West Northamptonshire Water Cycle Study

Pre-Submission Joint Core Strategy

Detailed WCS Final report

September 2011




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Halcrow Group Limited

Burderop Park
Swindon
SN4 0QD

01793 812479

http://www.halcrow.com/html/our_markets/watercycleplanning.htm

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Revision schedule:

Date	Document reference	Stage	Author
23/05/2010	WUNNDC007	Confidential draft report for steering group consultation only	ADM
29/07/2010	WUNNDC008	Confidential draft final report for steering group consultation only	ADM
11/01/2011	WUNNDC009	Confidential final report (as amended with RSS addendum) for steering group consultation only	ADM
15/04/2011	WUNNDC010	Draft final detailed WCS report for consultation	ADM
20/06/2011	WUNNDC011	Final detailed WCS report for signoff.	ADM
17/08/2011	WUNNDC012	Final detailed WCS report v2 for signoff.	ADM
30/09/2011	WUNNDC013	Final detailed WCS report v3.	ADM

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Appendices

1 Introduction

1.1 Background

1. This document updates and extends the draft Phase 1 water cycle study, prepared by Halcrow Group Limited and published in draft in June 2009. This report is a review of environmental and water services infrastructure capacity, and has been prepared to support the Joint Core Strategy[1].

2. This study addresses the key issues identified by the Phase 1 Water Cycle Study (WCS) and is intended to provide the water cycle evidence base to support the submission of the Core Strategy. This report:

- Brings the phase 1 study in line with the latest dwelling forecasts, preferred spatial distribution and timeline
- Reviews the implications of the Water Framework Directive, and the final River Basin Management Plans published by the Environment Agency in December 2009
- Assesses the implications of development on water resources and regional strategic water resources infrastructure
- Prepares demand management scenarios and a water efficiency action plan for consideration through the Core Strategy
- Assesses the implications of the spatial distribution being tested through the Pre-Submission Joint Core Strategy on water services infrastructure capacity,
- Reviews wastewater treatment works consents and water quality
- Identifies requirements for wastewater treatment infrastructure
- Identifies requirements wastewater network infrastructure
- Identifies requirements for water supply infrastructure

[1] See http://westnorthamptonshirejpu.org/ for further details on the Joint Core Strategy and the Local Development Framework (LDF) progress.

2 Growth and development

3. Building new homes is not simply a matter of constructing the buildings themselves. To operate effectively as a home, and as part of a wider community, each building is also dependant on a range of services, and the infrastructure necessary to provide these. A critical component of this infrastructure is associated with water; the provision of clean water for drinking and washing; the safe disposal of waste water; and protection from flooding.

4. The addition of a small number of new homes may not represent a significant additional burden on existing water infrastructure. However when large numbers of houses are built, there is a risk that existing infrastructure will be overwhelmed, and both the environment and people's quality of life, will suffer.

5. There is a finite capacity within the environment, and it cannot simply provide more and more water to serve new development. Equally, there is a limit to the amount of waste water that can be safely returned to our rivers and the sea without having a detrimental impact on the environment. Furthermore, we know that extreme rainfall can overwhelm drains and overtop flood defences. Climate change is bringing fresh challenges as patterns of rainfall are predicted to change, with more intense rainfall events. We must also make sure that water infrastructure contributes to the shift to a low carbon economy that is essential if greenhouse gas emissions are to be reduced. Planning for water has to take into account these natural constraints, and factors such as the timing and location imposed by the development itself.

2.1 Water cycle processes

6. The water cycle includes the processes and systems that collect, store, or transport water in the environment. Water cycle processes are both above and below ground level, and can be either natural or man-made. In an undeveloped area, the water cycle includes rainfall landing on the ground, where it is either transferred into above ground streams, rivers, wetlands, floodplains, and estuaries to the sea, or is absorbed into the soil, ending up in groundwater storage aquifers. The cycle is completed by evaporation from these systems back into the atmosphere.

7. In a developed area, the natural processes and systems are sometimes adapted for development or public health reasons. For example, water is taken from rivers, treated, and piped via water supply systems into urban areas. Wastewater produced by houses is collected in a below ground sewerage system, where it is transported to a wastewater treatment works before being discharged to the sea, rivers or to groundwater.

8. The natural processes are extremely important for wildlife and ecology, and even man made systems can have biodiversity and wildlife interest. It is important that when building new homes, or even redeveloping existing areas we understand the impact on the natural environment.

2.2 Sustainable growth

9. In order to ensure that development and growth do not impact on environmental capacity, and that necessary infrastructure is provided when and where it is needed, the water cycle study brings together stakeholders such as West Northamptonshire Development Corporation, Northampton Borough Council, Daventry District Council, South Northamptonshire Council, Anglian Water Services Ltd (AWS), and the Environment Agency.

10. This Water Cycle Study provides evidence of the impact of the development proposed in the Joint Core Strategy for West Northamptonshire on water quality and supply and is an important part of the evidence base which underpins the strategy.

11. Following on from the Level 1 SFRA for West Northants and the Level 2 SFRAs for Northampton and Daventry and South Northants, this water cycle study report is the final report of a process that has sought to understand the implications of ongoing growth and development in West Northamptonshire on the water cycle processes.

2.3 The current spatial distribution

12. The population of West Northamptonshire in 2007 was 372,000; around 8% of the total East Midlands region. West Northamptonshire contains a diverse range of settlements, from villages and hamlets, to market towns and main urban centres. A summary of the key characteristics of the main settlements is shown in Table 2-1.

Table 2-1 Settlement Characteristics

Settlement name	2007 population	Historical information	Current characteristics
Northampton	202,000	Northampton is the County town and main hub for area's employment, retail and culture. Much of the town's expansion has been since the 1960's. Northampton was designated as a new town in 1968.	Generally successful town but with a centre that in terms of investment hasn't kept pace with the increase in population. Requires major new investment in town centre retail, office and housing improvement led regeneration.
Daventry	25,000	Overspill town from London and Birmingham, with major growth in 1960s and 1970s	Town set to experience 2nd phase of major expansion
Towcester	10,000	Oldest town in Northamptonshire, market town	Has seen recent housing expansion without corresponding jobs or infrastructure; high levels of out-commuting
Brackley	14,000	Historic market town	Extensive housing expansion over past 20 years, without corresponding jobs or infrastructure; recent decline in retail
Villages and Hamlets (190 in total)	121,200 (remainder of population)	Changed considerably over past 20-30 years	Many rural jobs no longer exist, and village facilities vary significantly

2.4 Development policy context

13. The Secretary of State has given notice that the government will abolish the Regional Spatial Strategies (RSS) through the Localism Bill. The Bill, which was introduced to Parliament in December 2010, provides for the abolition of regional strategies by enabling the repeal of Part 5 of the Local Democracy, Economic Development and Construction Act 2009 and the revocation of existing Regional Strategies.

14. The regional strategy for the East Midlands is the East Midlands Regional Plan 2009, and this will be revoked when the Localism Bill is enacted. Until then however the Regional Plan remains in force and is part of the development plan for the West Northamptonshire area. Whilst Regional Strategies remain part of the development plan for the time being, the Secretary of State has advised Local Planning Authorities that their intended abolition is a material consideration in planning decisions.

15. At its meeting on 26 October 2010 the West Northamptonshire Joint Strategic Planning Committee agreed to pursue the approach of looking at what can reasonably be achieved and delivered in terms of housing provision up to 2026, given the current economic difficulties, the reduced levels of funding for infrastructure and the potential time it will take for a full economic and associated housing market recovery to occur. The Committee noted that the annualised housing target would be substantially revised downwards and that the headline RSS housing figure of 62,125 would be replaced with a much reduced figure of around 50,000 homes. Therefore this water cycle study is based on a lower housing provision than the East Midlands Regional Plan and a revised spatial strategy from that included in the Emergent Joint Core Strategy in 2009. This revised spatial strategy is in fact the spatial strategy that has now been set out in the Pre-Submission Joint Core Strategy published for the statutory six weeks representations period under Regulation 27 of the Town and Country Planning (Local Development) (England) Regulations 2004 (as amended 2008).

2.5 Distribution and phasing of development

16. Table 2-2 details the Sustainable Urban Extensions (SUEs) identified in the Pre-Submission Joint Core Strategy and the expected development trajectory. Figure 2-1 shows the location of the SUEs.

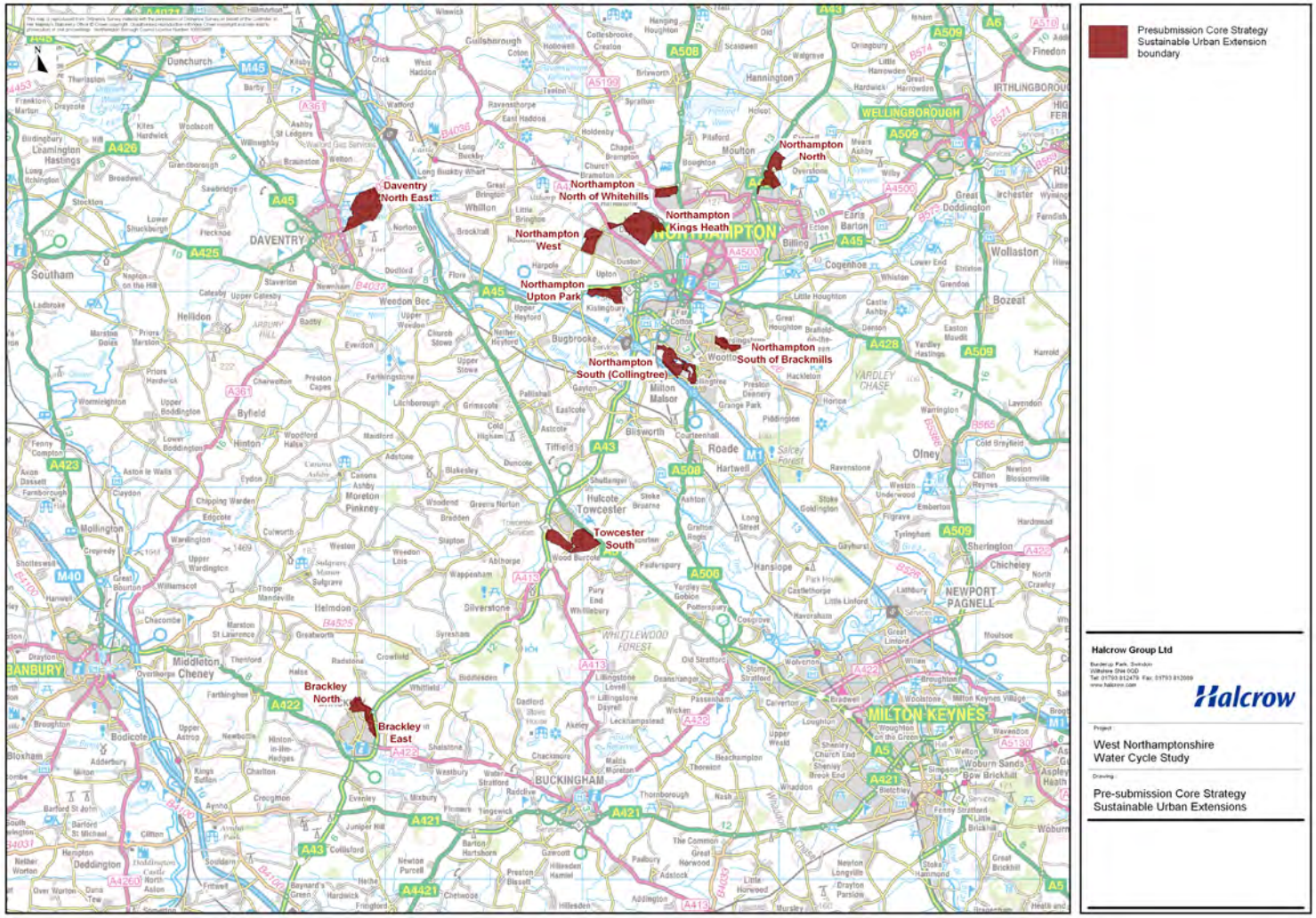
17. The commitments and application baseline are correct as at April 2009, and this is the baseline adopted by this study[2].

[2] The data in this report, and denoted in Table 2-3 is based on published information provided by the partner local authorities as part of their 5 year housing land supply statistics as at 1 April 2009. The study is cognisant there is revised baseline data available in the 2010 Joint Annual Monitoring Report for West Northamptonshire which updates the commitments, completions and allocations values. However, when the analysis that underpins this report was completed, the only available data was from 2009. There are a number of development locations that were included in the original analysis as commitments and allocations that have now been identified as SUEs. These include Northampton Upton Park, Northampton North of Whitehills, and Northampton Kings Heath. Commitments include sites that are either under construction or have outline / full planning permission and include local plan allocations where there is a realistic prospect of delivery in the plan period. Application sites are defined where there is a realistic prospect of delivery based on planning application activity, where a decision is either Pending or Approved in Principle (usually subject to signing S106 agreements), regardless of Local Plan Allocation status

Table 2-2 Pre-Submission Joint Core Strategy Sustainable Urban Extensions

Pre-Submission sustainable urban extensions	Council	Housing 2011 / 2016	Housing 2016 / 2021	Housing 2021 / 2026	Total Housing to 2026
Northampton South	Northampton BC	0	300	700	1000
Northampton South of Brackmills	Northampton BC	0	100	900	1000
Northampton Kings Heath	Northampton BC	230	1330	1940	3500
Northampton North	Daventry DC	250	1175	1075	2500
Northampton Upton Park	Daventry BC	180	600	220	1000
Northampton North of Whitehills	Daventry BC	120	640	240	1000
Northampton West	Daventry & S Northants	0	500	1000	1500
Daventry NE	Daventry DC	0	550	1450	2000
Towcester South	S Northants	240	610	650	1500
Brackley North	S Northants	180	850	350	1380
Brackley East	S Northants	0	380	0	380

Figure 2-1 Pre-Submission Joint Core Strategy sustainable urban extensions



18. A detailed breakdown of the latest understanding of existing commitments, including planning applications and local plan allocations for the whole of the West Northamptonshire joint core strategy area is given in Appendix A. The forecast growth timeline used in the following environmental and water services infrastructure assessment includes an assessment of the likely delivery of applications, commitments and allocations.

2.5.1 Commitments and applications

19. Table 2-3 outlines the current completions, planning applications and commitments for the WCS area.

Table 2-3 Commitments and applications in the WCS area (as at April 2009)[2]

	Completions	Planning Applications		Existing Commitments	
Location	2001- 2009	2009-2015	2016 onwards	2009-2015	2016 onwards
Northampton related development	10101	4150	3319	6337	2936
Daventry Town	2522	0	0	558	0
Other DDC Areas		0	0	400	0
Towcester		25	0	47	0
Brackley	2267	0	0	294	0
Silverstone		95	0	29	0
Other SNC		122	0	415	0

2.5.2 Daventry Appeals

20. Planning applications for three separate sustainable urban extensions in Daventry were submitted in 2007. These are:

- Monksmoor - Land at Monksmoor Farm, Welton Lane, Daventry – North - 1000 dwellings
- Churchfields - Land at Long Buckby Rd, Daventry – North east - up to 4000 dwellings
- Danetree - Land to the east of Daventry and north of the A45 road, Daventry – South east - up to 5150 dwellings

21. In 2008 appeals were submitted against non-determination of these proposals and were then heard at a Public Inquiry. The Inquiry started on Tuesday, 20 January 2009 and was expected to be completed at the beginning of April 2009.

22. At the end of February 2009, parties involved in the Daventry planning appeals agreed the Inquiry would be adjourned until later in the year.

23. The inquiry considered evidence from all parties with an interest in the proposed developments, including West Northamptonshire Development Corporation, Daventry District Council, Northamptonshire County Council, the Highway Agency, Environment Agency and the Appellants. Following this process, which took around 6 months in total and ended on 23rd July 2009, the inspectors compiled their report and prepared their recommendations for the Secretary of State.

24. Following this process, the Secretary of State has agreed with the Planning Inspectors regarding the Monksmoor appeal, which proposed 1,000 new homes on land at Monksmoor Farm, Welton Lane. The appeal is granted planning permission, subject to a number of conditions and a section 106 agreement.

25. There were also appeals regarding the Danetree and Churchfields areas. The Secretary of State has agreed with the Inspectors' conclusions regarding both these applications, consequently dismissing their appeals and refusing planning permission.

2.6 Environmental considerations

26. The Pre-Submission Joint Core Strategy recognises the importance of Green Infrastructure and sets out a policy approach which seeks to conserve, manage and enhance Green Infrastructure Corridors. This includes securing contributions from new development towards Green Infrastructure Networks. Due consideration will therefore need to be given to green infrastructure throughout the planning process.

27. West Northamptonshire has many areas noted for natural heritage and biodiversity. The areas include Sites of Special Scientific Interest (SSSI's), and the Upper Nene Gravel Pits Special Protection Area (SPA). Important habitats and species will be protected throughout the Local Development Framework process and the Habitats Regulations Appropriate Assessment will assess the impact of any of the preferred sites that are designated under European Directive.

28. The Pre-Submission Joint Core Strategy supports development that maintains and enhances existing designations and assets or deliver a net gain in biodiversity. Development which has the potential to harm sites of ecological importance are required to show how biodiversity is taken into account through design and implementation, how habitats can be conserved, enhanced and created, and in particular how designated sites, protected species and priority habitats will be safeguarded. Where adverse impacts are unavoidable, appropriate mitigation and compensatory measures will be required.

29. Policy BN8, the River Nene Strategic River Corridor, requires proposals for new development and habitat enhancement to demonstrate an understanding of the importance of the River Nene for biodiversity beyond the plan area. The phase 1 Water Cycle Study identified the ecological considerations associated with the water cycle and the implications of development. Appendix I contains an assessment of the importance of biodiversity sites within West Northamptonshire and provides some recommendations for development management to secure opportunities for biodiversity enhancement.

30. Policy BN9, Planning for Pollution Control, requires proposals for new development to demonstrate that that they provide opportunities to address existing pollution issues, and states that development which results in a deterioration of environmental quality, either individually or cumulatively will not be permitted. This water cycle study seeks to identify the cumulative impact of development on river water quality and achieving the Water Framework Directive requirements of Good Ecological Status in all waterbodies, and preventing deterioration of water quality.

