Luton Road is located within a valley with the surrounding rural and urban catchment area falling towards the highway. Levels from the upstream catchment of site 1 falls towards site 5. Therefore any mitigation measures within the upstream sites are likely to be effective for those within the lower catchments and wider area.
27 & Alexander Road	London Colney	Request made during stakeholder meeting to combine the two sites.

3.4.9 A number of sites were considered not to benefit from being combined due to either, topography (preventing mitigation for assisting a wider area), studies already undertaken at sites and/or mitigation works already undertaken. Those sites that were discounted as being combined are as follows:

(i) Sites 17,19, 19a &18 – Watford

(ii) Sites 20 & 29 – Watford

(iii) Sites 8 & 10 – Watford

(iv) Sites 21, 23 & 24 – Watford

3.5 Key Task - Activity 2

3.5.1 Following the high level overview of the Watford and St Albans scheme solutions, the list of selected sites within the previous SWMPs have been reassessed to determine the viability of the mitigation solutions proposed. The outcome of this overview is listed within Appendix B.

3.5.2 The adopted approach to determine the risk ratings of the partner key interest sites and those sites that are a priority is based on a multi-criteria approach. The selection criterion for determining the priority sites is based upon the principles of the Multi Coloured Manual (MCM) and data available for the SWMPs. The approach also gives a more detailed review of the sites than that previously used within the draft SWMPs.

3.5.3 The adopted approach consists of each site split and ranked into seven different categories. Each category is split into high priority, medium priority and low priority with the following weightings:

- High = 9
- Medium = 3
- Low = 1

3.5.4 The scoring categories are presented in Table 2 below.

Table 2 – Priority site scoring categories

Categories	Note	Scoring value		
		9	3	1
Residential	Number of dwellings within flood extent	20% Most deprived	20 – 40% Most deprived	Remaining 60%
Commercial properties	Commercial properties within flood extent.	Industrial buildings	Warehouses & offices	Retail building
Critical infrastructure	Critical infrastructure within flood extent	Electricity Generator / sewage treatment works	Fire / ambulance station / police station	Hospitals, hostels/ prisons / residential homes
Road crossings	Road crossings within flood extent	Main road / A road intersection	B road intersection	Very high impact
Education and cultural / civic buildings	Education, cultural and civic buildings within flood extent	Schools / colleges/ universities/ nursery / museums and libraries	Churches	Community centre/ halls/ law courts

Categories	Note	Scoring value		
		9	3	1
Railways	Railway infrastructure within flood extent	Station / intercity rail track	*N/A*	Local rail track
Listed buildings	As the vulnerability and impacts of flooding will really be dependent upon the type of property that is listed (due to the wide range of structures that can be listed) all listed buildings are given equal weighting of Low.	*n/a*	*n/a*	All

3.5.5 Each of the seven categories listed above were also weighted to enable prioritisation of different areas; 7 being the higher value and 1 the lowest.

3.5.6 To facilitate the priority site selection 5 scenarios were modelled. The first scenario assessed was a control assessment where all sites were given the same value ranking. Four other scenarios were then modelled with different values attributed to each importance. This process enabled any weighting errors or extremes to be reduced. These are illustrated in Table 3 below:

Table 3 – Importance Values for Priority Site Scenario

Scoring Categories	Scenario				
	Control	A	B	C	D
Residential properties	1	7	6	7	5
Area of commercial	1	5	5	4	6
Critical infrastructure	1	6	7	6	7
Road crossings	1	2	2	2	4
Cultural and civic	1	4	4	5	3
Railways	1	1	1	1	2
Listed buildings	1	3	3	3	1

3.5.7 Several scenarios were modelled to determine the importance values for Hertfordshire to help inform the priority site selection. The results from the Activity 1 works were also used to inform the priority site selection. The Priority Sites selected for the economic assessment are as follows:

- Combined sites 1 to 5 (St Albans)
- Combined Sites 25-26 (Watford)
- Site 13: Sotheron Road (Watford)
- Extension to Site 8 (Watford)
- Combined Sites 38 to 40 (St Albans)

3.5.8 The additional sites identified during the stakeholder meeting; Rose Acre, Redbourn, Alexander Road, London Colney and Derwent Road, Harpenden are within the mid to lower of the ranking table for the priority schemes review.

3.5.9 An overview of the current flooding and a drainage review for the Alexander Road, London Colney and Derwent Road, Harpenden have been included within Appendix B to help facilitate future funding options, as these are identified sites as priority areas based upon specific local knowledge.