31. With regards to climate change the Pre-Submission Joint Core Strategy outlines a policy approach to mitigate the effects of climate change and reduce carbon dioxide emissions through:

- making best use of existing infrastructure;
- providing alternative means of travel to the private car;
- encouraging the most sustainable approach to layout and design of development;
- promoting enhancement of the green infrastructure network;
- increasing woodland cover and safeguarding wetlands;
- considering the impact of development on the entire water cycle, and;
- seeking to adopt the highest standards of environmental performance and design in all development

32. Flood risk is a particular concern within West Northamptonshire, with the River Nene, Tove, Ouse, and their tributaries all contributing to flood risk. The role of the core strategy is to ensure new development is carried out in a sustainable manner. A level 1 SFRA has been completed for West Northamptonshire (February 2009) and level 2 SFRAs have been completed for South Northamptonshire and Daventry (June 2009) and Northampton (February 2010).

33. The evidence gathered in this water cycle study, and the other flood risk evidence base documents have informed the Pre-Submission Joint Core Strategy spatial objectives and the development of Core Strategy policies. There are number of spatial objectives that together ensure that the flood risk management concerns are explored fully, and that an understanding of flood risk management has informed the location of development. In particular, Objective 1 – Climate Change, Objective 2, Infrastructure and Development, Objective 11 – Housing, Objective 14 – Green Infrastructure and Objective 15 – High Quality Design, are important for effective future flood risk management. Policy BN7 – Flood Risk, has built on the outputs of the flood risk evidence base studies, and describes the proposed approach to flood risk & development management. It specifies that, where sustainable drainage techniques are required, these should;

- ensure surface water and foul sewer separation
- be accompanied by a long term management and development plan
- and protect and enhance water quality

2.7 The Water Framework Directive

34. The Water Framework Directive (WFD) came into force in December 2000, and was transposed into UK law in December 2003. It is the most substantial piece of European Commission water legislation to date and is designed to improve and integrate the way water bodies are managed throughout Europe. Under the WFD all Member States must:

- prevent deterioration in the classification status of aquatic ecosystems, protect them and improve the ecological condition of waters;
- aim to achieve at least good status for all waters by 2015. Where this is not possible, good status should be achieved by 2021 or 2027;
- promote sustainable use of water as a natural resource;
- conserve habitats and species that depend directly on water;
- progressively reduce or phase out releases of individual pollutants or groups of pollutants that present a significant threat to the aquatic environment;
- progressively reduce the pollution of groundwater and prevent or limit the entry of pollutants, and;
- contribute to mitigating the effects of floods and droughts.

No deterioration

35. The first principle of the WFD is to prevent deterioration in aquatic ecosystems. No deterioration must be met in all but very exceptional circumstances. Exceptional circumstances apply when the deterioration is caused by physical modifications or the result of sustainable new human development activities. Even in such cases it is necessary to demonstrate that there was no better way to achieve the desired development. No deterioration requires that a water body does not deteriorate from its current ecological or chemical classification, and applies to individual pollutants within a water body. For example, if dissolved oxygen was currently classified as moderate status, then the first principle of the

WFD would be to ensure no deterioration from moderate class. Box 2-1 shows article 4.7 of the Directive which covers the exemption from no deterioration.

Box 2-1 Text of Water Framework Directive Article 4.7

Member States will not be in breach of this Directive when:

- *failure to achieve good groundwater status, good ecological status or, where relevant, good ecological potential or to prevent deterioration in the status of a body of surface water or groundwater is the result of new modifications to the physical characteristics of a surface water body or alterations to the level of bodies of groundwater, or*
- *failure to prevent deterioration from high status to good status of a body of surface water is the result of new sustainable human development activities*

and all the following conditions are met:

(a) all practicable steps are taken to mitigate the adverse impact on the status of the body of water;

(b) the reasons for those modifications or alterations are specifically set out and explained in the river basin management plan required under Article 13 and the objectives are reviewed every six years;

(c) the reasons for those modifications or alterations are of overriding public interest and/or the benefits to the environment and to society of achieving the objectives set out in paragraph 1 are outweighed by the benefits of the new modifications or alterations to human health, to the maintenance of human safety or to sustainable development, and

(d) the beneficial objectives served by those modifications or alterations of the water body cannot for reasons of technical feasibility or disproportionate cost be achieved by other means, which are a significantly better environmental option.

Good Status

36. Under the WFD the objective is for all water bodies to meet good ecological status by 2015. For surface waters (rivers, lakes, transitional waters), good ecological status can be defined as:

- good chemical status for the relevant substances (there are also a series of daughter directives);
- good physico-chemical status on the scale of high, good, moderate, poor and bad;
- good biological class, and;
- good hydro-morphological class.

37. The status of a water body is measured through a series of specific standards and targets that have been developed by the UK administrations, supported by the WFD UK Technical Advisory Group (www.wfduk.org).

38. The manner in which overall status is assessed is by using a 'one out, all out' approach. That is, the status is determined by the lowest common denominator. Figure 2-2 shows how this works in practice.

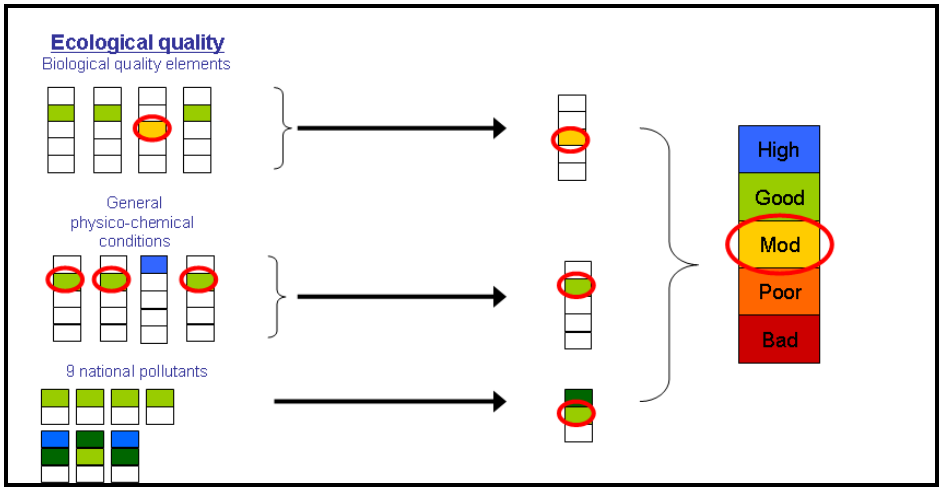


Figure 2-2 Determining Water Body Status (River Basin Management Plan – Anglian River Basin District; Environment Agency)

Alternative objectives

39. Although the WFD specifies that good status should be met by 2015 there are circumstances where it is possible to delay meeting good status until 2021 or 2027, or where a lesser objective will be required. These circumstances include technical feasibility, disproportional costs, or natural conditions (recovery times). In most instances it is likely that these circumstances will lead to an extended deadline (i.e. 2021 or 2027) to meet good status, rather than setting a less stringent objective.

40. Under Article 4 (3) of the WFD it is possible to designate water bodies as artificial or heavily modified water bodies. The WFD recognises that that some water bodies have been modified to provide valuable social or economic benefits, and it is recognised these water bodies are not able to achieve natural conditions, and hence should not be required to achieve good ecological status. Artificial or heavily modified water bodies therefore have an alternative objective of meeting "good ecological potential" and these are identified in the draft River Basin Management Plans.

2.8 River Basin Management Plans

41. In England and Wales, the Environment Agency is the lead authority in ensuring delivery of the WFD. The Environment Agency published the River Basin Management Plans (RBMP) in December 2009, these set out:

- the current status for each water body (including confidence limits);
- the objectives and targets for each water body;
- the main pressures for each water body;
- an action plan outlining what will be required, by whom, and when to meet good ecological status, and;
- justification for setting an alternative objective by 2015.

42. RBMPs will then be reviewed and updated every six years (i.e. 2015, 2021, 2027). The Environment Agency expects spatial planning to take the RBMP's into account through Sustainability Appraisals by incorporating evidence from the RBMP studies into the assessment.

43. The WCS study area is located almost entirely within the Anglian River Basin District Catchment, which along with its constituent catchment areas, is shown in Figure 2-3 below.

44. A small section of Daventry district falls within the Severn River Basin Management Plan. However, there are no Pre-Submission SUEs that may impact on this RBMP, and hence it has not been considered further in this study.

Figure 2-3 Map of the Anglian River Basin (River Basin Management Plan – Anglian River Basin District; Environment Agency)

45. The current state of the water environment is the baseline from which improvements and the 'no deterioration in status" of the WFD is measured. Nearly 70 percent of all water bodies in the Anglian River Basin District are designated as 'artificial' or 'heavily modified', as they have been created or modified for a particular use. As such they are not able to achieve natural conditions. For an artificial or heavily modified water body to achieve good ecological potential there must be a potential for the biology to be as close as possible to that of a similar natural water body. A summary of the ecological and biological classification of the Anglian RBMP with the current and predicted 2015 status for surface water bodies is shown in Figure 2-4 and Figure 2-5.

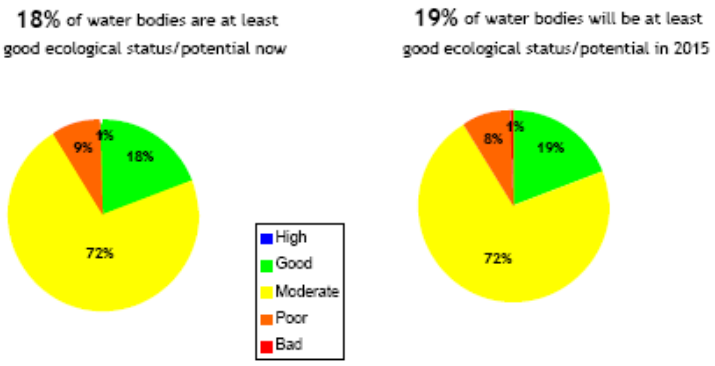


Figure 2-4 Ecological Status of Surface Water Bodies, Now and in 2015 (River Basin Management Plan – Anglian River Basin District; Environment Agency)

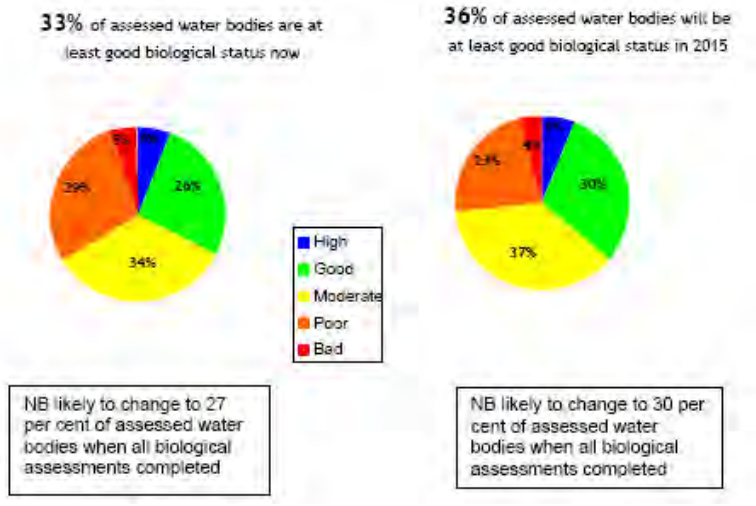


Figure 2-5 Biological Status of Surface Water Bodies, Now and in 2015 (River Basin Management Plan – Anglian River Basin District; Environment Agency)

46. Figure 2-6 shows the proportion of assessed river water bodies in each status class, by element. It is clear from the graph which elements are currently failing to meet the standards for good status, these are diatoms, macrophytes, fish and phosphate.

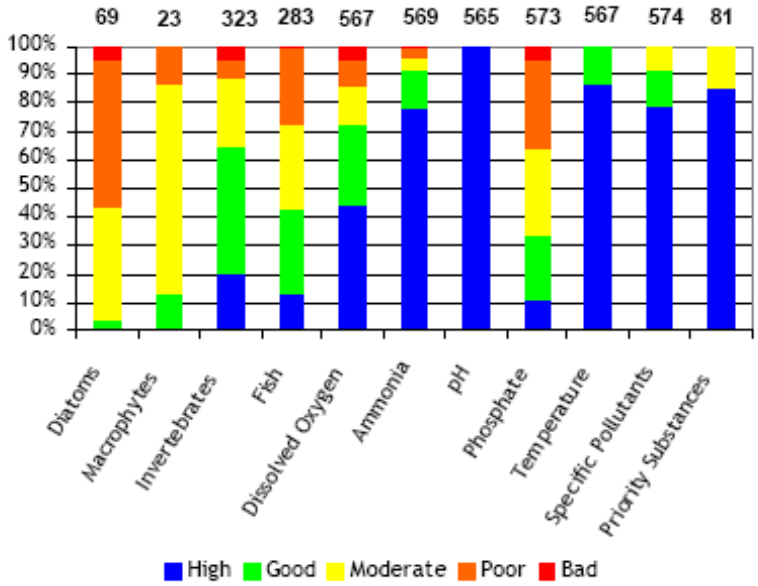


Figure 2-6 Proportion of assessed river water bodies in each status class, by element (numbers above bars indicate total number of water bodies assessed for each element)

47. Currently 65 percent of groundwater bodies are at good chemical and qualitative status. This is predicted to remain constant to 2015.

Figure 2-7 Predicted Surface Water Status and Potential for Surface Water Bodies in 2015 (River Basin Management Plan – Anglian River Basin District; Environment Agency)

48. The West Northamptonshire water cycle study area is covered predominantly by two of the Anglian River Basin District's constituent catchment areas, Nene Catchment and the Upper Ouse and Bedford Ouse Catchment (all constituent catchments can be seen in Figure 2-3).

Nene Catchment

49. The River Nene is an important source of raw water to fill both Pitsford and Rutland Water reservoirs for public water supply. It is also important for navigation and recreational uses. There is no significant groundwater abstraction in the catchment, due to the absence of major aquifers.

50. There are 69 river water bodies in the Nene catchment and 4 lakes. Over 47 percent of rivers and lakes (183km of river length) currently achieve at least good biological status. It is predicted that the status of 6 water bodies will be improved by 2015 with 16 percent of rivers (by length) improved for at least one ecological component.

Table 2-4 Statistics for the Nene Catchment (River Basin Management Plan – Anglian River Basin District; Environment Agency)

River and lake water bodies	Now	2015
% at good ecological status or potential	21	22
% assessed at good or high biological status (31 water bodies assessed)	47	56
% assessed at good chemical status (11 water bodies assessed)	82	91
% at good status overall (chemical and ecological)	21	22
% improving for one or more element in rivers		9

51. One of the major influences on the quality of surface water in the catchment is from large discharges into the River Nene. These include treated effluent from wastewater treatment works and industrial sources. Other problems are low flows, barriers to fish movement and habitat degradation through flood defence and navigation works. With planned growth in the catchment these cumulative impacts will require action to ensure good ecological status is achieved and there is no deterioration of the water bodies.

Upper Ouse and Bedford Ouse Catchment

52. The catchment supports a wide range of recreational activities, an important navigation and abstraction for a number of uses, including agriculture, public water supply and industry. The major aquifers are the Chalk, Lower Greensand and the Bedford Oolite. The Environment Agency also operates, in partnership with Three Valleys Water, the River Hiz Support Scheme, whereby groundwater can be pumped into the rivers Hiz and Oughton to support it in times of low flow.

53. There are 94 river water bodies in the catchment and 5 lakes. Over 39 percent of rivers (347km of river length) currently achieve at least good biological status. It is predicted that the status of 16 surface water bodies will be improved by 2015 and over 20 percent of rivers (by length) improved for at least one ecological component.

Table 2-5 Statistics for the Upper Ouse and Bedford Ouse Catchment (River Basin Management Plan – Anglian River Basin District; Environment Agency)

River and lake water bodies	Now	2015
% at good ecological status or potential	26	29
% assessed at good or high biological status (46 water bodies assessed)	39	39
% assessed at good chemical status (21 water bodies assessed)	100	100
% at good status overall (chemical and ecological)	26	29
% improving for one or more element in rivers		17

54. Nutrient enrichment is the main water quality problem in the catchment with both the River Great Ouse and River Ouzel designated as Sensitive Areas (Eutrophic) under the Urban Waste Water

Treatment Directive and the majority of the catchment is designated a Nitrate Vulnerable Zone. Pressures on water resources and water quality from planned growth in the catchment will require action to ensure good ecological status is achieved and there is no deterioration, subject to Article 4.7 (See box 2.1, page 17 for details of Article 4.7).

Classification of Receiving Waters

55. The Water Framework Directive classification status of each of the water bodies that receives urban water runoff or discharges from wastewater treatment works affected by the Pre-Submission sustainable urban extensions are listed in Table 2-6.

Table 2-6 WFD Classification Status of Water Bodies Affected by Proposed Development

No.	Reach	Receiving Water Body Name	Water Body ID	Overall physicochemical Status (EcoGen)	Overall Biological status (EcoBio)	Overall hydromorphological status (EcoHM)	Overall ecological status (EcoClass)	Ecological status objective (EcoObj)
Daventry								
1	-	Nene, Whilton	GB105032045360	○	○	●	○	●
2	-	Nene, Whilton	GB105032045340	○	●	●	○	●
Northampton								
1	1	Nene	GB105032045340	○	○	●	○	●
2	1	Nene	GB105032045340	○	○	●	○	●
3	2	Wootton Brook	GB105032045550	●	●	●	●	●
4	2	Wootton Brook	GB105032045550	●	●	●	●	●
5	4	Brampton Branch	GB105032045390	○	○	●	○	●
6	4	Brampton Branch	GB105032045390	○	○	●	○	●
7	4	Nene, Brampton	GB105032045380	○	○	●	○	●
8	4	Brampton Branch	GB105032045380	○	○	●	○	●
9	5	Nene, Ml'boro	GB105032045420	○	○	●	○	●
10	5	Nene	GB105032045050	○	○	●	○	●
11	6	Nene	GB105032045050	○	○	●	○	●

No.	Reach	Receiving Water Body Name	Water Body ID	Overall physicochemical Status (EcoGen)	Overall Biological status (EcoBio)	Overall hydromorphological status (EcoHM)	Overall ecological status (EcoClass)	Ecological status objective (EcoObj)
Towcester								
12	-	Silverstone	GB105033038250	○	○	○	○	○
13	-	Ouse	GB105033038180	○	○	○	○	○
Brackley								
14	-	Ouse	GB105033037880	○	○	○	○	○
15	-	Ouse	GB105033037860	○	○	○	○	○

3 Water quality environmental capacity assessment

3.1 Introduction

56. A review of water quality is required during the development process to ensure that development does not adversely affect water quality, and does not hinder the ability of a water body to meet the WFD. This overview outlines the process to assess water quality as part of the WCS.

57. Effluent from development can adversely affect water quality in two principal ways:

- increases in final effluent load from wastewater treatment works (WwTW) which causes a deterioration of water quality, and;
- increases in intermittent discharges from combined sewer overflows (CSOs), pumping stations, and storm tanks at WwTW – the potential for development to affect the operation of overflows has been assessed as part of the wastewater assessment.

58. The future expansion potential of a wastewater treatment works with respect to water quality is determined by assessing the discharge consent, set by the Environment Agency. This consent is based on the ecological sensitivity of the receiving watercourse and specifies a maximum flow and a minimum effluent quality that the WwTW has to achieve to meet water quality targets without causing environmental damage.

59. As the population connected to a wastewater treatment works increases, the amount of treated wastewater (or effluent) being discharged to the receiving water generally increases in proportion to the population increase. When this increased population causes the treatment works to exceed the consented maximum discharge volume allowed by the Environment Agency consent, improvements are likely to be required to the treatment works to improve the standard of treatment and to ensure river quality does not deteriorate.

60. The quantity of treated effluent discharged from each treatment works and its quality is specified by the legal discharge consent, issued by the Environment Agency under the Water Resources Act 1991. The consent is normally based upon the Dry Weather Flow (DWF) of the treated effluent, and stipulates limits for the concentration of biochemical oxygen demand (BOD), total suspended solids (TSS) and ammoniacal nitrogen (NH3). Compliance is determined by means of statistical analysis of effluent quality data.

61. Future consent limits will be set with a view to meeting the requirements of the Water Framework Directive (WFD) whose aim is to ensure that good river quality standards are met throughout each waterbody. The intention is to set the discharge consent limits based upon the quality and volume of the receiving watercourse and the volume of wastewater effluent at the point of discharge. However, the means of applying these principles to an individual discharge when upstream quality is already unsatisfactory, or when upstream flow provides inadequate dilution to maintain "good" quality status using conventionally applied wastewater treatment techniques, is presently unclear.

3.2 Data and References

62. The data used for this section of the WCS has been sourced from the following locations:

- Measured DWF – Anglian Water
- Consented DWF – Anglian Water
- Housing and employment numbers – West Northamptonshire Joint Planning Unit
- WFD classifications – taken from the Anglian River Basin Management Plan (published December 2009) and the Environment Agency's "What's in my backyard?"

- Per capita consumption (pcc), infiltration, people per dwelling – from Anglian Water wastewater RAG assessment
- Detailed water quality and river flow data have been provided directly by the Environment Agency Water Quality Planner (WQP), where available.
- Future DWF has been calculated in agreement with the Environment Agency and Anglian Water Services.
- WFD targets for individual classification parameters have been provided by the EA Water Quality Planner.

3.3 Methodology

63. To assess the environmental impact of growth we have assessed the maximum number of houses likely to be connected to each WwTW to assess whether a new flow consent would be required to accommodate growth. A no deterioration assessment has then been carried out. This analysis has used the Environment Agency River Quality Planning (RQP) toolkit.

64. The no deterioration assessment calculates the BOD, ammonia and phosphate consent required at the WwTW to maintain the current WFD status with the addition of the 2026 growth flows. For this the upstream river flow and quality values and the future DWF are entered into RQP with the current WFD status (as provided by the Environment Agency WQP) used as the target value for downstream river quality. The future consents required to meet no deterioration of status are then calculated.

65. Further to the no deterioration analysis, an assessment has been made to establish whether growth is likely to make achievement of WFD good status unfeasible. To assess this, the consents required to meet good WFD status are calculated using the current consented flows and the 2026 growth flows. The difference between these consents determines whether the growth has an impact on the ability to meet good status.

66. This analysis has also used the Environment Agency River Quality Planning (RQP) toolkit. To calculate the consent required at the WwTW to meet WFD good status the upstream river flow and quality values (river quality upstream of the WwTW has been assumed to be at mid-point of 'good status' – this assumes that all sources of pollution upstream of the WwTW have been addressed and this allows an assessment to be made of the discharge consents from the WwTW to 'play its part' in meeting WFD good status) and the current consented DWF are entered into RQP with WFD good status used as the target value for downstream river quality. The current consents required to meet WFD good status are then calculated. This process is then repeated with the 2026 growth DWF.

3.4 Northampton water quality assessment

3.4.1 Northampton current environmental context: water quality

67. The current WFD status has been assessed for the waterbody that the WwTW that serves Northampton (Great Billing WwtW) discharges into. As shown in Table 3-1 the River Nene is currently failing to meet good ecological status, because the waterbody does not achieve good physicochemical status. The WFD states that all water bodies must reach good ecological status by 2027 at the latest.

Table 3-1 Current WFD Status of Waterbodies with WwTW Affected by Growth

Symbol	Status
	High
	Not High
	Good
	Moderate
	Poor
	Bad
	Not yet assessed
	Other

		Water Framework Directive Classification Status of Waterbody						
Relevant WwTW	Waterbody Name	Water Body ID	Overall Physiochemical Status (EcoGen)	Overall Biological Status (EcoBio)	Overall HM Status (EcoHM)	Overall Ecological Status (EcoClass)	Ecological Status Objective (EcoObj)	RQO
Gt Billing WwTW	Nene	GB105032045050					Good Ecological Potential by 2027. Good Chemical Status by 2015.	3

3.4.2 Northampton water quality environmental capacity results

68. The method of measuring Dry Weather Flow has recently changed to a statistical method based on the 10%ile flow. As part of the change consents are being revised. The revised consent came into force on 5th March 2010. For this assessment the revised AMP5 consent has been used. The revised consent includes an allowance for statistical variations but does not include any allowance for growth.

69. To determine the environmental capacity for growth, we adopted the new flow compliance consent (83,215m^3/day) as the current baseline flow and consented quality and added the forecast flow from new residential and commercial developments to this up to and including 2026. This value includes the allowance for statistical variations (also referred to as environmental variations within this report), infiltration at its current very high rate, and has not assumed any per capita consumption reduction in demand for water, therefore is likely to be the maximum theoretical flow expected by 2026. The forecast dry weather flow in 2026 used for modelling is 90,922m^3/d.

Consents to meet no deterioration

70. No deterioration analysis has been carried out to provide an estimate of the quality consent required to prevent a deterioration of the WwTW discharge.

Table 3-2 No deterioration assessment

	Great Billing STW		
RIVER DOWNSTREAM OF DISCHARGE	BOD	Amm	Phosphate
Current Status			
Quality target (90-percentile)	4.00	0.60	1.00
DISCHARGE QUALITY NEEDED			
Mean quality	-	-	> current consent
95-percentile quality	8	2	-
Current Consent (95%ile)	13	4	1 (mean)

71. Table 3-2 shows that with the additional flows from the growth up to 2026 at Great Billing WwTW, the BOD and ammonia consents will require tightening to prevent deterioration of the downstream waterbody, but the indicative standards can be achieved with current conventional wastewater treatment techniques.

Consents to achieve 'Good Status'

72. The River Nene downstream of Great Billing WwTW is classified as a lowland waterbody and therefore to meet WFD good status, must meet BOD 5 mg/l (90 percentile), ammonia 0.6 mg/l (90 percentile) and phosphate 0.12 mg/l (mean).

73. The waterbody is already at good status or better for Ammonia and BOD, therefore the no deterioration consents identified in the no deterioration assessment above will ensure good status. However, phosphate is not currently at good status or better. Therefore further analysis has been undertaken to establish the likely consent required to meet WFD good status, assuming the upstream water quality is at good status.

Table 3-3 WFD good ecological status analysis

	Great Billing WwTW	
	Current consented DWF	2026 growth DWF
RIVER D/S OF DISCHARGE	P	P
Quality Target (mean)	0.12 (mean)	0.12 (mean)
DISCHARGE QUALITY NEEDED		
Mean Quality	**0.17**	**0.17**

74. Table 3-3 shows the results of the good status environmental capacity assessment. Where no consent change is needed, the value is Green. Where a consent change is needed, and the consent change can be achieved with conventionally applied wastewater treatment technology, the consent value is ***Italicised Amber.*** Where a consent change is needed and it cannot be achieved with conventionally applied wastewater technology, the consent value is **Bold Red.**

75. The results in Table 3-2 show that the BOD consent would need to be tightened from 13mg/l to 8mg/l and the ammonia consent tightened from 4mg/l to 2mg/l to ensure no deterioration of the current WFD status downstream of the treatment works with growth up to 2026. Although these are significant changes, they are achievable with conventionally applied wastewater treatment technology.

76. This analysis therefore shows that **BOD and ammonia should not considered constraints** to achieving the Pre-Submission Joint Core Strategy long term growth forecast, subject to a future consent tightening being agreed with the Environment Agency and Anglian Water. This will need to be agreed through the National Environment Programme and Periodic Review in 2014. A wastewater treatment infrastructure feasibility assessment is detailed in Chapter 7.

77. With respect to phosphate, no tightening of the current discharge consent is required to ensure no deterioration of current class. However, to meet good status for phosphate with the current population of Northampton, even assuming the river quality upstream of the treatment works is good status, would require a mean annual average discharge consent significantly beyond what can be achieved by current sewage treatment technology (0.17 mg/l required compared to 1mg/ achievable with current conventional technology). The consent required to meet good status for phosphate for the 2026 population does not need to be tighter than 0.17mg/l. Therefore development in Northampton itself does not make it any more difficult to achieve good status. The implications of this are discussed in section 3.8 below.

3.5 Brackley water quality assessment

3.5.1 Brackley current environmental context; water quality

78. Brackley WwTW discharges into the Great Ouse, and the current WFD status for this waterbody is show in Table 3-4. The River Great Ouse is currently failing to meet good ecological status because the overall physicochemical status does not reach good. The WFD states that all water bodies must reach good ecological status by 2027 at the latest.

Table 3-4 Current WFD status of waterbodies with WwTW affected by growth

		Water Framework Directive Classification Status of Waterbody						
Relevant WwTW	Waterbody Name	Water Body ID	Overall Physiochemical Status (EcoGen)	Overall Biological Status (EcoBio)	Overall HM Status (EcoHM)	Overall Ecological Status (EcoClass)	Ecological Status Objective (EcoObj)	RQO
Brackley WwTW	Great Ouse, Ouse	GB105033037860					Good Ecological Potential by 2027	2

3.5.2 Brackley water quality environmental capacity results

79. The method of measuring Dry Weather Flow has recently changed to a statistical method based on the 10%ile flow. As part of this change consents are being revised. The revised consent came into force on 5th March 2010. For this assessment the revised AMP5 consent has been used. The revised consent includes an allowance for statistical variations but does not include any allowance for growth.

80. To determine the environmental capacity for growth, we adopted the new flow compliance consent (6,320 m3/day) as the current baseline flow and consented quality and added the forecast flow from new residential and commercial developments to this up to and including 2026. This value includes the allowance for statistical variations (also referred to as environmental variations within this report), infiltration at its current rate, and has not assumed any per capita consumption reduction in demand for water, therefore is likely to be the maximum theoretical flow expected by 2026. The maximum DWF modelled was 7,684m^3/day in 2026.

Consents required to ensure no deterioration

81. No deterioration analysis has been carried out to provide an estimate of the quality consent required to prevent a deterioration of the WwTW discharge.

Table 3-5 No deterioration assessment

	Brackley WwTW		
RIVER DOWNSTREAM OF DISCHARGE	**BOD**	**Amm**	**P**
Current Status			
Quality target (90-percentile)	4	0.3	0.25
DISCHARGE QUALITY NEEDED			
Mean quality	-	-	**0.81**
95-percentile quality	> current consent	*1*	-
Current Consent (95%ile)	11	3	2 (mean)

82. Table 3-5 and Table 3-6 show the results of the environmental capacity assessment. Where no consent change is needed, the value is Green. Where a consent change is needed, and the consent change can be achieved with conventionally applied wastewater treatment technology, the consent value is ***Italicised Amber.*** Where a consent change is needed and it cannot be achieved with conventionally applied wastewater technology, the consent value is **Bold Red.**

Consents to achieve 'Good Status'

83. The waterbody is already at good status or better for Ammonia and BOD, therefore the no deterioration consents identified in the no deterioration assessment above will ensure good status. However, phosphate is not currently at good status or better. Therefore further analysis has been undertaken to establish the likely consent required to meet WFD good status. These calculations are based on the assumption that the river upstream of the works is currently meeting WFD good status.

84. The results in Table 3-5 show that no change is needed to the BOD consent, but the ammonia consent will need to be tightened from 3mg/l to 1mg/l to ensure no deterioration of the current WFD status downstream of the treatment works with growth up to 2026. Although this change in ammonia consent is a significant change, it achievable with conventionally applied wastewater treatment technology.

85. This analysis therefore shows that **BOD and ammonia should not be considered constraints** to achieving the Pre-Submission Joint Core Strategy long term growth forecast, subject to a future consent tightening being agreed with the Environment Agency and Anglian Water. This will need to be agreed through the National Environment Plan and Period Review in 2014. Chapter 7 discusses the infrastructure feasibility of providing the additional infrastructure.

86. With respect to phosphate, a tightening of the current discharge consent is required to ensure no deterioration of current class. Furthermore, the consent would need to be tightened beyond what is currently achievable with conventional technology. In fact, the modelling indicates that if the wastewater treatment works was to discharge at the new consented dry weather flow (i.e. with no new development), and the consent was tightened to the limit currently achievable with conventional technology, the downstream waterbody phosphate status would deteriorate from moderate to poor.

87. To meet good status for phosphate with the current population of Brackley, even assuming the river quality upstream of the treatment works is good status, would require a mean annual average discharge consent significantly beyond what can be achieved by current sewage treatment technology (0.23 mg/l

required compared to 1mg/ achievable with current conventional technology). The implications of this are discussed in section 3.8. The consent required to meet good status for phosphate for the 2026 population is marginally tighter at face value (0.22mg/l) however, such a marginal difference is not significant when considered in terms of modelling uncertainty in input data. Therefore development in Brackley itself does not make it any more difficult to achieve good status.

Table 3-6 Good status analysis

	Brackley WwTW	
	Current consented DWF	2026 growth DWF
RIVER D/S OF DISCHARGE	P	P
Quality Target (mean)	0.12	0.12
Mean Quality	0.23	0.22
Current Consent (mean)	2	2

3.6 Towcester water quality assessment

3.6.1 Towcester current environmental context: water quality

88. The WwTW serving Towcester (Towcester WwTW) discharges into the River Tove. The current WFD status of the River Tove is shown in Table 3-7, which identifies that the waterbody is currently failing to meet good ecological status. The WFD states that all water bodies must reach good ecological status by 2027 at the latest.

Table 3-7 Current WFD Status of Waterbodies with WwTW Affected by Growth

		Water Framework Directive Classification Status of Waterbody						
Relevant WwTW	Waterbody Name	Water Body ID	Overall Physiochemical Status (EcoGen)	Overall Biological Status (EcoBio)	Overall HM Status (EcoHM)	Overall Ecological Status (EcoClass)	Ecological Status Objective (EcoObj)	RQO
Towcester WwTW	Tove, Ouse	GB105033038180					Good Ecological Potential by 2027. Good Chemical Status by 2015.	2

3.6.2 Towcester water quality environmental capacity results

89. Table 3-8 shows the results of the consented capacity assessment assessment.

90. To determine the environmental capacity for growth, we have used the current observed flow (2,066 m3/day) as the current baseline flow and added the forecast flow from new residential and commercial developments to this up to and including 2026. This value includes the environmental variation headroom, infiltration, and has not assumed any per capita consumption reduction in demand for water, therefore is likely to be the maximum theoretical flow expected by 2026. The maximum DWF used in modelling was therefore 2,800m^3/d.

91. This assessment suggests that the current flow consent would not need to be revised to accept the growth flows up to 2026.

Table 3-8 Initial Assessment of Developments up to 2026

Relevant WwTW	Receiving Water	Measured DWF	Consented DWF	Max Population (Testing Scenario)	AMP 4/5 2006-2011	2016	2021	2026
Towcester WwTW	Tove, Ouse	2066	2800	3,301	841	2,189	2,446	2,714

92. Table 3-9 and Table 3-10 show the results of the environmental capacity assessment. Where no consent change is needed, the value is Green. Where a consent change is needed, and the consent change can be achieved with conventionally applied wastewater treatment technology, the consent value is ***Italicised Amber.*** Where a consent change is needed and it cannot be achieved with conventionally applied wastewater technology, the consent value is **Bold Red.**

Consents required to ensure no deterioration

93. No deterioration analysis has been carried out to provide an estimate of the quality consent required to prevent a deterioration of the downstream waterbody.

Table 3-9 No deterioration assessment

	Towcester WwTW		
RIVER DOWNSTREAM OF DISCHARGE	**BOD**	**Amm**	**P**
Current Status			
Quality target (90-percentile)	4.00	0.3	0.25 (mean)
DISCHARGE QUALITY NEEDED			
Mean quality	-	-	**0.7**
95-percentile quality	At current consent	3	-
Current Consent (95%ile)	15	5	2 (mean)

94. Table 3-9 shows that with the growth up to 2026, the ammonia consent at Towcester WwTW will require marginal tightening from 5 mg/l to 3 mg/l to prevent deterioration of the downstream waterbody. However, the phosphate consent would need to be tightened to 0.7 mg/l which cannot be achieved with conventionally applied wastewater treatment technology.

Consents required to achieve 'Good Status'

95. The River Tove downstream of Towcester WwTW is classified as a lowland waterbody and therefore to meet WFD good status, must meet BOD 5 mg/l (90 percentile), ammonia 0.6 mg/l (90 percentile) and phosphate 0.12 mg/l (mean).

96. The waterbody is already at good status or better for Ammonia and BOD, therefore the no deterioration consents identified in the no deterioration assessment above will ensure good status. However, phosphate is not currently at good status or better. Therefore further analysis has been undertaken to establish the likely consent required to meet WFD good status. These calculations are based on the assumption that the river upstream of the works is currently meeting WFD good status.