3.5.10 Rose Acre, Redbourn has not been included within the review as a Section 19 Flood Investigation is currently being undertaken for the site.

3.6 Key Task - Activity 3 & 4

3.6.1 Hertfordshire County Council as Highways Authority, the Environment Agency (EA), Watford Borough Council (WBC), St Albans District Council (SADC), Thames Water and local parish councils have all been contacted for comments on the emerging SWMP review. Key partners and key stakeholders attended a stakeholder meeting, for input into the latest SWMP. Comments were received at the meeting from the EA, Thames Water, WBC, SADC and Hertfordshire County Council as Highways Authority.

3.6.2 Mitigation measures listed within the proposed schemes were discussed at the Stakeholder Meeting. The comments from the stakeholders have been incorporated within the mitigation proposals for the sites and an updated review of the schemes is provided within Appendix B.

3.6.3 The works in Appendix B are for the sites listed within the draft SWMP and the two additional sites identified during the stakeholder meeting of Alexander Road, Colney and Derwent Road, Harpenden.

3.7 Key Task - Activity 5

3.7.1 The Economic Assessment is to be focused upon 5 priority schemes determined as part of the initial activities.

3.7.2 The cost was estimated using the methodology set out within the Flood and Coastal Erosion Risk Management: A Manual for Economic Appraisal (Multi-coloured Manual 2013).

3.7.3 By virtue of the available data the economic assessment has been based upon a limited number of return periods derived from a relatively coarse national dataset. This means that rather than calculating the damages at a wide range of return periods only two (1 in 30 and 1 in 100) were used and interpolated between. This approach is suitable at this level of study to provide an initial understanding of which schemes may secure funding after further studies. There is a risk that this approach may over or under estimate the damages and further studies which should be based upon site specific modelling (i.e. using a tighter grid and inclusion of local features and drainage network along with property thresholds) which will provide a more accurate damage profile and could alter the benefit cost ratio.

3.7.4 The benefit-cost ratio required to take a scheme forward is no longer as straight forward as when the original SWMP was prepared. There have been several changes to the Flood Defence Grant in Aid (FDGiA) approach to increase the importance of localism in the funding mix. As a result of this schemes are largely no longer able to secure 100% FDGiA funding (although high risk areas i.e. those with significant depths and/or velocities may still secure full funding), as more importance has been attached to partnership funding (such as LA, residents or developer contributions) and the delivery of other benefits (e.g. habitat and water framework directive goals). As the time of the SWMP preparation the Medium Term Plan (MTP) is currently being finalised, which covers the FDGiA for the next 6 years. Once this has been finalised the target benefit/cost ratios to secure funding will be known. FDGiA can also be supplemented by the local levy and the degree to which this can contribute to the funding is largely driven by the attitudes of the Regional Flood Defence Committee (RFDC) and the pressures placed upon this across the catchment and local residents, as

represented by their elected members. Further information on the funding options is detailed in section 6.

3.7.5 Further studies are required for the majority of the priority sites in order to better understand the suitable mitigation proposals. However to enable an economic viability study to be undertaken and to determine the suitability of progressing the additional studies indicative costings have been estimated.

3.7.6 The costs have been estimated based on standard pricing books (e.g. SPONS) and experience of similar engineering works (e.g construction of embankments, storage areas and new sewers under existing roads). In the absence of detailed information a number of assumptions were made for the costing, these are listed in Table 4 below:

Table 4 – Costing Assumptions

Component of cost	Assumption
Additional studies (Including surveys, and flood studies. The amount depends on scale of likely scheme based on experience of similar works)	£15,000 to £40,000
Additional pipework under existing carriageway	£260 / m
Embankments / bunding (using imported fill)	£25 / m
Soakaway tests	£1,750 (day rate)
Swale / infiltration trench	£105 / m
Storage areas	Estimated based on area available for storage feature and estimating the duration and approx. volume to be excavated, disposed or bought on site.
New weir (including works, automation, engine and electrical supply)	Lump sum of £105,000

3.7.7 Maintenance costs were based on those listed within “Sustainable Drainage, Cambridge Design and Adoption Guide”.

3.7.8 Third party land costs have been excluded from the costings and will need to be included within any future costings.

3.7.9 SuDS options and relief solutions are detailed within the draft SWMPs for Watford and St Albans.

3.7.10 The results for the economic assessment are separated into the corresponding SWMP districts, Section 4 and Section 5 of this report lists the results for Watford and St Albans respectively.