97. The results in Table 3-9 show that although no change is needed to the BOD consent, the ammonia consent needs to be tightened from 5mg/l to 3mg/l to ensure no deterioration of the current WFD status downstream of the treatment works with growth up to 2026. Although this change in ammonia consent is a significant change, it achievable with conventionally applied wastewater treatment technology.

98. This analysis therefore shows that **BOD and ammonia should not be considered constraints** to achieving the Pre-Submission Joint Core Strategy long term growth forecast, subject to a future consent tightening being agreed with the Environment Agency and Anglian Water. This will need to be agreed through the National Environment Plan and Period Review in 2014. Chapter 7 discusses the infrastructure feasibility of providing the additional infrastructure.

99. With respect to phosphate, a tightening of the current discharge consent is required to ensure no deterioration of current class. Furthermore, the consent would need to be tightened beyond what is currently achievable with conventional technology. To meet good status for phosphate with the current population of Towcester, even assuming the river quality upstream of the treatment works is good status, would require a mean annual average discharge consent significantly beyond what can be achieved by current sewage treatment technology (0.46 mg/l required compared to 1mg/ achievable with current conventional technology). The implications of this are discussed in section 3.8. The consent required to meet good status for phosphate for the 2026 population is marginally tighter at face value (0.39mg/l). It

is not considered that 0.39mg/l is significantly more difficult to achieve than 0.46mg/l, therefore development in Towcester itself does not make it any more difficult to achieve good status.

Table 3-10 Good status analysis

	Towcester WwTW	
	Current consented DWF	2026 growth DWF
RIVER D/S OF DISCHARGE	P	P
Quality Target (mean)	0.12	0.12
DISCHARGE QUALITY NEEDED		
Mean Quality	0.46	0.39
Current Consent (mean)	2	2

3.7 Daventry water quality assessment

3.7.1 Daventry current environment context: water quality

100. The WwTW serving Daventry is Daventry Whilton WwTW which discharges into the River Nene. The current WFD status has been assessed for this waterbody in Table 3-11. This shows that the River Nene is currently failing to meet good ecological status. The WFD states that all water bodies must reach good ecological status by 2027 at the latest.

Table 3-11 Current WFD Status of waterbodies with WwTW affected by growth

		Water Framework Directive Classification Status of Waterbody						
Relevant WwTW	Waterbody Name	Water Body ID	Overall Physiochemical Status (EcoGen)	Overall Biological Status (EcoBio)	Overall HM Status (EcoHM)	Overall Ecological Status (EcoClass)	Ecological Status Objective (EcoObj)	RQO
Whilton WwTW	Whilton Bridge - Nene	GB105032045340					Good Ecological Potential by 2027, Good Chemical Status by 2015	2

3.7.2 Daventry water quality and wastewater environmental capacity results

101. The method of measuring Dry Weather Flow has recently changed to a statistical method based on the 10%ile flow. As part of the change consents are being revised. The revised consent came into force on 5th March 2010. For this assessment the revised AMP5 consent has been used. The revised consent includes an allowance for statistical variations but does not include any allowance for growth.

102. To determine the environmental capacity for growth, we adopted the new flow compliance consent (8,500 m3/day) as the current baseline flow and consented quality and added the forecast flow from new residential and commercial developments to this up to and including 2026. This value includes the allowance for statistical variations (also referred to as environmental variations within this report), infiltration at its current rate, and has not assumed any per capita consumption reduction in demand for water, therefore is likely to be the maximum theoretical flow expected by 2026. The maximum DWF used for modelling is 9,906m^3/d.

103. Table 3-12 and Table 3-13 show the results of the environmental capacity assessment. Where no consent change is needed, the value is Green. Where a consent change is needed, and the consent change can be achieved with conventionally applied wastewater treatment technology, the consent value is ***Italicised Amber.*** Where a consent change is needed and it cannot be achieved with conventionally applied wastewater technology, the consent value is **Bold Red.**

Consents required to ensure no deterioration

104. No deterioration analysis has been carried out to provide an estimate of the quality consent required to prevent a deterioration of the downstream waterbody.

Table 3-12 No deterioration assessment

	Whilton WwTW		
RIVER DOWNSTREAM OF DISCHARGE	**BOD**	**Amm**	**P**
Current Status			
Quality target (90-percentile)	4	1.1	1
DISCHARGE QUALITY NEEDED			
Mean quality	-	-	= current consent
95-percentile quality	7	= current consent	-
Current Consent (95%ile)	12	3	2 (mean)

105. Table 3-12 shows that no change of the Ammonia consent would be required to prevent deterioration of the downstream waterbody with the additional flows from the growth up to 2026 at Whilton WwTW. The BOD consent would need to be tightened from 12mg/l to 7 mg/l. This is a significant tightening which may require additional wastewater treatment infrastructure to be provided. However, this standard can be delivered with currently applied conventional wastewater treatment techniques.

Consents to achieve 'Good Status'

106. The Whilton branch of the River Nene downstream of Whilton WwTW is classified as a lowland waterbody and therefore to meet WFD good status, must meet BOD 5 mg/l (90 percentile), ammonia 0.6 mg/l (90 percentile) and phosphate 0.12 mg/l (mean).

107. The waterbody is already at good status or better for BOD, therefore the no deterioration consents identified in the no deterioration assessment above will ensure good status. However, phosphate and Ammonia are not currently at good status or better. Therefore further analysis has been undertaken to establish the likely consent required to meet WFD good status. These calculations are based on the assumption that the river upstream of the works is currently meeting WFD good status.

108. To ensure good status for Ammonia with the future 2026 population, the ammonia consent would need to be tightened from 3mg/l to 2mg/l. This can be achieved with current conventional technology.

109. With respect to phosphate, although no tightening of the current discharge consent is required to ensure no deterioration of current class, the consent would need to be tightened beyond what is currently achievable with conventional technology to achieve good status. To meet good status for phosphate with the current population of Daventry, even assuming the river quality upstream of the treatment works is good status, would require a mean annual average discharge consent significantly beyond what can be achieved by current sewage treatment technology (0.19mg/l required compared to 1mg/ achievable with current conventional technology). The implications of this are discussed in section 3.8. The consent required to meet good status for phosphate for the 2026 population is marginally tighter at face value (0.18mg/l). It is not considered that 0.18mg/l is significantly more difficult to achieve than 0.19mg/l, therefore development in Daventry itself does not make it any more difficult to achieve good status.

110. This analysis therefore shows that **BOD and ammonia should not considered constraints** to achieving the Pre-Submission Joint Core Strategy long term growth forecast, subject to a future consent tightening being agreed with the Environment Agency and Anglian Water. This will need to be agreed

through the National Environment Plan and Period Review in 2014. Chapter 7 discusses the infrastructure feasibility of providing the additional infrastructure.

111. However, achieving good status for phosphate remains an issue. This is discussed in section 3.8.

Table 3-13 Good status analysis

	Whilton WwTW	
	Current consented DWF	2026 growth DWF
RIVER D/S OF DISCHARGE	P	P
Quality Target (mean)	0.12	0.12
DISCHARGE QUALITY NEEDED		
Mean Quality	0.19	0.18
Current Consent (mean)	2	2

3.8 Water quality environmental capacity summary

	Great Billing	Daventry (Whilton)	Brackley	Towcester
BOD	Current status is HIGH. Consent needs to be tightened from 13mg/l to 8mg/l (for 2026 flows) to prevent deterioration from High to Good.	Current status is high. Consent will need to be tightened from 12 to 7 mg/l to prevent deterioration from high to good status	Current consent quality (13mg/l) will ensure no deterioration of current status of HIGH	Current consent quality (15mg/l) will ensure no deterioration of current status of HIGH
Ammonia	Current status is GOOD. Consent needs to be tightened from 4mg/l to 2mg/l (for 2026 flows) to prevent deterioration from Good to Moderate	Current status is MODERATE. Existing consent of 3mg/l will prevent deterioration of moderate status	Current status is HIGH. Consent needs to be tightened from 3mg/l to 1mg/l (for 2026 flows) to prevent deterioration from High to Good	Current status is HIGH. Consent needs to be tightened from 5mg/l to 3mg/l (for 2026 flows) to prevent deterioration from High to Good
Phosphate	Current consent quality (1mg/l) will ensure no deterioration of current status of POOR	Current status is POOR. Existing consent of 1mg/l will prevent deterioration of poor status	Current status is MODERATE. There is a risk that tightening the consent to the current limit of conventional wastewater treatment technology (1mg/l) will not prevent a deterioration of status to Poor	Current status is MODERATE. Thjere is a risk that tightening the consent to the current limit of conventional wastewater treatment technology (1mg/l) will not prevent a deterioration of status to Poor
No deterioration summary	**The consent for BOD, ammonia and phosphate will need to be tightened to prevent deterioration of current status, and this may require additional wastewater infrastructure. However, this is within the limits of conventional technology. Section 7 considers the feasibility of providing additional infrastructure to meet tighter consent standards.**	**The consent for BOD will need to be tightened to prevent deterioration of current status, and this may require additional wastewater infrastructure. However, this is within the limits of conventional technology. Section 7 considers the feasibility of providing additional infrastructure to meet tighter consent standards.**	**The consent for Ammonia and phosphate will need to be tightened to prevent deterioration of current status, and this may require additional wastewater infrastructure. Even when the phosphate consent is tightened to the limit of conventional technology, there remains a modelled risk of deterioration of phosphate status from moderate to poor. Section 7 considers the feasibility of providing additional infrastructure to meet tighter consent standards.**	**The consent for ammonia and phosphate will need to be tightened to prevent deterioration of current status, and this may require additional wastewater infrastructure. For ammonia this is within the limits of conventional technology. Even when the phosphate consent is tightened to the limit of conventional technology, there remains a modelled risk of deterioration of phosphate status from the current status of moderate. Section 7 considers the feasibility of providing additional infrastructure to meet tighter consent standards.**

Figure 3-1 Meeting the no deterioration requirements of the Water Framework Directive

	Great Billing	Daventry (Whilton)	Brackley	Towcester
BOD	Current consent achieves good status or better	Current consent achieves good status or better	Current consent achieves good status or better	Current consent achieves good status or better
Ammonia	Current consent achieves good status or better	A consent of 2mg/l would be required to achieve good status with the current consented DWF. This consent would also achieve good status with the 2026 calculated DWF.	Current consent achieves good status or better	Current consent achieves good status or better
Phosphate	A consent of 0.17mg/l, significantly tighter than what can be achieved with conventional wastewater treatment technology, would be required to achieve good status with the the current consented DWF. This consent would also achieve good status with the 2026 calculated DWF.	A consent of 0.19mg/l, significantly tighter than what can be achieved with conventional wastewater treatment technology, would be required to achieve good status with the the current consented DWF. This consent would need marginal tightening to 0.18mg/l to achieve good status for the calculated 2026 DWF.	A consent of 0.23mg/l, significantly tighter than what can be achieved with conventional wastewater treatment technology, would be required to achieve good status with the the current consented DWF. This consent would need marginal tightening to 0.22mg/l to achieve good status for the calculated 2026 DWF.	A consent of 0.46mg/l, significantly tighter than what can be achieved with conventional wastewater treatment technology, would be required to achieve good status with the the current consented DWF. This consent would need tightening to 0.39mg/l to achieve good status for the calculated 2026 DWF.
Good status summary	**Good status is already achieved for BOD and Ammonia. Good status cannot be achieved for phosphate even if there is no development, and development does not make it any more difficult to achieve good status.**	**Good status is already achieved for BOD. Good status can be achieved for Ammonia with a tightening of the discharge consent from 3 to 2 mg/l. Good status cannot be achieved for phosphate even if there is no development, and development does not make it any more difficult to achieve good status.**	**Good status is already achieved for BOD and Ammonia. Good status cannot be achieved for phosphate even if there is no development, and development does not make it any more difficult to achieve good status.**	**Good status is already achieved for BOD and Ammonia. Good status cannot be achieved for phosphate even if there is no development, and development does not make it any more difficult to achieve good status.**

Figure 3-2 Meeting the Good Status requirements of the Water Framework Directive

112. The Environmental capacity assessment has identified that there a number of issues with respect to meeting the WFD requirements.

113. No deterioration of current WFD physicochemical status for BOD and Ammonia can be achieved at each of the WwTW assessed, although the assessment indicates that a tighter consent will be needed between 2011 and 2026 for BOD, Ammonia or both. The point at which a new consent will be required is dependant on the trajectory of development. Additional wastewater treatment infrastructure may be required to achieve these tighter standards, and the feasibility of providing this infrastructure is discussed for each WwTW in Chapter 7.

114. No deterioration of current WFD physicochemical status for phosphate can be achieved at Great Billing and Daventry WwTW without the requirement for a tighter phosphate consent.

115. A phosphate consent of 1mg/l, the limit of what is achievable with conventional wastewater treatment technology, will be needed at Towcester and Brackley WwTW to limit the modelled deterioration of phosphate physicochemical status from moderate to poor. The point at which a new consent will be required is dependant on the trajectory of development. Even when the phosphate consent is tightened to the limit of conventional technology, there remains a modelled risk of deterioration of phosphate status from the current status of moderate. Section 7 considers the feasibility of providing additional infrastructure to meet tighter consent standards.

116. The impact of development on water quality deterioration and failing to achieve Good status can be reduced by:

- ensuring that sustainable drainage systems contain treatment components designed to ensure that they function effectively to treat surface water drainage. If development is to be allocated, despite concerns about deterioration and ability to achieve good status, it is essential that all the water quality of runoff from developments to watercourses should be controlled using well designed sustainable drainage systems that have considered water quality treatment. In addition, the biodiversity benefits of providing additional green blue space for the management of surface water ensuring addition space, combined with green infrastructure masterplanning of SUEs could enhance the ecological status of waterbodies and partially offset the impact of additional treated effluent.
- ensuring developments are designed to high standards of water efficiency, and demand management is promoted through these developments. This will reduce the volume of foul discharge created from new developments and partially mitigate the additional volume being discharged from the WwTW.
- ensuring that no surface drainage is permitted to discharge into foul or combined systems. If new development requires upgrade of existing drainage systems, the opportunity should be taken to review the operation of any intermittent discharges or storm tanks on the relevant section of drainage network, and seek to reduce the operation of storm discharges.
- Additionally, where a waterbody is not in good hydromorphological status, development could be used as an opportunity for river restoration and habitat improvements, and the opportunities for this should be further examined.

4 Water resources and water supply

4.1 Introduction

117. This Water Cycle Study (WCS) has collated the latest information on water resource planning and supply infrastructure from the Environment Agency, and Anglian Water Services (AWS) in order to identify any significant constraints to proposed LDF growth. A summary of available water within the study area has been provided in light of AWS planning for proposed core strategy growth.

118. A number of projected water demand scenarios have been examined with respect to the proposed growth and LDF development, and options identified that lead to a more sustainable use of water resources. An outline programme of measures and policy recommendations are provided for achieving a sustainable water supply-demand balance.

119. Information resources applied for this analysis include:

- www.statistics.gov.uk;
- AWS Water Resource Management Plan 2010;
- Strategic Direction Statement 2010 – 2035;
- East Midlands Regional Spatial Strategy (Government Office for the East Midlands, 2009);
- Planning for drought in the Anglian Water region (AWS, 2008);
- Catchment Abstractions Management Strategies (Environment Agency);
- AWS infrastructure information;
- Code for Sustainable Homes – A Step Change in Sustainable Home Building (Crown copyright, 2006);
- Future Water: the Government's water strategy for England (DEFRA, 2008).
- West Northamptonshire Joint Core Strategy Issues and Options (West Northamptonshire Joint Planning Unit, 2007);
- West Northamptonshire Emergent Joint Core Strategy 2009[3]

[3] The water resources analysis has not been updated with the housing and development trajectory identified in the Pre-Submission Joint Core Strategy, because the water resources section of the report had been completed and signed off in advance of the Pre-Submission Joint Core Strategy changes being published.

4.2 Environment Agency Water Resource Management

120. The Environment Agency manages water resources at a local level through Catchment Abstraction Management Strategies (CAMS), which have previously been prepared on a 6 yearly cycle.

121. The CAMS process has changed and will become a 'live strategy' called the Future CAMS, in order to feed into the Water Framework Directive. The CAMS products will be more customer focused with customers both within the Environment Agency and external, such as current and future abstraction licence holders. The future CAMS process has been divided into three stages which are:

- Stage 1: Resource Assessment Management (Blue in Figure 4-1 below)
- Stage 2: Licensing strategy (Green in Figure 4-1 below)
- Stage 3: Measures appraisals process (Purple in Figure 4-1 below)

122. The first two are the main CAMS processes; the third stage is where CAMS links with other Water Resource activities. Figure 4-1 gives an overview of the three stages that will be adopted.

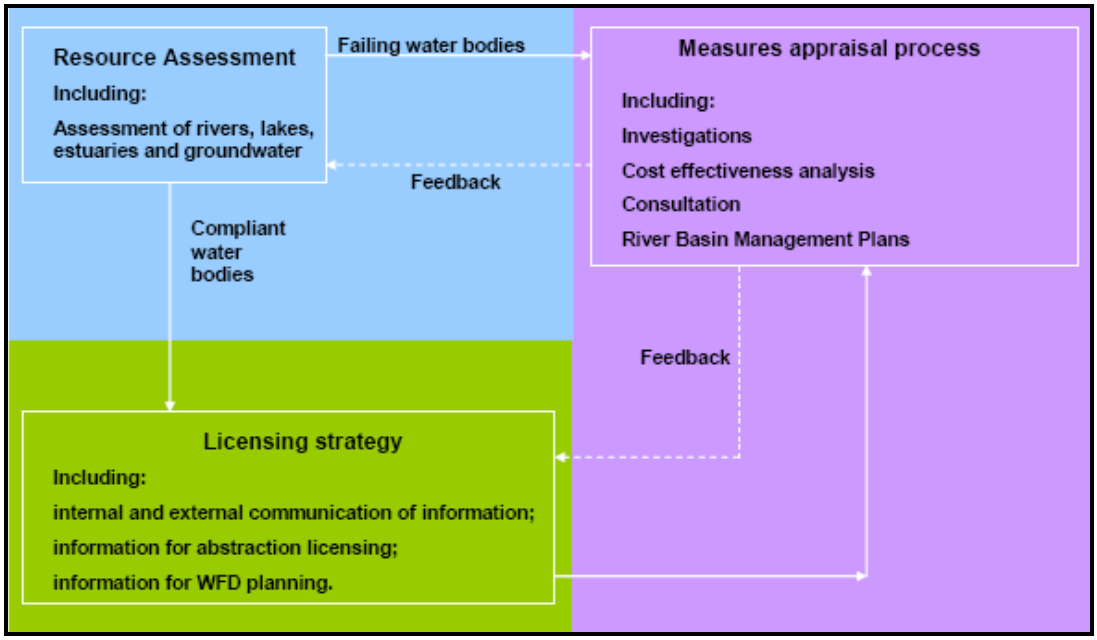


Figure 4-1 Overview of CAMS Process Stages

123. Within the CAMS areas the Environment Agency's assessment of water resource availability is based on a classification system for the perceived status of water resource availability, indicating:

- The relative balance between the environmental requirements for water and how much is licensed for abstraction;
- Whether water is available for further abstraction;
- Areas where abstraction needs to be reduced.

124. The categories for resource availability status, shown in Table 4-1, are based upon assessments of the ecological sensitivity to abstraction-related reduction of individual Water Resource Management Units

(WRMU), which may be either surface water or groundwater sources. An assessment is made of each of the WRMUs located within each CAMS area.

Table 4-1 CAMS Resource Availability Status Categories

Indicative Resource Availability Status	Licence Availability
Water available	Water is likely to be available at all flows including low flows. Restrictions may apply.
No water available	No water is available for further licensing at low flows. Water may be available at high flows with appropriate restrictions.
Over-licensed	Current actual abstraction is such that no water is available at low flows. If existing licences were used to their full allocation they could cause unacceptable environmental damage at low flows. Water may be available at high flows with appropriate restrictions.
Over-abstracted	Existing abstraction is causing unacceptable damage to the environment at low flows. Water may still be available at high flows with appropriate restrictions.

125. The classification can be used to help assess the potential for additional water resource abstraction opportunities. Figure 4-2 shows the Environment Agency's assessment of relative water stress throughout England, and it can be seen that there is a great deal of pressure on water resources in the whole south east of England. The effects of climate change are likely to further reduce supply and could also actually increase demand.

126. The Environment Agency recommends that, due to the specific pressures faced, the region should adopt the following measures:

- Efficient use of water in all new homes with water efficiency set at 105 litres pre head per day (i.e. level 3/4 for water within Code for Sustainable Homes) or better;
- That all growth point plans liaise with water companies to ensure that company have the water resources and associated environmental infrastructure (such as new resources and adequate distribution) now, and in the future, to meet planned development;
- All new buildings, including flats, must be metered;
- Whenever possible developments should consider the benefits of rainwater harvesting and water recycling in new developments;
- Use of low water use landscaping and gardens; and
- Local authorities to follow their duties, as noted in the Water Act 2003 (part 3 sections 81 & 83), that 'the relevant authority must, where appropriate, take steps to encourage the conservation of water'.

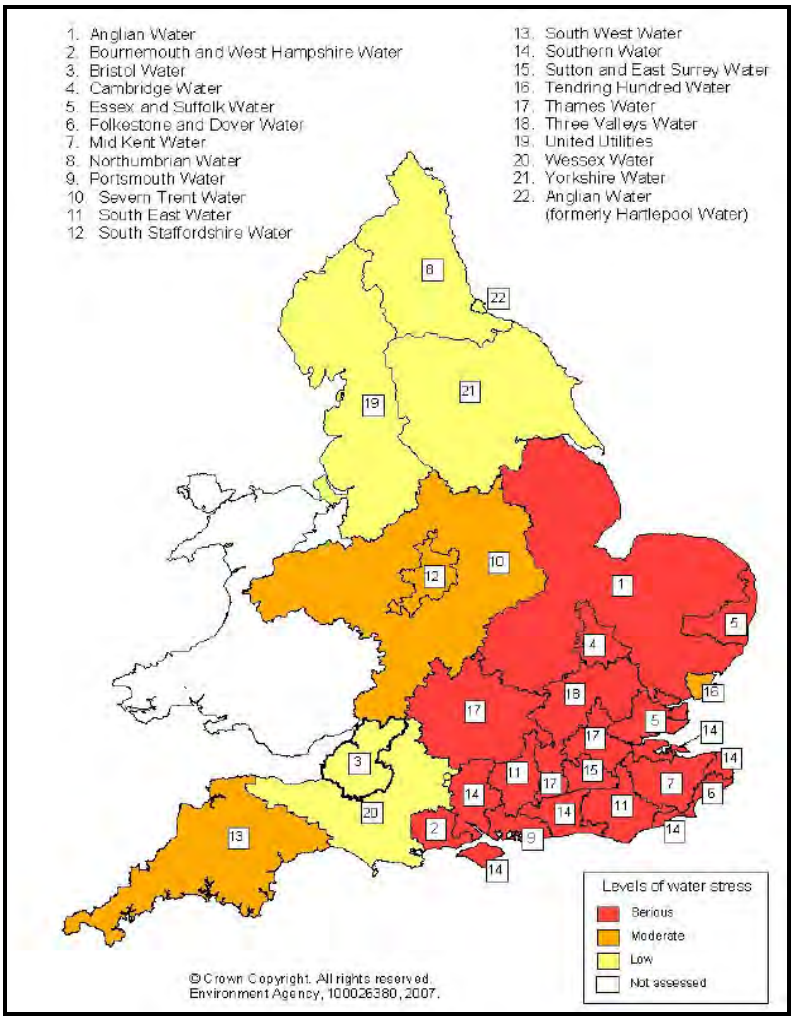


Figure 4-2 Map of Areas of Relative Water Stress (source: Areas of Water Stress, Final Classification; Environment Agency)

4.3 CAMS Review

127. Northampton and Daventry fall within the Nene CAMS, whilst South Northamptonshire comes under the Upper Ouse and Bedford Ouse CAMS. Neighbouring CAMS areas; Warwickshire and Avon and Cherwell have also been reviewed. Whilst there is no current abstraction from these CAMS into the study area it is worthwhile noting their status for completeness.

128. Within the CAMS areas the Environment Agency's classification assessment of water resource availability has been carried out for each Water Resource Management Unit (WRMU) to provide an indication of water availability, the abstraction level, licence status and strategy. A nationwide indication of relative water stress is provided in Figure 4-2, while Figure 4-3 provides an overview of CAMS regions and water stress for the West Northamptonshire study area.

Nene CAMS

129. The Nene CAMS region consists of 3 WRMUs which have been assessed under the management strategy published in March 2005. This has subsequently been reviewed annually. All WRMUs are currently classified as over licensed.

130. If all licence holders abstracted the whole volume they are permitted, the minimum required river flows established by the Environment Agency (River Flow Objectives) would not be satisfied for:

- WRMU 1 – 82% of the year
- WRMU 2 – 70% of the year
- WRMU 3 – 90% of the year

131. The Nene CAMS identifies abstraction by AWS for public water supply as the main use of water within the catchment comprising of approximately 92% of total abstractions.

132. The most relevant AWS abstraction license within the Nene CAMS is to the west of Peterborough and is used to fill Rutland Water (located in the neighbouring Welland CAMS) where water is also transferred under the abstraction licence (at Stamford).

133. AWS have three reservoirs within the Nene catchment (to the north of Northampton, Ravensthorpe and Hollowell), which between them account for most of the remaining water abstracted by the company. The reservoir to the west of Huntingdon is located within the Upper Ouse and Bedford Ouse CAMS. In addition AWS have an abstraction licence from Duston, located within the Nene catchment.

The Upper Ouse and Bedford Ouse CAMS

134. The Upper Ouse and Bedford Ouse CAMS region consists of 10 WRMUs which have been assessed under the management strategy published in March 2005. This has subsequently been reviewed in June 2007. Only a small area of this CAMS relates to the Ruthamford supply zone although the abstraction and transfer of water from source to the west of Huntingdon to South Northamptonshire with in the WNWCS area.

135. The key WRMU for AWS abstraction falls in the group of units (1-4).The resource availability status for all these units is "No Water Available". This means that any additional water resource required by new development in Northamptonshire will not be able to rely on new licences being granted from the Upper Ouse and Bedford CAMs area. Therefore, the actions taken by Anglian Water to manage water across the whole Ruthamford Water Resource Zone are critical. These are discussed in 3.4.

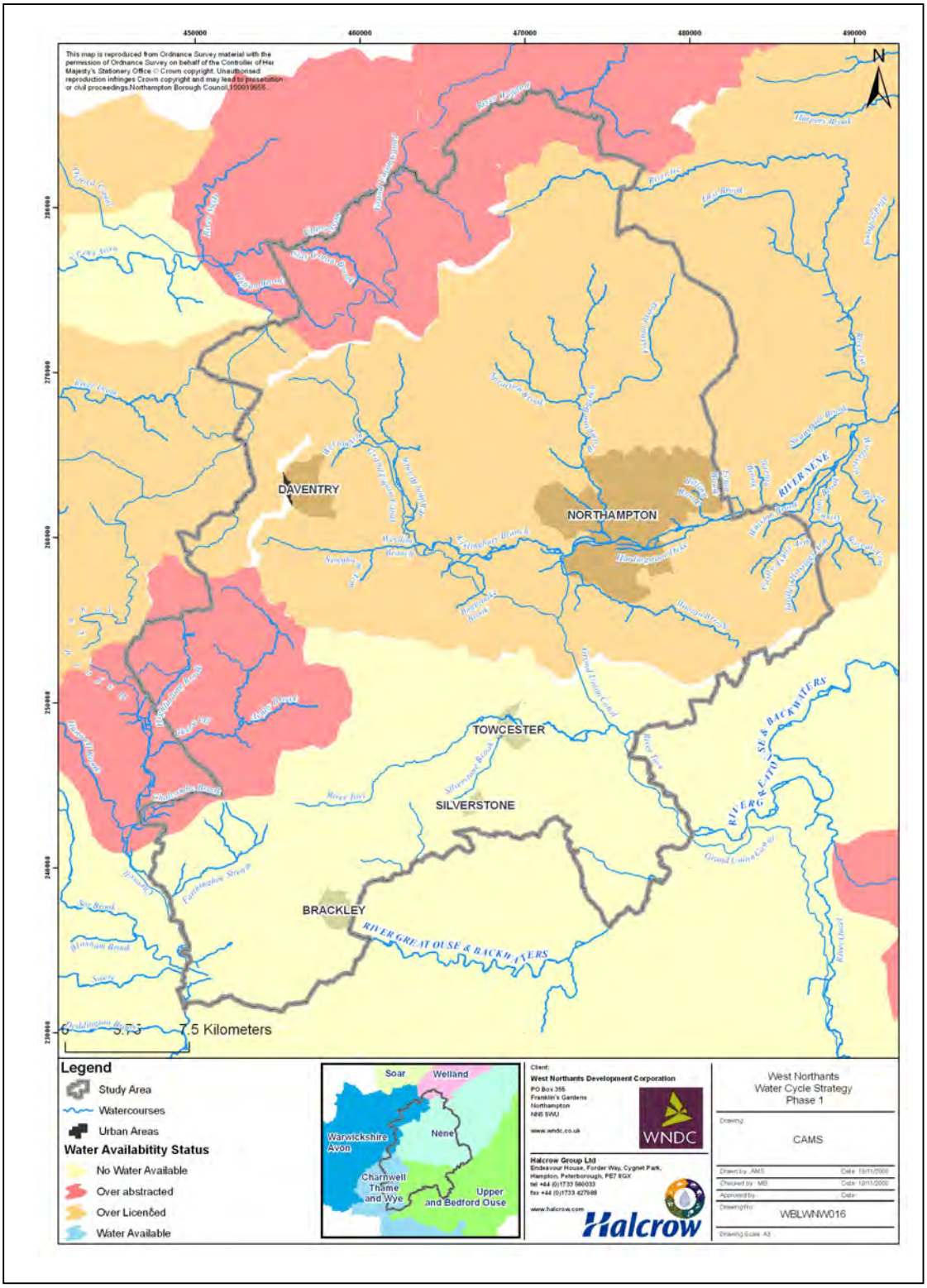


Figure 4-3 CAMS Overview for West Northants Study Area (from phase 1 WCS)

4.4 Water Company Planning

136. As the appointed water company, Anglian Water Services has a responsibility to provide sufficient quantity and quality of water to meet the needs of its customers, whilst also minimising their impacts on the environment. This responsibility applies to new customers and population growth as well as changing demands within the existing customer base and must therefore be comprehensively planned for.

137. All water companies have a duty to produce water resources plans covering the next 25 years. These plans set out how companies intend to provide sufficient water to meet their customers' needs. Although not previously compulsory, companies have prepared 25 year water resource management plans on a voluntary basis, and shared these with the Government and regulators, since 1999. On 1 April 2007 these plans became compulsory under changes to the Water Industry Act 1991, and in 2009, for the first time they were also subject to public consultation before they were finalised.

138. Information regarding the strategic water resources for West Northamptonshire has been obtained from AWS' Water Resources Management Plan (WRMP), this was published February 2010. AWS typically undertake a yearly review of their water resource plans as part of the June Return process.

139. Whilst strategic plans for meeting future demand over a 25 year period are set out in the WRMP, detailed design of schemes is not undertaken until works have been granted funding by Ofwat.

140. Any improvements to the water services infrastructure needs to be programmed into a water company's capital programme, which runs in five year Asset Management Plan (AMP) cycles. We are currently in the AMP5 period (2010-2015). Water companies will begin the process of preparing for its next submission to Ofwat, to determine its allowable capital expenditure for AMP6 in 2013. Figure 4-4 illustrates the AMP planning cycle. This funding cycle and its associated constraints can have implications for the phasing of development, and it is important that water companies are involved in the planning process to ensure that infrastructure can be provided in time.

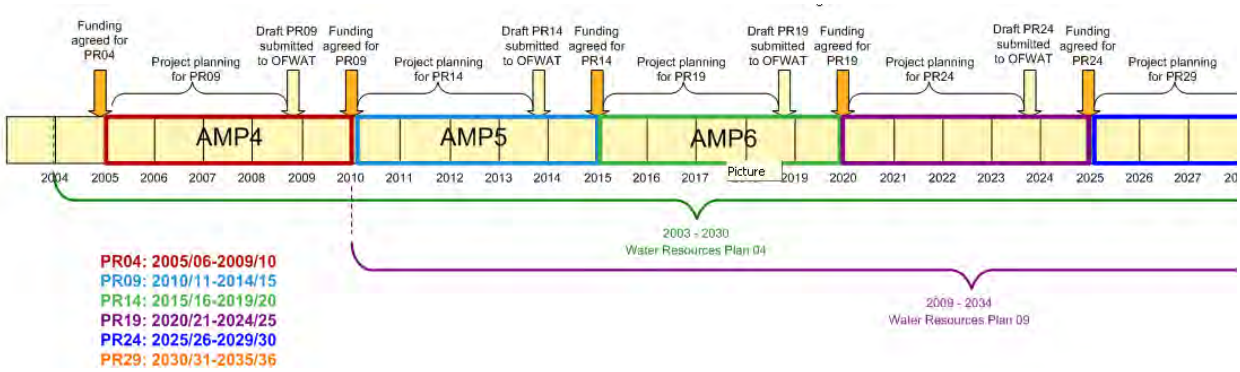


Figure 4-4 Water Company Capital Funding Cycle

4.5 Current Water Resources

Existing Supply

141. The existing potable water supply network for the study area is operated and maintained by Anglian Water Services Ltd (AWS). The AWS region is the largest geographical territory of any water company in England and Wales, stretching from the Humber to the Thames estuary and Buckinghamshire to the east coast. The region is split between 12 Water Resource Zones (WRZ) which are based on the existing water supply system and represent the largest areas in which water resources can be shared.

142. The WCS area is located within the largest WRZ, Ruthamford (see Figure 4-5). The three main potable sources in this resource zone are water treatment works (WTW) and associated reservoirs located to the north of Northampton, in Rutland and to the west of Huntingdon. Table 4-2 provides a summary of the major supply reservoirs and treatment works in the Northampton, Daventry, Towcester and Brackley areas.

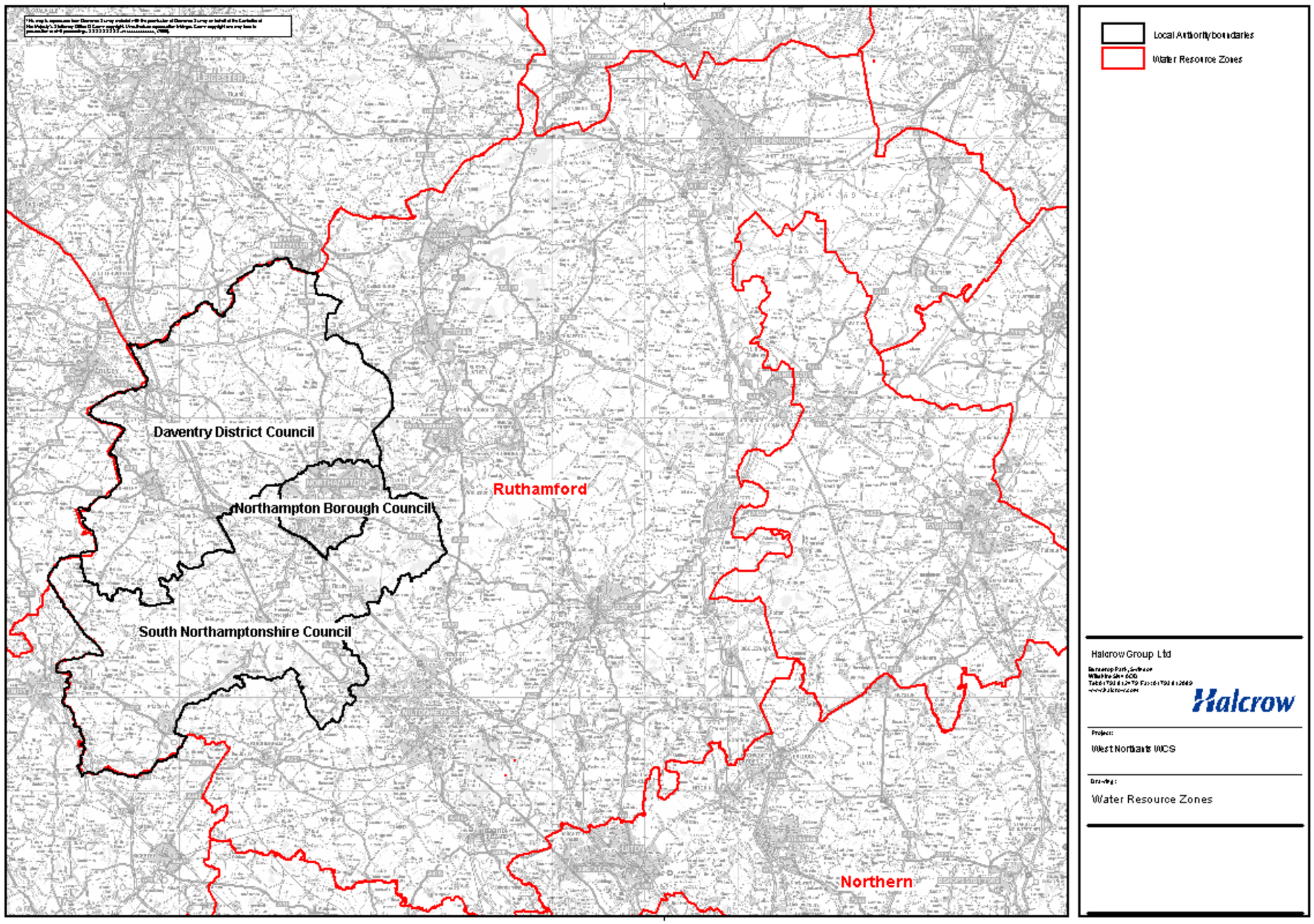


Figure 4-5 Ruthamford water resource zone

Table 4-2 Northampton, Daventry and Towcester Water Resource and Supply Sources

Area	Water Treatment Works Source	Reservoirs/Towers
Northampton	Northampton	Boughton
		Harpole
		Brixworth Tower
	Rutland	West of Wellingborough
		Harpole
	Huntingdon	Great Houghton
		Lings
Daventry	North of Northampton and Rutland	Harpole
		Weedon
		Borough Hill
Towcester and Brackley	West of Huntingdon	Great Houghton
	Rutland	West of Wellingborough
	West of Huntingdon and Rutland	Salcey
		West of Milton Keynes
		Foxcote
		Greatworth
		Tiffield

143. The Ruthamford supply system is characterised by long strategic trunk mains connecting large treated water storage reservoirs, as shown in Figure 4-6. Water resources in the area are founded upon the large clay catchments with high winter runoff, and return-to-river flows from upstream catchments. Almost all the reservoirs are filled by pumping from rivers.