3.7.11 From the review process of activities 1 to 4 a range of possible mitigation measures has been identified, which could be implemented at each priority site to reduce the impacts and damage associated with flooding. At each priority site several measures were identified and assessed as a first step in assessing the various options to manage surface water flood risk in line with the SWMP objectives.

3.7.12 The following categories of measures have been considered:

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

3.7.13 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 measure, or a combination of previously defined measures.

3.7.14 The measures and options were discussed with the partners during meetings. During these discussions the criteria in Table 5 were considered to ensure the options were viable and beneficial.

Table 5 - Option Criteria

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

4 Watford SWMP

4.1 Ranking of Priority Site Locations

4.1.1 The sites and their associated ranking, scenario and final score are detailed in Table 6 below. It should be noted that in some areas the number of properties inundated is likely to be artificially high due to the resolution of the modelling coupled with the GIS method of counting. Much of this assessment was undertaken in GIS using the National Receptors Database, which assigns a class value to the property, it should also be noted that the threshold levels are not accounted for. Appendix A shows the location of the sites.

Table 6 - Ranking of hotspot locations and scores for each criteria

Rank	Draft SWMP refer	Site Reference	Score				
			Control	A	B	C	D
1st	25 -26	Combines Sites 25 to 26	506	3274	2845	3292	2471
2nd	13	Sotheron Road	455	3137	2693	3135	2269
3rd	8	Extended Site 8 Balmoral Road / Imperial Way	405	2479	2189	2482	1976
4th	N/A	P32 St Albans Road / Bushey Mill Road	267	1468	1342	1423	1337
5th	6A	Falcon Way / Gaddesdeon Crescent	98	646	556	646	482
6th	24	Lower High Street	92	327	324	284	457
6th	21	Extension to Site 21 – Wiggenhall Road	92	361	326	360	404
7th	6	Extension to Site 6 The Gossamers	89	593	510	593	439
8th	4	Gammons Lane	85	556	479	555	416
9th	10	Eastfield Avenue – Radlett Road	63	421	362	421	311
10th	N/A	P33 Chalk Hill / London Road	61	414	356	414	304
11th	N/A	P30 Peregrine Close to Harvest Way	55	297	283	315	252
12th	1	Extension to Site 1 Hempstead Road	52	249	220	249	237

Rank	Draft SWMP refer	Site Reference	Score				
			Control	A	B	C	D
13th	12	St Albans Road	41	168	175	184	178
13th	7	Eastlea Avenue	41	272	234	272	202
14th	27	Watford Heath	31	122	110	122	136
15th	14	Radlett Road	29	421	166	193	143
16th	18	Rickmansworth Road / Whippendell Road	23	56	54	56	94
18th	20	Vicarage Road	22	90	88	108	72
19th	N/A	P31 Colney Way	12	59	57	50	65
20th	9	Busheymill Lane	11	52	46	52	50
21st	28	Stratford Way / Parkside Drive	9	43	38	43	41
22nd	11	Copsewood Road	9	63	54	63	45
23rd	23	York Road / Munel Avenue	9	44	50	58	44
24th	17	Rickmansworth Road	8	51	44	51	39
25th	15a	Harwoods Road / Mildred Avenue	8	41	36	41	37
26th	16	Water Lane	2	4	4	4	8
27th	19	Hagden Lane / Princess Avenue	1	2	2	2	4
28th	29	Jellicoe Road	0	0	0	0	0
29th	3	West Herts College	0	0	0	0	0

4.2 Priority Sites

4.2.1 As detailed in Section 3, several scenarios were modelled to determine the importance values for Hertfordshire to help inform the priority site selection. The results were to use priority sites based on the results of the Activity 1 works. The Priority Sites selected for the economic assessment for Watford District were as follows:

- Combined Sites 25-26 (Watford)
- Site 13: Sotheron Road (Watford)
- Extension to Site 8 (Watford)

4.2.2 Watford High Street (Site 24 of the SWMP) was raised as a priority site during the stakeholder meeting. A SFRA has been produced for this area and a review of the mitigation measures and proposals was undertaken to ensure that they remain viable and deliverable. The results of this review are listed within Appendix B of this report.

4.2.3 A SFRA for Watford High Street was produced in draft at time of writing this report. Watford Borough Council have undertaken a Level 2 SFRA study to investigate the flood risk associated with proposed development sites. The Level 2 SFRA forms an important part of the evidence base and framework for managing and addressing future flood risk. The evidence from the SFRA has been used to help inform the site viability assessment in Appendix B.