144. The Ruthamford WRZ is a net exporter of water supplying Luton, Stevenage and Oakham for Three Valleys Water Services and Severn Trent Water. These standing agreements are set to remain in place for the WRMP.

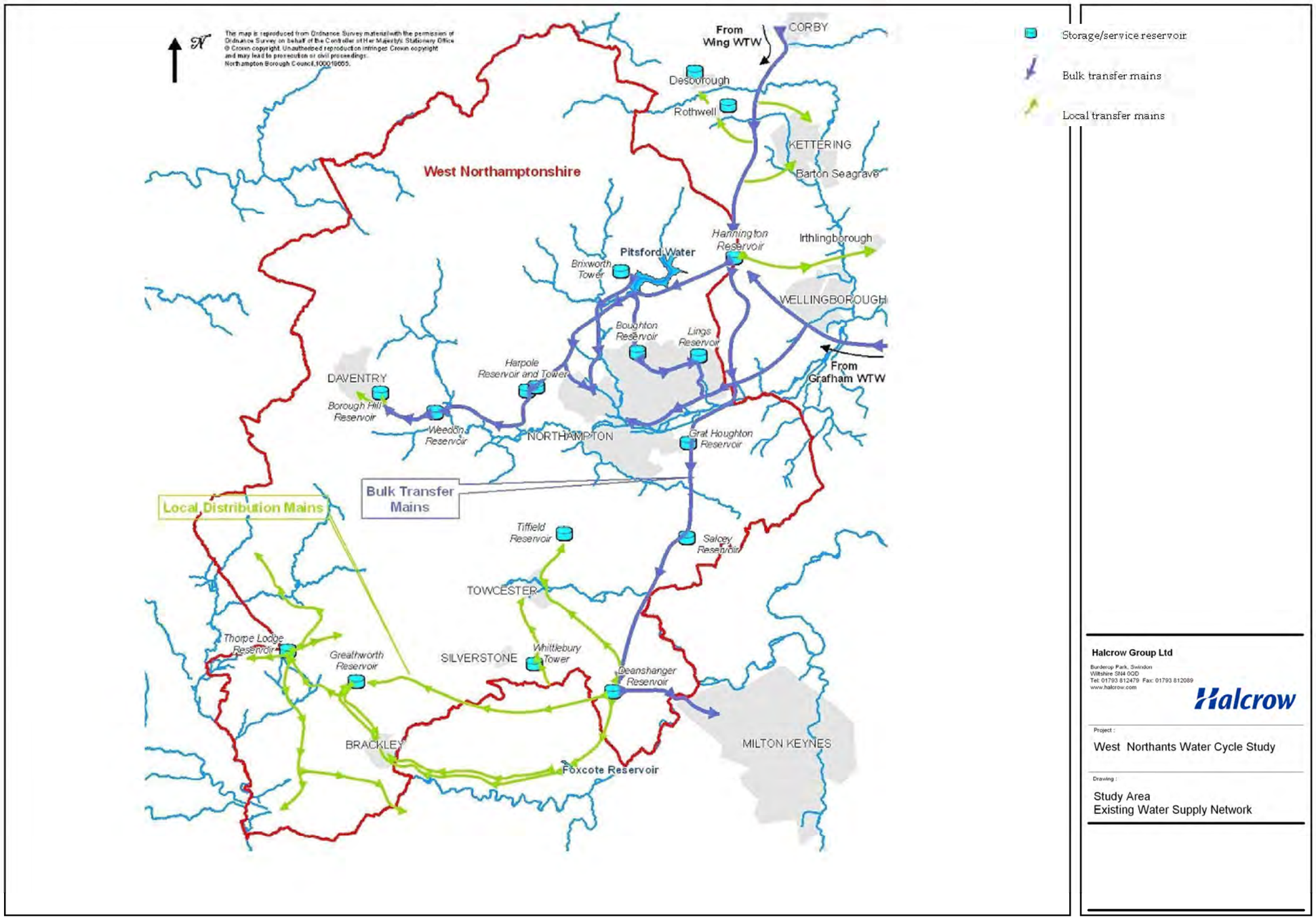


Figure 4-6 Study Area Existing Water Supply Network

145. Demand management in the WRZ has been progressed through leakage and pressure management in the distribution system, household metering and customer efficiency in water use. This in addition to the extension of Grafham Water Treatment Works (WTW) in the 1990s has maintained secure supplies. Continued growth however may require further development of water resources, as problems were experienced during 2001 and 2003 in maintaining secure reservoir water levels in parts of the WRZ.

Previous Planning and Works

146. The following works were implemented to meet growth by Anglian Water Services during the AMP4 period (2005-2010). These upgrades to make additional water available from the WTW in Rutland are under way and on track for completion by the end of the AMP4 period (2010):

- Increasing transfer capacity at the WTW; (due for completion in March 2010). Includes duplication of the existing major transfer from the WTW to Beanfield Reservoir and Beanfield to a reservoir to the west of Wellingborough.
- Increase supply from the WTW to north of Northampton to Daventry and part of Northampton by increased transfer of water from Rutland via a reservoir to the west of Wellingborough.
- Upgrade of the transfer mains from WTW north of Northampton to Harpole Reservoir, including an increase in supply to Northampton through Harlstone Road;
- Increasing available storage capacity at Rutland Water by working within Habitat Directive conditions and requirements;
- Increasing pump capacities at relevant stations to support the increased flows (transfer pumps to Harpole Reservoir have been upgraded, Boughton and Brixworth to be upgraded);
- Upgrade Weedon Water Booster capacity to increase supply to Borough Hill reservoir and into Daventry South.

147. The additional resource resulting from the works in Rutland is made available at a reservoir to the west of Wellingborough. Further works are required in AMP 5 to transfer this water to the specific growth areas, e.g. Daventry. Details of future required works is covered in Section 7.2.6 for Northampton, Section 7.3.6 for Brackley, Section 7.4.6 for Towcester and Silverstone and Section 7.5.6 for Daventry.

4.6 Water Efficiency Targets

National Policy

148. The Government's water strategy for England, Future Water was published February 2008. Future Water outlines a strategic and integrated approach to the sustainable management of Britain's water resources to 2030, for the public water supply as well as for the provision of healthy ecosystems and the services they provide.

149. The Vision by 2030 includes the following measures:

- Reduced per capita consumption of water through cost effective measures, to an average of 130 litres per person per day (l/p/d) by 2030 or possibly even 120 litres per person per day depending on new technological developments and innovation
- Amend the Building Regulations to include a requirement for a minimum standard of water efficiency in new homes. The requirement will be in the form of a calculated whole building performance standard set at 125 litres per day (l/p/d).
- In areas of serious water stress it is believed that near universal metering will be needed by 2030.

150. In response to the Strategy, the Environment Agency have stated that in water stressed areas, such as West Northamptonshire the introduction of universal metering needs to be undertaken earlier. The Environment Agency would like to see the majority of households in areas where water is scarce to be

metered by 2015 with the remainder in water scarce areas being metered by 2020. The Environment Agency also wishes to promote the metering of all new properties, including flats. The Environment Agency recommends that measures are adopted to allow the efficient use of water in all new homes with water efficiency set at 105 litres pre head per day (i.e. level 3/4 for water within Code for Sustainable Homes) or better.

Code for Sustainable Homes (CSH)

151. The Code for Sustainable Homes introduces a step-change in sustainable development and forms a basis for future developments to the Building Regulations. As of May, 2008 the Government has made it mandatory that all new homes have a rating against the Code for Sustainable Homes. The Code measures the sustainability of a new home against nine categories of sustainable design, rating the 'whole home' as a complete package. The Code uses a 1 to 6 star rating system to communicate the overall sustainability performance of a new home. The Code sets minimum standards for energy and water use at each level.

152. A minimum requirement for each of the nine included categories is necessary to achieve the base rating of Level 1. Beyond this, threshold values must be attained for both 'Water' and 'Energy' to achieve higher code levels. Hence to achieve for example Code Level 3, the requirements for both carbon and water efficiency must be achieved in addition to the minimum points system requirement. Points may be awarded in the other sustainability categories for initiatives and measures implemented beyond the base level requirement for Code Level 1.

153. Figure 4-7 defines the Carbon and Water Efficiency requirements for each Code Level rating. This assumes the basic entry requirements are met for the other six categories.

Achieving a sustainability rating

	Minimum Standards				
	Energy		Water		
Code Level	Standard (Percentage better than Part L' 2006)	Points Awarded	Standard (litres per person per day)	Points Awarded	Other Points[4] Required
1(★)	10	1.2	120	1.5	33.3
2(★★)	18	3.5	120	1.5	43.0
3(★★★)	25	5.8	105	4.5	46.7
4(★★★★)	44	9.4	105	4.5	54.1
5(★★★★★)	100[2]	16.4	80	7.5	60.1
6(★★★★★★)	A zero carbon home[3]	17.6	80	7.5	64.9

Notes
1. Building Regulations: Approved Document L (2006) – 'Conservation of Fuel and Power.'
2. Zero emissions in relation to Building Regulations issues (i.e. zero emissions from heating, hot water, ventilation and lighting).
3. A completely zero carbon home (i.e. zero net emissions of carbon dioxide (CO_2) from all energy use in the home).
4. All points in this document are rounded to one decimal place.

Figure 4-7 Code Level Requirements for Energy and Water Efficiency (Source: Code for Sustainable Homes – A Step Change in Sustainable Home Building Practice. Crown Copyright, 2006.)

Regional Policy

154. Under the Water Act 2003, (Part 3 sections 81 & 83), relevant authorities must, where appropriate, take steps to encourage the conservation of water. The West Northamptonshire Area is covered by the East Midlands Regional Spatial Strategy (RSS8) and the East Midlands Regional Plan which will guide

policy until 2026. The East Midlands Regional Plan, published March 2009[4] sets targets for water efficiency (Policy 32) as follows:

155. "Promote improvements in water efficiency in new development and in regeneration to achieve a regional target of 25% (equivalent to an average saving of about 35 litres per person per day);"

156. The strategy also identifies potential resource developments for implementation over the next 25 years, these include:

157. River Trent – The existing abstraction scheme will continue but in the future it will have flow support during low flows periods provided by releases of groundwater from sources developed in the Birmingham area.

158. Rutland Water – Extension to Wing Water Treatment Works to fully utilise the capacity of Rutland Water in the east of the region.

4.7 Anglian Water Resource Strategy

Strategy Overview

159. AWS adopts a twin track approach for water resource management via both demand management and water resource development. A number of demand management proposals have been outlined within the WRMP including:

- Targeted customer metering,
- Targeted leakage control,
- Pressure reduction,
- Domestic water audits, and
- Encouraging water efficient devices.

160. It is noted that many aspects of demand management relies on customer behaviour, and whilst AWS can influence these habits, it is ultimately outside of their control to enforce them. It is therefore essential to the success of demand reduction measures that other bodies also promote the importance of being water smart. This includes Local Authorities (through both planning policy and public education), the Environment Agency, and local press. When this does occur achievements can be made in reducing water demand. AWS currently meter approximately 60% of household properties. This is hoped to be increased to 90% by 2035 and sooner in water stressed areas.

161. AWS has identified within its Strategic Direction Statement that the main risk to supply faced over the next 25 years is climate change. The assumptions made by AWS within its WRMP have been closely aligned with recommendations provided by UK Climate Impact Programme (UK CIP). The combined effect of increased rainfall in the winter months and reduction of rain in the summer months, with higher temperatures will act to decrease the winter recharge season.

162. AWS have published a report referred to as AWS's Strategic Direction Statement 2010-2035, which outlines the direction AWS will be required to take to meet key requirements in their business and align

[4] The status of the Regional Spatial Strategy remains uncertain. Please refer back to paragraphs 13 – 16.

with the regions needs. Key challenges affecting water supply and resources are identified within the document as:

- Housing Population and economic growth
- Climate change
- Effects of environmental pressures
- Provision of water supply

Drought Measures

163. The main drought measures are the potential to reduce the minimum residual flow (MRF's) at Duston Mill intake to the reservoir to the north of Northampton and the Offord intake to the reservoir to the west of Huntingdon. These measures would be sought to allow for increased abstraction during a winter low flow period.

164. In terms of groundwater, on a local scale replacement / satellite boreholes would be used if required, to sustain source reliable outputs and hence deployable outputs from the Greensand aquifer source works. Intra-zone transfers would be used to balance supplies with demands using existing or new trunk mains.

Future Water Resource Strategy

165. The study area falls over a number of AWS Planning Zones (PZ), including Daventry, Northampton, Wellingborough, Ravensthorpe and Corby and Buckingham. AWS's WRMP predicts that the Daventry and Northampton PZs will be in a deficit of 16Ml/day and 28 Ml/day respectively by 2035 for a dry year peak flow scenario. Wellingborough, Ravensthorpe, Corby and Buckingham all have a minor surplus for a dry year peak flow scenario.

166. Ruthamford was identified by AWS as having a surplus of available supply against target headroom during AMP4 and AMP5 (owing to significant investment to increase output from the Rutland Water Treatment Works during the AMP 4 period). AWS's WRMP predicts a deficit for this WRZ by the end of AMP 6 (i.e. around 2020). Figure 4-9 below is taken from AWS' WRMP which depicts the company's resource development strategy to ensure security of supply. Figure 4-8 below indicates the schemes relevant to the Ruthamford Water Resource Zone to support new and existing customers.

PZ	Selected option	Period
ALL	Intra WRZ transfers	AMP5-AMP10
65-67,69,71,76,77,79-81,83	Active leakage control	AMP5-AMP10
77,80	Water efficiency measures	AMP5
66,67,69,71,73,76,77-79,81,82,84	Pressure reduction	AMP5-AMP10
65,66,70,71,76,79,81,83	Enhanced metering	AMP5
65,66,70,71,76-79,81,83-85	Intra WRZ transfer	AMP5-AMP10
ALL	Uprating of Bedford Ouse WTW	AMP6-AMP7
	Recommission Pulloxhill WTW	AMP6-AMP7
	Recommissioning of Foxcote reservoir WTW	AMP6-AMP7
	Peterborough discharge re-use	AMP6-AMP7

Figure 4-8 Preferred Water Management Options in Ruthamford WRZ – Data from Anglian Water's WRMP.

167. The schemes will supply water to more than one planning zone, and may be further extended by the enhancement of trunk mains and local water distribution which will facilitate the supply to new and existing customers.

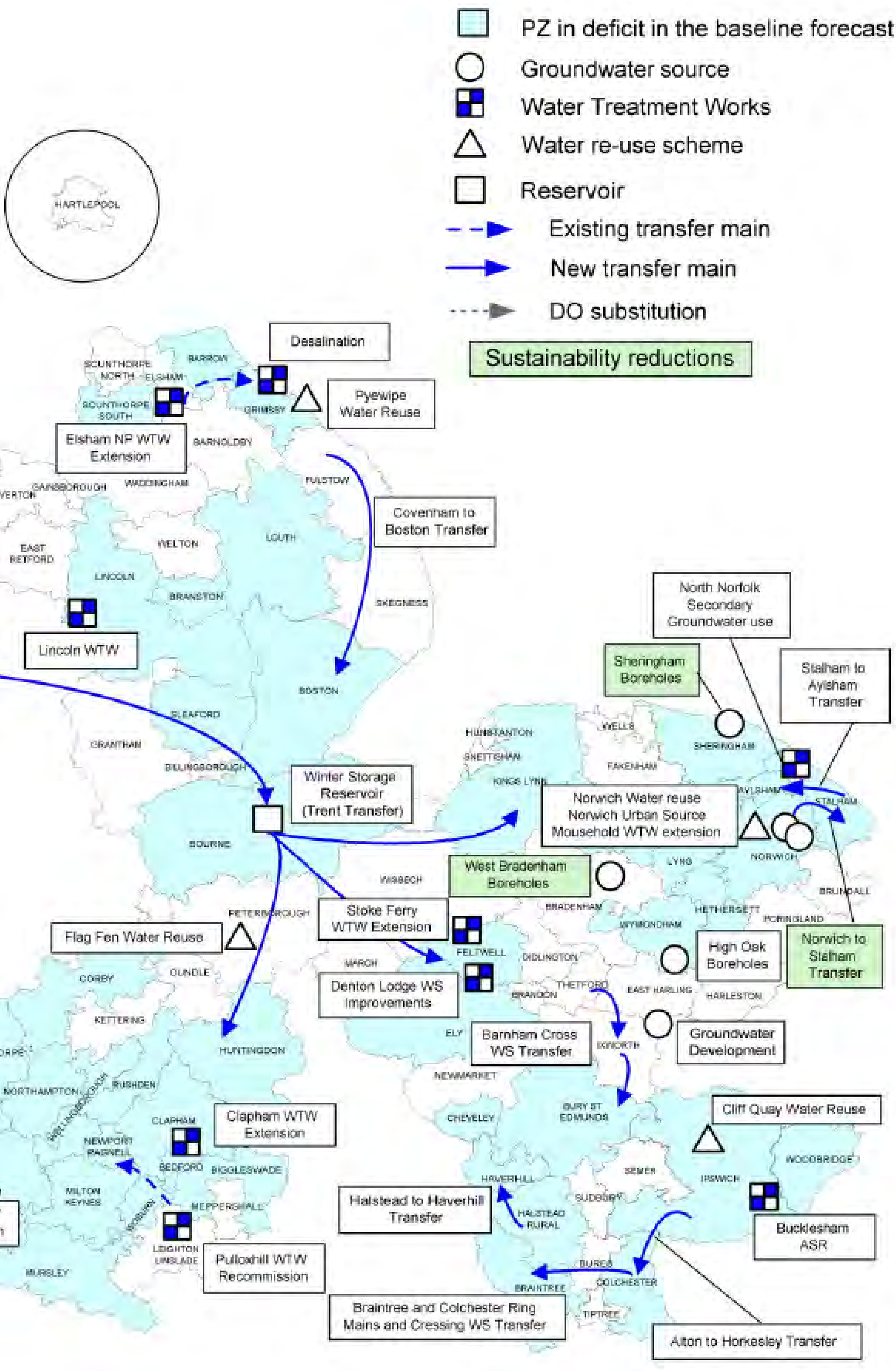


Figure 4-9 Resource development strategy for Ruthamford resource zone

168. In the longer term, AWS is considering the strategic development of the River Trent via a new winter storage reservoir in the Lincolnshire Fens WRZ as a potential solution to provide additional resources to Ruthamford WRZ as well as adjacent water companies who rely on bulk supplies from the region. However, Veolia Water, in preparing their WRMP, have considered the option of the bulk supply provided from the Ruthamford system towards the end of the 25-year planning period. Detailed investigation is ongoing by AWS into this long term strategy as there are a number of issues to be considered, including water resource availability in the Lower River Witham.

169. In conclusion, AWS' strategic infrastructure and resource strategic planning within the Ruthamford Water Resource Zone will support the proposed growth within the study area until 2035. It should be noted that iterative reassessment of this will be undertaken as standard in water company planning, to incorporate latest changes to the social, environmental, and legislative aspects of water resource availability.

Planned and Current Upgrades

170. A number of major strategic capacity constraints to support the proposed growth within the Ruthamford Water Resource Zone (which includes our study area) were identified as part of PR09 planning. It should be noted that this water resource zone will be home to major growth within the Milton Keynes and South Midlands Sub Regional Strategy, and it is supplied by the three major sources in the area. Longer term water resource planning will need to integrate all growth and supply sources within this relatively large demand region.

171. Anglian Water Services (AWS) have undertaken modelling of individual sites within the study area in their planning processes. They were able to provide their outcomes for the purposes of this project. It should be noted that, as the extent and exact location of the growth has not been confirmed, sites have been assessed individually and at a high level to determine the potential offsite works required. For the purposes of strategic transfers, a level of growth appropriate for the design horizon, typically 20 years has been assumed. The growth assumptions are consistent with the East Midlands plan and the Joint Core Strategy.

Network Summary

172. AWS's provision for improvements and upgrades is dependent on the planned growth and developments. Infrastructure strategy to supply this growth is at an advanced stage and some of the work is already being carried out in the current AMP period.

173. For the planned growth being assessed by this WCS, local reinforcements will be required. This is covered in detail in Section 7.2.6 for Northampton, Section 7.3.6 for Brackley, Section 7.4.6 for Towcester and Silverstone and Section 7.5.6 for Daventry.

4.8 Future Water Demand Scenario Testing

Baseline Assumptions

174. All the analysis within the AWS WRMP undergoes a rigorous testing and review process with Defra, Ofwat and the Environment Agency, as well as public consultation. The assumptions made by AWS and the baseline case provided have been accepted for use within the future demand scenario testing undertaken for the WCS.

175. The Office of National Statistics (ONS) publishes mid-year population estimates for local authority areas on an annual basis. The most recent data available when this assessment was carried out was for June 2007 and was published in August 2008. These have been used to estimate the current WRZ and WCS area populations.

176. The 2006/07 population for the Ruthamford WRZ is identified by AWS as 1,541,073. Data from the ONS records a population of 1,629,348. With over 5% difference between the two sets of population data the ONS figures have been used in the demand scenario testing.

177. AWS has developed both a Baseline supply-demand balance and a predicted Final Planning supply-demand balance, based upon the AWS preferred list of water management options to maintain balance of supply within the Ruthamford WRZ up to 2035. The resulting supply-demand balance is shown in Figure 4-10 and is based upon the criteria outlined above and in Section 4.7 for a dry year annual average. The final planning balance shows a minor deficit in the current year, with the remainder of the plan period (other than the last year) in surplus.

Figure 4-10 Ruthamford WRZ Supply-Demand Balance

178. The water company has a statutory requirement to supply water to a specific level of service. The way that it is regulated means that it cannot rely on promises by developers or local authorities to manage demand. Hence, the per capita consumption (PCC) scenarios used by AWS in its demand assessment does not look at more aspirational demand management scenarios that can only be achieved with strong planning policies. This study has therefore considered demand management scenarios that go beyond AWS's plans.

179. The demand management scenarios considered below use the most recent figures from the June Return figures for a 'Dry Year' as a baseline for assessment of more ambitious consumption reduction scenarios. Dry year baseline forecasts are based on "policy growth" projections, this is a combination of the ONS population trend predictions redistributed geographically by the new build property targets published in the RSSs and LDFs. The scenarios show how various demand management strategies can affect the requirement for additional water resources in the study area, and what would need to be done to achieve this in the existing urban areas and the new development sites.

- We have calculated the current total potable water demand for the WCS area by factoring the current demand within the Ruthamford WRZ to that area covered by the WCS. This factor was used to apportion all demand values, including non use (e.g. leakage) and non household demand.
- We have assumed that leakage will remain constant for the WRZ during the plan period at 84.45 Ml/d. AWS assume the same starting point in their WRMP, with leakage increasing to 100 Ml/d by 2035.
- We have assumed that baseline water consumption for existing metered and unmetered properties remains constant during the plan period. This differs from AWS assumption in the WRMP that PCC for these properties varies throughout the planning period.
- We have assumed that non-household demand remains the same during the planning period. AWS have assumed that unmeasured non-household demand remains constant but that measured non-household consumption decreases over the planning period.
- We have used AWS baseline and forecast occupancy rates for new properties provided in their WRMP. We have assumed the occupancy rate in the existing housing remains constant throughout the planning period at the average of baseline unmeasured and measured household rates. The AWS WRMP assumes that the occupancy rate varies for measured households and unmeasured households during the planning period.
- As mentioned earlier, the WRMP undergoes a rigorous testing and review process with Defra, Ofwat and the Environment Agency, as well as public consultation. One of the key areas for scrutiny in this process is the forecast dwelling and population assumptions; therefore we are not undertaking any additional review of the accuracy of AWS forecast population or dwelling numbers.

Water Neutrality

180. The concept of water neutrality has been developed as a measure or goal for water efficiency of new developments. It is defined by the government and the Environment Agency as:

181. "For every new development, total water use across the wider area after the development must be equal or less than total water use across the wider area before the development"

182. The concept of water neutrality is to be applied over an appropriate geographic area. Therefore, additional water demand from a development can be directly offset by reducing demand in the surrounding area.

183. The demand scenarios have been developed to show how water efficiency measures could be used to drive down overall demand to create water neutral growth.

Demand Scenarios

184. Details of each scenario tested for the West Northamptonshire WCS area are listed below. These have allowed an impact assessment to be made on predicted future water demand in relation to various demand management activities. A summary of the scenarios can be found in Table 4-3 and the outcomes of the WCS area demand management scenarios are shown in Figure 4-11.

Scenario 1: Business as usual.

185. This scenario looks at how potable demand would increase should new development be consummate with the RSS levels of development, and that AWS WRMP forecast PCC rates be realised in the new development areas, assuming that all new properties are metered. The PCC for existing homes (metered and unmetered) is assumed to remain constant throughout the planning period. The meter penetration ratio of metered to unmetered homes is assumed to be in agreement with the AWS WRMP forecast. This scenario has been used as the basis against which all other scenarios have been derived.

Scenario 2: New homes built to Code for Sustainable Homes Level 3.

186. This scenario looks at how the implementation of CSH water efficiency targets to CSH level 3 would affect potable demand. All new homes built after 2009 will be required to achieve CSH level 3 (105 l/h/d). We have assumed that all other variables are as detailed in Scenario 1.

Scenario 3: New homes built to Code for Sustainable Homes Level 5.

187. This scenario looks at how the implementation of CSH water efficiency targets to CSH level 5 would affect potable demand. All new homes built after 2009 will be required to achieve CSH level 5 (80 l/h/d). We have assumed that all other variables are as detailed in Scenario 1.

Scenario 4: New homes built to Code for Sustainable Homes Level 5 and increased meter penetration.

188. This scenario looks at how the implementation of water efficiency targets to CSH level 5 and increased meter penetration to 90% by 2016 would affect potable demand. All new homes built after 2009 will be required to achieve CSH level 5 (80 l/h/d) with all new properties metered and plans implemented to increase total meter penetration to 90% by 2016, which is a corresponding uptake of meters by around 4,000 existing homes each year from 2010 to 2016.

Scenario 5: New homes built to Sustainable Homes Level 3 and reduced existing PCC.

189. This scenario is as Scenario 2 with the addition of a reduction in PCC for existing metered properties of 1.4 litres per head per day each year from 2009 to the end of the planning period, equating to a total reduction in PCC of 22 l/h/d for existing metered properties. Existing unmetered PCC remains is assumed to remain constant at the 2006 baseline. All new homes built after 2009 will be also be required to achieve CSH level 3 (105 l/h/d).

Scenario 6: New homes built to Sustainable Homes Level 5 with reduced existing PCC and increased meter penetration.

190. This scenario is as Scenario 3 with the addition of a reduction in PCC for existing metered properties of 2 litres per head per day each year from 2009 to the end of the planning period equating to a total reduction of 32 l/h/d. Existing unmetered PCC is assumed to remain constant at the 2006 baseline. Increased meter penetration is required to 90% by 2016. All new homes built after 2009 will be required to achieve CSH level 5 (80 l/h/d).

Table 4-3 Demand Scenarios Tested

Scenario	Metering			CSH Level 3	CSH Level 5	Yearly Reduction in Existing PCC (l/h/d)	Variance from 2006 Baseline Demand (Ml/d)
	All New Properties	90% by 2035 (AWS)	90% by 2016				
1	✓	×	×	×	×	×	+8.71
2	✓	×	×	✓	×	×	+6.58
3	✓	×	×	✓	✓	×	+4.97
4	✓	✓	✓	✓	✓	×	+4.50
5	✓	×	×	✓	×	1.4	-0.50
6	✓	✓	✓	✓	✓	2.0	-6.22

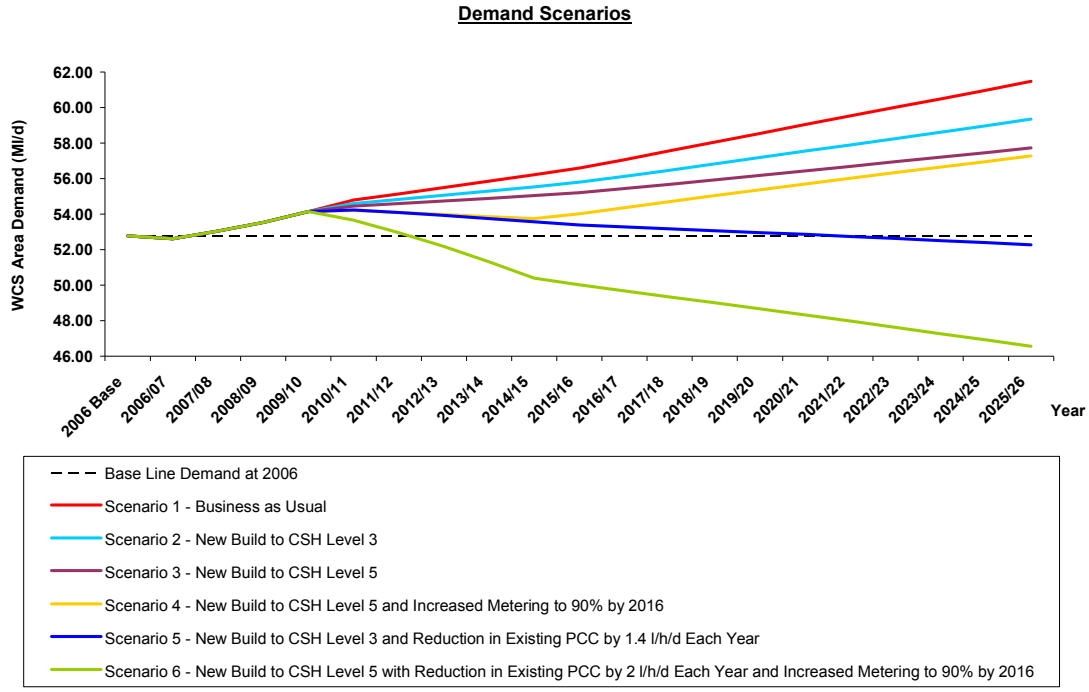


Figure 4-11 West Northamptonshire WCS Area Demand Scenario Results

191. Baseline potable water demand in the WCS area in 2006/07 was 52.77 Ml/d. The business as usual case (Scenario 1), based upon constant existing PCC rates and varying new PCC rates, shows that if no demand management measures are implemented other than those proposed within the baseline forecast an additional 8.71 Ml/d of potable water will be required in the study area by 2026 due to increased development. This is equivalent to almost three and a half Olympic size swimming pools on a daily basis, or an increase in household demand of 16.5 % between now and 2026.

192. The implementation of various levels of the CSH has been tested alongside AWS's proposals on metering. It can be seen that the introduction of increasing levels of the CSH in homes built from 2009 onwards reduces the impact of additional demand from new development. The demands resulting from the implementation of CSH Levels 3 and 5 are around 2% and 4% less than the Business as Usual scenario respectively. A further reduction of 12.5% would be required for Scenario 2 to achieve water

neutrality. Therefore achieving water neutrality cannot be achieved without a reduction in the existing PCC.

193. AWS's proposals for meter penetration are to meet 90% metering by 2035 which is behind the Environment Agency's proposals on 95% meter penetration of the existing population in water stressed areas by 2016, though other demand management procedures are also prescribed in the WRMP. The introduction of increased water meter penetration above those rates proposed by AWS, reduces demand earlier in the planning period, as seen in the comparison between Scenarios 3 and 4, though the overall demands converge by 2035 as AWS meter penetration increases.

194. Scenario 5 shows that a reduction in PCC demand from existing metered properties in conjunction with a suitable level of CSH for new homes can create a water neutral position. Further increasing reductions in existing PCC combined with more stringent efficiency levels show how demand can be dramatically reduced to levels below the baseline 2006 figure, with Scenario 6 creating a saving on baseline demand of 6.22 Ml/d by 2026. A comparison of the predicted 2026 water demands resulting from the various scenarios tested for new strategic development can be found in Figure 4-12.

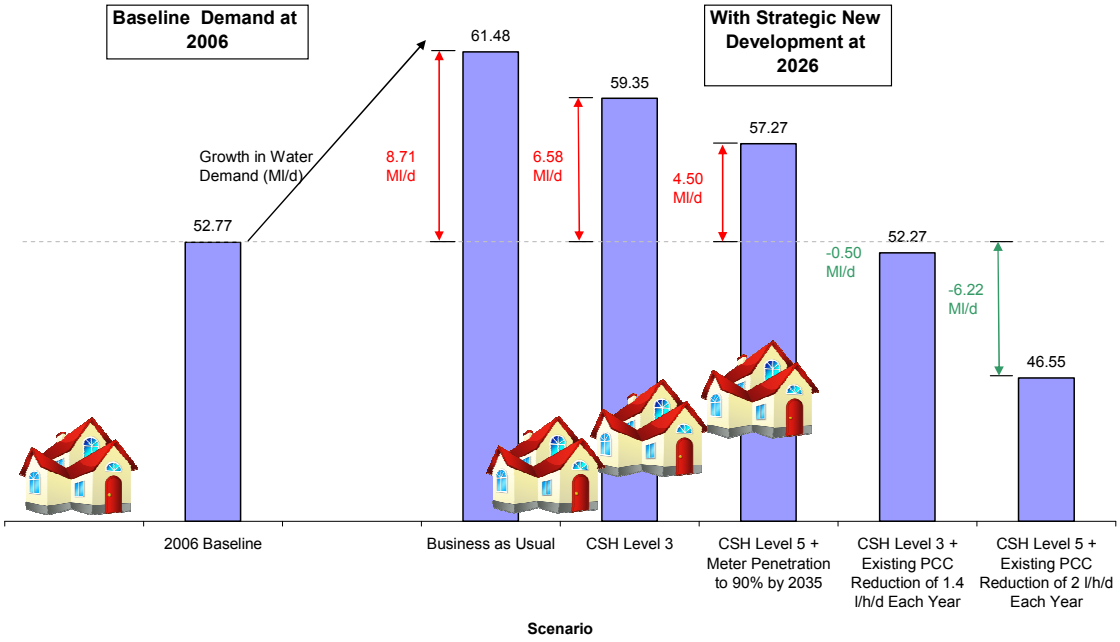


Figure 4-12 A comparison of the 2026 strategic new development water demand scenarios, relative to the 2006 baseline.

195. The analysis shows that the greatest reduction in water demand can be achieved by reducing demand in the existing population and it is apparent that without this action it will not be possible to achieve water neutrality. This is because the existing population account for a larger proportion of the total population than the population from new development. Although measures such as CSH targeted at new developments have a positive impact upon demand, they should be used in conjunction with proposals for the existing population in order to achieve maximum reductions in total demand.