4.2.4 The priority schemes costed are illustrated in Table 7 with their benefit cost ratios.

Table 7 – Benefit Cost Ratio

Site	Comments	Annual Average damage	Present Value Damage	Present Value Benefit	Present Value Cost	Benefit / Cost Ratio
Combined Sites 25 - 26	Assume no damages at either the 30 year and 100 year event	£20,880	£623,564	£130,834	£105,500	1.24
Site 13	Assume no damages at either the 30 year and 100 year event	£64,560	£1,927,973	£489,430	£128,750	3.8
Extension to Site 8	Assumes no damages at the 30 year event but still all damages at the 1 in 100 year event	£49,561	£1,480,055	£269,433	£93,609	2.88

4.2.5 The outcome of the above assessment and how this is applicable to the future funding is discussed further in Section 6 of this report.

5 St Albans SWMP

5.1 Ranking of Priority Site Locations

5.1.1 The sites and their associated ranking, scenario and final score are detailed in Table 8 below. It should be noted that in some areas the number of properties inundated is likely to be artificially high due to the resolution of the modelling coupled with the GIS method of counting. Much of this assessment was undertaken in GIS using the National Receptors Database, which assigns a class value to the property, it should also be noted that the threshold levels are not accounted for. Appendix A shows the location of the sites.

Table 8 - Ranking of Hotspot Locations and Scores

Rank	Draft SWMP refer	Site Reference	Score				
			Control	A	B	C	D
1st	1 to 5	Combined Sites 1 to 5 Luton Road – High Street Harpenden	690	2441	2285	2441	2997
2nd	38-40	Combined Sites 38 to 40 Lockes Grove to Camlet Way, St Albans	394	2618	2252	2618	1942
3rd	N/A	P59 Normandy Road, St Albans	232	1444	1250	1443	1125
4th	N/A	P62 Sherwood Avenue / Belsize Close, St Albans	221	1437	1238	1437	1083
5th	N/A	P58 Upper Latimore Road, St Albans	195	1118	998	1114	958
6th	N/A	P61 Thirmere Drive, St Albans	185	1250	1074	1250	916
7th	N/A	P17 Rose Acre, Redbourne	142	862	752	862	681
8th	49	Extension to Site 49, House Lane, St Albans	112	729	628	729	549
9th	N/A	P60 Flinders Close / Roeney Avenue, St Albans	91	497	434	497	427
10th	N/A	P11 Tuffnells Way / Vale close, Harpenden	66	432	372	432	324
11th	30	Haseldine Road, St Albans	65	423	365	422	319
12th	14	Hemel Hempstead, St Albans	62	381	332	381	292

Rank	Draft SWMP refer	Site Reference	Score				
			Control	A	B	C	D
13th	56	Brampton Road, St Albans	61	417	358	417	303
13th	N/A	P10 Townsend Lane, Harpenden	61	378	327	377	294
14th	6	Southdown Road, Harpenden	55	367	316	366	273
14th	26	Peters Avenue, St Albans	55	364	315	364	273
15th	27	Combined Sites 27 & Alexander Road, London Colney	47	320	275	320	234
16th	35	High Street / House Lane, St Albans	37	203	178	202	175
17th	16	Mansdale Road, St Albans	33	221	190	221	163
18th	N/A	P9 Coldharbour Lane, Harpenden	30	128	127	107	163
19th	N/A	P12	28	181	156	181	137
20th	N/A	Derwent Road, Harpenden	25	170	146	170	124
21st	8	Grove Road	19	83	74	83	85
22nd	34	St Albans Road	9	28	175	184	178
22nd	N/A	Rose Acre, Redbourne	9	58	50	58	44
23rd	N/A	P57b	8	16	16	16	32
24th	N/A	P57a	0	0	0	0	0

5.2 Priority Sites

5.2.1 As detailed in Section 3, several scenarios were modelled to determine the importance values for Hertfordshire to help inform the priority site selection. The results were to use the priority sites based on the results of the Activity 1 works. The priority sites selected for the economic assessment for St Albans District were as follows:

- Combined sites 1 to 5 (Harpenden)
- Combined Sites 38 to 40 (St Albans)

5.2.2 The additional sites identified during the stakeholder meeting of Rose Acre, Redbourn, Alexander Road London Colney, and Derwent Road, Harpenden are within the lower rankings of the priority schemes review.

5.2.3 An overview of the current flooding and a drainage review for each for Alexander Road, London Colney and Derwent Road, Harpenden have been included within Appendix B to help facilitate future funding options, as these are identified as critical areas based upon specific local knowledge.

5.2.4 Rose Acre, Redbourn has not been included within the review as a Section 19 Flood Investigation is currently being undertaken for the site.

5.2.5 The priority schemes have been costed and are illustrated in Table 9 with their Benefit cost ratios.

Table 9 – Benefit cost Ratio

Site	Comments	Annual Average damage	Present Value Damage	Present Value Benefit	Present Value Cost	Benefit / Cost Ratio
Combined Site 1 to 5	Assume no damages at the 30 year but still damages at the 100 year event	£123,730	£3,694,988	£1,808,666	£812,662	2.23
Combined Site 38 to 40	Assume no damages at either the 30 year and 100 year event	£0	£0	£3,370,358	£75,599	44.58

5.2.6 Sites 38 to 40 have a large benefit/cost ratio. This is based upon the best available information (i.e. the RfSWM/Environment Agency Risk of Surface Water Flood Map) and the adopted economics approach. However, due to the high ratio further investigations were undertaken and it was deemed that as these sites are within a steeply sided valley therefore the actual damages may be overestimated, although there are several properties and businesses that are in high risk areas which means that a viable scheme should remain.

5.2.7 The outcome of the above assessment and how this is applicable to the future funding is discussed further in Section 6 of this report.

6 Funding Options

6.1 National Funding

Flood and Coastal Resilience Partnership Funding

6.1.1 Over the last couple of years changes have been made to the approach adopted by Central Government for allocating funding for Flood and Coastal Erosion Risk Management schemes. In short, a contribution to flood risk management schemes from the Flood Defence Grant in Aid (FDGiA) funding is now provided whenever there is a **positive ratio** of benefit to cost (i.e. this applies to all of the priority schemes). However, a positive ratio does not necessitate full funding and the formula determines the amount of Central Government funds based on the calculated ratio.

6.1.2 The amount of Central Government funding that can be secured for each of the priority schemes will be linked to the number of households protected, the damages prevented, environmental benefits, amenity improvements, agricultural productivity (unlikely for the majority of the priority schemes) and economic benefits. The payment rates for household protection will vary depending on the index of multiple depravation; with more deprived households receiving higher payment rates. This ensures that schemes identified within poorer areas are more likely to receive full funding from Central Government.

6.1.3 The calculation of funds to be provided by FDGiA is as follows[1]:

$$\text{Share of costs funded by Defra} = \frac{\text{Household benefits} + \text{other whole-life benefits} + \text{environmental outcomes}}{\text{Amount of funding required}} \times \text{Fixed payment rates}$$

6.1.4 The benefit of this approach is that more schemes will be eligible for some national funding including minor schemes and those not solely related to fluvial and/or coastal flooding. However, it is now more difficult to obtain 100% funding from national sources and therefore cost saving measures and other sources of funding are likely to be required to fill the gap.

6.1.5 As the Medium Term Plan (MTP) is currently being finalised which will determine which schemes have allocated funding for the next six years by the Environment Agency and Defra it is difficult to estimate the threshold levels (i.e. cost benefit ratio) at which funding for this period will be allocated. Although the priority schemes will not be considered for inclusion in the six year plan, it does not mean that they cannot secure funding through this route as it is likely that there will be an annual review to ensure that the plan (spending £370m in 2015/16 to over £400m in 2020/21) remains on target to protect over 300,000 houses and deliver at least 15% in partnership funding in terms of flood defence spend, as some schemes will prove too challenging or uneconomic to deliver as they progress through the funding cycle.

[1] Taken from the Framework to assist the development of the Local Strategy for Flood Risk Management, 2nd Edition (Local Government Association, 2011)

6.2 Regional Funding

Local Levy

6.2.1 Watford and St Albans are in the area of Hertfordshire covered by the Thames Regional Flood and Coastal Committee's area of control (RFCC). Part of the RFCC's powers include raising a Local Levy from Local Authorities (and where appropriate IDBs) and then providing these funds for flood risk management. The Local Levy is seen as one of the principal ways of obtaining funds where a shortfall from FDGiA occurs.

To obtain these funds it is important to engage with the RFCC early in the allocation process once a decision has been made whether HCC/partners wish to progress with each of the priority schemes.

6.3 Local Funding

6.3.1 Depending on the shortfall from FDGiA and the number of schemes competing for the RFCC's allocation, it is possible that the Local Levy will not solely provide all the required funding for a scheme and therefore other measures could be explored in the future if necessary.

Section 106 agreements and the Community Infrastructure Levy

6.3.2 To be compliant with the National Planning Policy Framework all new development as part of the planning process needs to take account of flood risk from all sources. It should be designed in such a way that flood risk is managed appropriately for the development and also to ensure that there is no adverse impact on flood risk elsewhere. In managing flood risk for a development it may bring benefits to the management of flood risk for surrounding properties as a natural consequence. The local planning authority's local plan and supporting Strategic Flood Risk Assessment may set out specific requirements on how flood risk should be addressed both generally in the district and for specific locations.

6.3.3 A development may make contributions to infrastructure away from the development site either through Community Infrastructure Levy (CIL) or a Section 106 agreement. Payments under such agreements may make a direct or indirect contribution to flood risk management projects but that very much depends on local circumstances and normally would be associated with projects of general benefit such as making access to an area more flood resilient.

6.3.4 However it may be possible for proposals to reduce flood risk in an area to "piggyback" projects associated with development either on site or being funded off site through section 106 and CIL. Examples would be using funding from elsewhere to enhance the flood risk management infrastructure already required on a development site so that it brought wider benefits or by enhancing, for example, an offsite access or amenity project so that it could also bring flood risk benefits .

Business rate increases

6.3.5 Local business rates could be increased for a short period to cover any short fall, with the express purpose of using the money for flood risk management. However, this is unlikely to be suitable for the majority of the priority schemes before consideration is given to the political aspects.

Council tax increases

6.3.6 Certain LLFAs are known to have increased council tax across their localities with the express purpose of spending on local flood risk management.

6.4 Combination of Funding Sources

6.4.1 In summary, for HCC to secure sufficient funding to deliver the schemes for each of the priority sites it is recommended that the approach that is adopted should try to secure funding from a variety of sources as few (if any) of the priority schemes are likely to have sufficient benefits to be 100% funded through the FDGiA system. This is shown in the Figure 1[2] below as "Payment for Outcomes (anticipated)".

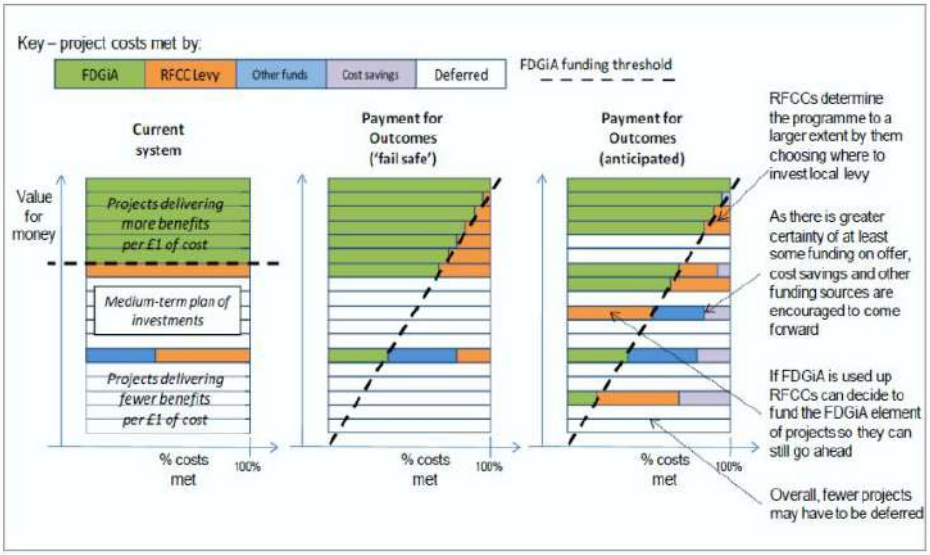

Figure 1 - Combination of possible different funding sources to cover costs of flood risk management schemes

[2] Taken from the Framework to assist the development of the Local Strategy for Flood Risk Management, 2nd Edition (Local Government Association, 2011)

7 Implementation and Review

7.1 Activity 6

7.1.1 The Action Plan for the priority schemes has been prepared and discussed with the HCC project team to ensure ownership of the actions. It will be a living document and open to review and changes over the long-term.

7.1.2 A stand-alone Action Plan (Appendix C) has been set out to identify the SWMP actions along with what is required to enable these actions to happen/be completed. This also includes target commencement and completion dates, maintenance regime(s), how the preferred option could be funded, what needs to be done to make this happen along with who is responsible for the action.

7.1.3 The Action Plan identifies the items that need to be taken forward and divides these into critical and optional paths. The critical path contains tasks which must be completed whereas the optional path contains tasks which do not necessarily need to be completed but should provide a cost benefit if they are taken forward. Both of these paths are split into high, medium and low priorities which identify an approximate time line for their completion. It is envisaged that high priority elements should be completed within six months, whilst medium priority elements should be completed between 6 and 12 months and low priority elements in 1 to 5 years.

7.1.4 The Action Plan contains various types of tasks which include policy changes, informative, GIS, maintenance. Each task identifies the lead partner, timescales along with the estimated external cost where it has been possible to derive this.

7.1.5 The tasks within the Action Plan are wide ranging, some of these tasks are outlined below:

- Continue existing partnerships;
- Creating a maintenance and repair programme to ensure that these assets operate at the maximum capacity;
- SuDS to be incorporated in new and re-development (retrofitting of SuDS in existing development should also be considered as a future measure);
- Influence third party landowners to retrofit SUDS measures;
- Continue to apply, and review, existing policy and look to influence national policy;
- Hertfordshire County Council is preparing an Flood Risk Asset Register for the county as required under the Flood and Water Management Act. A maintenance schedule for critical drainage infrastructure needs to be incorporated in the Asset Register;
- Continue a programme of enhancement of the Asset Register through surveying and recording the condition of all assets to include culverts, inlets, grills and outlets;
- Hertfordshire CC, district and borough councils, Thames Water and Environment Agency maintenance regimes/strategies of drainage features to be coordinated;
- Measures should be put in place to ensure that surface water flood risk is given the same consideration as fluvial flood risk during planning;
- The Groundwater Flooding Susceptibility and Risk Assessment should be undertaken and converted to a Supplementary Planning Document;
- Undertake further assessment of the potential technical options to refine the benefit-cost ratio;
- Explore the potential for alteration of the preferential flow paths to areas where less damage can occur such as roads;
- Explore opportunities to secure funding contributions towards the technical measures;

- Prioritise further assessment for the sites that were not assessed as part of this SWMP in order to secure funding and implement mitigation measures;
- Undertake measures to increase the public awareness of the surface water flood risk to ensure that the public are aware of the risks and can take measures to reduce the associated risks prior to any flood event occurring.

7.2 Emergency Planning

7.2.1 The findings from the SWMP should be used as a resource to inform HCC's planning and response to flood incidents.

7.2.2 The findings and outputs of the SWMP such as the flood hazard maps should be used to inform the emergency plan for Hertfordshire in terms of drainage and flooding issues. This should include the identification of properties within the flood plain inhabited by vulnerable people, to ensure they are prioritised should evacuation be required.

7.2.3 The Multi Agency Flood Plan which will assess flood risk in terms of Health, Social, Economic and Environmental issues.

7.3 Next Steps

7.3.1 Hertfordshire County Council as the lead partner of the SWMP will undertake a scrutiny of the Action Plan with input from the SWMP partners.

7.3.2 To ensure a successful implementation and review of the Surface Water Management Plan, all partners must contribute to the process. Clear lines of communication and defined responsibilities are critical.

7.3.3 Consideration of the environmental implications of the mitigation options for each site will need to be appropriately assessed as part of the detailed design stage.

7.3.4 The SWMP should be used to inform and advise the Plans and Polices for the area and emergency planning as well as inform local planning decisions.

7.3.5 A program of further works to include implementation of the elements within the action plan should be prepared and a provisional timetable for completing follow up actions should be agreed by all partners. As a SWMP study is considered to be a long-term plan, partners should continue to work together after the SWMP study has been completed.

7.3.6 The SWMP will inform the preparation of future maintenance programmes for surface water management assets within Watford and St Albans and any necessary co-ordination of maintenance programmes of different partners to ensure their effective operation. As the SWMP identifies the locations at greatest risk of surface water flooding, this information can be used to target maintenance improvements in areas at greatest risk. This can also be used to identify areas to apply for funding and support any funding applications that are required to ensure the schemes are completed.

8 Conclusions

8.1.1 WSP UK Limited has completed a Surface Water Management Plan update and review on behalf of Hertfordshire County Council for Watford and St Albans. The study has been undertaken in consultation with key local partners and stakeholders who are responsible for surface water management and drainage in the area. The partners worked together to understand the causes and effects of surface water flooding and agree the most cost effective processes of managing surface water flood risk for the long term. The process of working together as a partnership is designed to encourage the development of innovative solutions and practices as well as identifying funding streams to assist in the delivery of the outcomes of the SWMP.

8.1.2 The emergence of the Risk of Flooding from Surface Water Mapping (RfSWM) has enabled a review of the draft SWMPs for Watford and St Albans. The results of this comparison show a reduction in the predicted number of properties which may be affected by surface water flooding.

8.1.3 An overview of the sites selected within the previous draft SWMPs have been undertaken and potential mitigation solutions assessed. These have been based on the following key categories:

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

8.1.4 Following stakeholder consultation, two additional sites were included in the review process to help future funding facilities and potential studies.

8.1.5 The review of the SWMPs enabled an assessment for Priority Sites to be undertaken based upon with the principles of the Multi Coloured Manual (MCM) and the latest data available for the SWMP. The priority site criterion resulted in five sites being selected, three sites for Watford and two sites for St Albans.

8.1.6 Further studies are required for the majority of the priority sites to better understand the suitable mitigation proposals. However, to enable an economic viability study to be undertaken and to determine the suitability of progressing the additional studies indicative costings were estimated within the SWMP.

8.1.7 As the Medium Term Plan (MTP) is currently being finalised which will determine which schemes have allocated funding for the next six years by the Environment Agency and Defra it is difficult to estimate the threshold levels (i.e. cost benefit ratio) at which funding for this period will be allocated. Although the priority schemes will not be considered for inclusion in the six year plan, it does not mean that they cannot secure funding through this route as it is likely that there will be an annual review to ensure that the plan (spending £370m in 2015/16 to over £400m in 2020/21) remains on target to protect over 300,000 houses and deliver at least 15% in partnership funding in terms of flood defence spend, as some schemes will prove too challenging or uneconomic to deliver as they progress through the funding cycle.

8.1.8 A stand-alone Action Plan has been set out to identify the SWMP actions along with what is required to enable these actions to happen/be completed. This also includes target commencement and completion dates, maintenance regime(s), how the preferred option could be funded, what needs to be done to make this happen along with who is responsible for the action.

8.1.9 The Surface Water Management Plan is to be a living document that should be reviewed approximately every five years, to ensure the implementation of the agreed actions is correct and that any new issues are addressed. A review may be required following any new flood event, when new flood data becomes available or new modelling techniques are developed and when there is a change of policy in the catchment.

8.2 Recommendations

8.2.1 It is recommended that further studies are undertaken within the priority sites to better understand the potential mitigation and economic solutions available.

8.2.2 The SWMP Action Plan identified the need for the established partnership to continue working together. The various departments in Hertfordshire County Council such as Highways, Planning and Development Control, the Borough and District Councils can use this SWMP to help facilitate further workings to achieve their goal of minimising the surface water flood risk impacts of new developments or extensions. Close collaboration between departments will ensure that surface water flood risk is given the same consideration as fluvial flood risk during planning.

8.2.3 Opportunities to reduce surface water flooding in new developments should be considered during the planning stage including maintaining existing overland flow routes or ensuring diversion of the overland flow route if development is going to cross the flow path. However, it should be noted that the risk identified by this SWMP is strategic and additional site specific analysis should be undertaken for new developments to quantify the risk specific to the site.

8.2.4 Coordination and cooperation between the various departments within Hertfordshire County Council should ensure that notification of flood warnings from the Environment Agency's Flood Warning system and the joint Flood Forecasting Centre are shared and can be acted upon in a timely and efficient manner.

8.2.5 Retro-fitting of SuDS for existing developments should also be considered/promoted to third party landowners, particularly for areas with the worst predicted surface water flooding. In addition, SuDS should be heavily promoted within new development sites to help reduce surface water runoff to greenfield runoff rates where ever possible.

8.2.6 In addition to the technical solutions the recommended flood mitigation options include ensuring coordinated maintenance is undertaken, assessing the need for flood resilience and resistance measures on a site specific basis as required, retrofitting SuDS, implementing existing policies and promoting SuDS take up as part of Hertfordshire's future new role.

8.2.7 Once the identification of key flood assets is complete, a maintenance and inspection schedule should be implemented should to ensure that they will be fully functioning when required.

Appendices

- Appendix A – Overview of SWMP Sites
- Appendix B – Viability of Sites Review
- Appendix C – Action Plan