196. A combination of measures is required to achieve water neutrality by 2026. These include AWS proposals for meter penetration or higher, the implementation of CSH level 3 for new homes and a reduction in the existing PCC of the existing population of 1.4 l/h/d each year. This equates to an existing PCC reduction to 106 l/h/d by 2026, the equivalent of CSH level 3. This reduction in existing PCC is perceived to be the greatest challenge and the required levels are unlikely to be realised without

strong policy over and above that currently proposed and should include further measures for retrofitting, education, tariff management and encouraging use of water efficient devices.

197. The reductions in existing PCC each year of 2 l/h/d detailed in Scenario 6 actually reduces overall demand for the period. It results in existing metered properties attaining a PCC of 99 l/h/d by 2026, the equivalent of a new build home between CSH levels 4 and 5. However, even with increased efficiency measures inclusive of retrofit and behavioural change, it must be accepted that reducing existing PCC each year cannot be sustained over the long-term and will be constrained by technology at some point.

4.9 Drivers and Constraints

198. Based on the above assessment of the existing situation, drivers for change, opportunities and constraints (or potential barriers to change) have been identified as summarised below:

- West Northamptonshire has a role to plan for additional housing;
- Unless positive action is taken, population and employment growth will lead to increased water demand;
- Existing water resources in the area are already 'Over Abstracted', 'Over Licensed' or have been given a status of 'No Water Available' by the Environment Agency.
- Notwithstanding the above, water resources do not represent a "show stopper" to development;
- AWS has identified preferred strategies to ensure existing and future residents have an adequate supply of potable water;
- With proposed development water neutrality cannot be achieved without a significant reduction in demand from adjacent settlements. New West Northants residents would be limited to an average of 105 l/h/d from 2010. Existing residents would need to reduce consumption to an average of 106 l/h/d by 2026, which may not be deemed practicable.

4.10 Water Resources Summary

199. AWS's WRMP details a plan to continue with a twin-track approach to supply-demand management. The WCS SC region is in a state of water stress with Environment Agency CAMSs status of 'No Water Available', 'Over Abstracted' or 'Over Licensed' which may result in a tightening of abstraction licences and decreased future licensing when viewed in conjunction with required programs such as the Environment Agency's Restoring Sustainable Abstraction. AWS are currently undertaking and have planned a number of capital schemes to meet predicted further demands through successive AMP periods to 2035 in order to balance supply in the West Northamptonshire WCS area. However, headroom available is seen to decrease through the period due to the effect of growing levels of development, increasing water scarcity and climate change.

200. The scenarios tested above have attempted to predict effects on future demand with various demand management measures in place. Water neutrality has been considered but requires immediate implementation of CSH Level 3 or above, with new tariff structures and/or water efficiency projects to produce the 1.4 l/h/d reductions in existing PCC each year to 2035. It is likely that such a reduction within existing housing stock is impracticable, though this aim along with the implementation of CSH Levels for new homes, intensive efficiency targeting and tighter policies for meter penetration, and the augmentation of water resources can significantly reduce the impact of increased development upon the environment.

201. The demand analysis shows how the application of higher levels of the Code for Sustainable Homes and increasing the proportion of the metered population can help reduce water demand. It also demonstrates that a reduction in the PCC of existing properties and population is likely to have a greater impact than targeting new developments alone. It is recommended that continued support is given to measures currently in place and that new measures and technologies are supported at a national and local level.

202. The promotion of water efficient devices and awareness of water saving measures should continue to be encouraged. Whether this can achieve and maintain a reduction in water consumption as shown in the demand scenarios is uncertain. It is likely that initially a reduction in water consumption is feasible during the initial stages of the planning period with promotion of efficiency devices and education. However to continue the decrease in water consumption beyond a certain level will be difficult as campaigns saturate the customer base and existing technologies are utilised. By this point consumption may be reduced to a level whereby measures, such as additional water resources or licences to support the increase in supply will not be required.

203. Overall, whilst AWS have plans in place to increase the amount of water available, it must be recognised that water availability is finite and good practice should be adopted now to avoid adverse environmental consequences at a later date. It is critical that planning policies are adopted by West Northamptonshire joint Strategic Planning Committee to ensure that all new developments (including greenfield and brownfield) are built to a minimum of CSH level 3 (105 l/h/d), and preferably higher. Furthermore, the evidence from the demand management scenarios indicates the importance of reducing demand in the existing housing stock. This needs to be achieved through an ongoing partnership approach by West Northamptonshire Joint Planning Unit, the Environment Agency and AWS, to identify and implement the optimal mechanism for reducing demand in the existing housing stock. Appendix H identifies an indicative action plan of activities to be explored to manage demand.

5 Flood risk management

5.1 Introduction

204. A review of flood risk management options during a Water Cycle Study is essential to ensure that:

- The risk of flooding from all sources to the development areas is considered and development is steered away from high risk areas (in particular, Flood Risk Zones 2 and 3).
- The potential impact of development proposals on catchment flood response is considered.
- Any flood risk mitigation measures are planned in a strategic, rather than unplanned fashion.
- There is no deterioration to existing communities' standard of protection.

205. The Water Cycle Studies Guidance (Environment Agency, 2008) states that the output of the Water Cycle Study should answer the following question:

206. "Is there enough land available for development - without increasing flood risk or building vulnerable properties in flood risk areas?"

207. It also states that a detailed Water Cycle Study should establish minimum design standards for new development, identify a timeline of infrastructure requirements and consider the basis for developer contributions to infrastructure.

208. The Water Cycle Study is not intended to replace the Strategic Flood Risk Assessment or site-specific flood risk assessments by developers. Instead, it identifies the potential for developers, local planning authorities and the Environment Agency to work together in providing strategic solutions that benefit the catchment as a whole. The Strategic Flood Risk Assessment contains a detailed appraisal of the whole of the council areas. This water cycle study only considers flood risk issues in the context of the Pre-Submission Joint Core Strategy SUEs.

209. The aims and scope of this Water Cycle Study are therefore as follows:

- to review the findings of recent studies into flood risk in West Northamptonshire, with respect to the SUEs being assessed in the Pre-Submission Joint Core Strategy; Sections 4.1.1 to 4.1.6 detail these studies
- to determine existing flood risk to the proposed development areas from all sources of flooding, in order to aid the local planning authority in selecting preferred areas for development; this is covered in section 4.2
- to identify the potential for strategic solutions to mitigate the effects of development and improve flood risk protection standards in the study area. An estimate of 75% PIMP is likely to overestimate of the development area, therefore a detailed site specific Flood Risk Assessment (FRA) should be applied by the developers to determine the specific attenuation volumes required. In addition, no assessment has been undertaken in this study to calculate the attenuation storage that may be required for non residential developments. The Flood Risk Assessment prepared by developers should consider the drainage of the whole site, including non-residential land uses.
- Table 5-3 to table 5-10 identify the requirements for flood risk management at each of the SUEs.

210. Throughout this section, standards of flood protection are referred to according to the probability of flooding occurring in a location in one year. A standard of protection to the 1 in 100 year event means that the location has a 1% chance (1 in 100) of flooding in any year, this is the 1% Annual Exceedance Probability (AEP). This does not mean that if the location floods in one year, it will definitely not flood again for the next 99 years, or that if it has not flooded for the previous 99 years, that it will definitely flood this year.

211. The River Nene, River Great Ouse (including River Tove), River Cherwell and their tributaries all originate within the administrative areas of the West Northamptonshire local planning authorities (LPAs). The principal rivers in the study area drain from west to east with the exception of the River Cherwell, which flows from north to south. The upper reaches of these catchments are classed as being 'flashy' due to the underlying hard rock geology, leading to relatively short catchment response times. The main source of flooding within West Northamptonshire is from rivers and watercourses overtopping their banks. A full description of catchment hydrology is given in Appendix B.

5.1.1 Nene Catchment Flood Management Plan Summary Report (December 2009)

212. The Nene Catchment Flood Management Plan (CFMP) covers the catchment of the River Nene, the upper reaches of which are within the Water Cycle Study area. It is a high-level document of strategic policies designed to plan for flood risk management in the catchment over the next 100 years. The final CFMP was published by the Environment Agency in December 2009.

213. The River Nene CFMP area has been divided into 8 sub areas, four of these are located partly or wholly within the West Northamptonshire Water Cycle Study area. Sub areas are based on clearly defined areas of the catchment which have common sources and mechanisms of flooding and common receptors of flooding (people, properties, environment etc). The scale of flood risk across each sub area is also similar. One preferred appropriate policy will be applied across the sub area.

214. The three sub areas which include presubmission core strategy SUEs, plus the sub area in which the Northampton Central Area Action plan falls are detailed in Table 5.1. Further detail regarding all of the five sub areas included within the West Northamptonshire Water Cycle Study area can be found in Table B1 in Appendix B. The flood risk management policy selected for each sub area is detailed in. General actions from the CFMP relating to development are included in Appendix B

Table 5-1 Flood Risk Management Policies from the River Nene CFMP for Sub areas lying (partly or wholly) within West Northamptonshire

Sub area	Pre submission SUEs	Flood risk management policy	Policy option number
Upper and Middle Nene catchment	Daventry North East Northampton West Northampton Kings Heath Northampton North of Whitehills Northampton North Northampton South of Brackmills	Areas of low to moderate flood risk where we can generally reduce existing flood risk management actions.	2
Northampton Central and Northampton Outer	-	Areas of low, moderate or high flood risk where we are already managing the flood risk effectively but where we may need to take further actions to keep pace with climate change.	4
River Nene (Weedon to Kislingbury) and River Nene Corridor	Northampton Upton Park	Areas of low to moderate flood risk where we will take action with others to store water or manage run-off in locations that provide overall flood risk reduction or environmental benefits.	6
Wootton, Thrapston, Barnwell and River Nene (Oundle to Water Newton)	Northampton South	Areas of low to moderate flood risk where we are generally managing existing flood risk effectively.	3

5.1.2 Draft Great Ouse Catchment Flood Management Plan Summary Report (April 2010)

215. The Great Ouse Catchment Flood Management Plan (CFMP) covers the catchment of the River Great Ouse, The River Great Ouse starts in Northamptonshire near Brackley and passes through several towns before it crosses the Fens and flows into The Wash downstream of King's Lynn. The western area of the Great Ouse catchment is within the Water Cycle Study area

216. The Great Ouse CFMP area has been divided into 11 sub areas, two of these are located partly or wholly within the West Northamptonshire Water Cycle Study area. Sub areas are based on clearly defined areas of the catchment which have common sources and mechanisms of flooding and common receptors of flooding (people, properties, environment etc). The scale of flood risk across each sub area is also similar. One preferred appropriate policy will be applied across the sub area.

217. The two sub areas within the West Northamptonshire Water Cycle Study area are described in Table B1 in Appendix B. The flood risk management policy selected for each sub area is detailed in Table 5-2. General actions from the CFMP relating to development are included in Appendix B.

Table 5-2 Flood Risk Management Policies from the Great Ouse CFMP for Sub areas lying (partly or wholly) within West Northamptonshire

Sub area	Pre submission SUEs	Flood risk management policy	Policy option number
Bedford Ouse Rural and Eastern Rivers	Brackley East Brackley North	Areas of low to moderate flood risk where we can generally flood risk management actions.	2
Towcester, Shefford/the Flit Corridor, Alconbury/Alconbury Weston and Huntingdon/Brampton	Towcester South	Areas of low to moderate flood risk where we are generally managing existing flood risk effectively	3

5.1.3 West Northamptonshire Strategic Flood Risk Assessment Level 1

218. The West Northamptonshire Strategic Flood Risk Assessment (SFRA) together with the Northampton Borough Council SFRA covers the same area as this Water Cycle Study. The purpose of the SFRA is to provide information on current and future flood risk (taking into account climate change) from all sources to allow decision makers to allocate development and infrastructure in accordance with PPS25.

219. Level 1 of the West Northamptonshire SFRA was published in February 2009 by Scott Wilson.

220. The key recommendations from the Level 1 SFRA that apply to the SUEs being assessed are listed below:

- 'Councils should undertake their Sequential Testing based upon the information presented in the Final Level 1 SFRA and the accompanying mapping and GIS datasets.
- Following the completion of the Sequential Testing, any areas that cannot be located within a low flood risk area (i.e. Flood Zone 1) should then be examined in more detail during a Level 2 assessment. The purpose of a Level 2 assessment is to provide enough information to allow the

relevant LPA to either re-apply their Sequential Testing, in light of further information or to apply the Exception Test to the proposed development area. The scope of the Level 2 assessments cannot be set until the Sequential Testing has been undertaken.'

5.1.4 Daventry and South Northamptonshire Strategic Flood Risk Assessment Level 2

221. The principal recommendations from the Level 2 SFRA in relation to the Pre-Submission sustainable urban extension are listed below:

- 'It would be prudent to undertake a Surface Water Management Plan for the Daventry and South Northamptonshire administrative areas.
- It will be necessary to identify safe and dry access and egress routes for all development and any development in Flood Zone 1 over 1ha will require a surface water FRA.
- A site specific FRA which included detailed modelling of the ordinary watercourses flowing through the Pre-Submission sustainable urban extensions of Towcester South has already been undertaken. The Environment Agency however subsequently objected to the planning application on flood risk grounds. Therefore a review of the existing modelling work and an updated FRA for any new planning applications are recommended for this site.'

5.1.5 Northampton Strategic Flood Risk Assessment Level 2

222. Level 2 of the SFRA looked in more detail at those areas of high risk of flooding where it is likely the PPS25 exception test will be required.

223. The principal recommendations from the Level 2 SFRA in relation to the Pre-Submission sustainable urban extensions are listed below:

- 'Critical Drainage Areas' (CDA's) have been identified within the Borough using Anglian Water DG5 Data and Environment Agency 'Area Susceptible to Surface Water Flooding Maps' and these should be addressed by a Surface Water management Plan.
- There are a wide variety of SuDS techniques and therefore it is possible to incorporate SuDS into all development.
- Recommendations and policies have been presented for each of the individual area and the Northampton Longer Term Growth Options Study (NTLGOS) areas, and should be considered if any of the area comes forward for development.'

5.1.6 West Northants Water Cycle Study Phase One Outline (May 2009)

224. The study identified three key findings relating to flood risk:

- It is critical to the sustainable management of flood risk that all new developments take account of the guidance provided in PPS25. Flood risk mitigation measures will be required on a strategic basis, as well as on individual development sites, to ensure that this guidance is adhered to.
- The CFMP for the River Nene recommended a strategic study of flood risk across the whole catchment.
- There is a risk of flood mitigation measures in one area exacerbating flood risk in other parts of the catchment, even if accepted guidance for individual sites is followed. It is therefore recommended that detailed consideration is given to the cumulative impact of development across the study area.

5.2 Northampton town catchment review

225. A high level assessment of current flood risks was undertaken using the Environment Agency's Flood Zones. Flood zones 2 and 3 are present along all watercourses. For sites of 1ha or larger, where part of the development sectors are in flood zone 2 and 3 the developer of these sectors should undertake a flood risk assessment to establish the extent of the flood zones 2, 3a and 3b for these sectors, and the future extent of these flood zones with climate change. Land use within these sectors should be allocated according to the appropriate uses for the flood zones according to PPS25. Hydrology and flood risk in the context of the Pre-Submission SUEs

226. Bugbrooke Brook joins the River Nene from the south upstream of Northampton. There are areas benefitting from defences on the south bank of the River Nene around Bugbrooke Mill and around Kislingbury. The Nene CFMP state that up to 100 properties benefit from the Kislingbury defences with a standard of protection of 0.5%AEP (reference Table 6.7 Page 302 of River Nene CFMP (Final Plan V10.0) dated December 2008).

227. The flood risk management policy from the Nene CFMP for the River Nene (Weedon to Kislingbury), which is upstream of the development sectors (except Northampton Upton Park), is: "Take action with others to store water or manage run-off in locations that provide overall flood risk reduction or environmental benefits."

228. One of the actions arising from the Nene CFMP for the River Nene (Weedon to Kislingbury) sub area is to develop a Flood Storage Study to investigate creating/developing flood storage on the River Nene. The lead partner for the study is the Environment Agency. The CFMP states that the study should consider the flood defence measures constructed at Upton and should determine the possible location of storage and combination of river restoration and engineered flood storage. Flood storage between Weedon and Kislingbury will provide an opportunity to mitigate future flood risk to downstream Northampton. The timing of development and the LDF may provide an opportunity for links between the two strategies.

229. To the south of Northampton Wootton Brook flows north-west to join the River Nene above Northampton at Upton Mill. Areas of Flood Zones 2 and 3 along Wootton Brook and its tributaries (including the Kislingbury Grange Brook and the watercourse running north from Blisworth through Milton Malsor) are relatively narrow, indicating narrow floodplains. The Pre-Submission SUE of Northampton South borders the Wootton Brook.

230. According to the Environment Agency's flood maps there are some areas benefitting from defences in the area around the Pre-Submission SUE of Northampton South and a short length of defences upstream of the site on Wootton Brook. The Nene CFMP notes that the defences on Wootton Brook are privately maintained. The Nene CFMP states that the Wootton Sub Area is largely urbanised with insufficient floodplain area to make flood storage effective. Therefore any runoff from development would have to be attenuated on site. The CFMP flood risk management policy selected for Wootton Brook is to continue with existing and alternative actions to manage flood risk at the current level (accepting that flood risk will increase overall over time from the current baseline due to the predicted impacts of climate change). Therefore development in this area may be exposed to higher fluvial flood risk in the future as flood risk increases with climate change. Although the CFMP indicates that the preferred policy for this area accepts that flood risk may increase over time, if development is to proceed in this location we recommend that developers should be required to achieve betterment on their sites to mitigate the additional risk. This supports the Northampton Borough Council SFRA level 2 (February 2010) which states that development should seek a strategic solution and also aim to provide betterment (PPS25).

231. The CFMP states that there have been a number of modifications to the channels and floodplains as part of the development of the Wootton catchment. This includes some online storage lakes along Wootton Brook and other measures linked to specific developments to compensate for their impact in terms of increased surface runoff to the watercourses from paved areas.

232. The **Brampton Branch of the River Nene** flows south through the town centre. Areas of flood zones 2 and 3 along the Brampton Branch and its tributaries are relatively narrow, indicating narrow floodplains. The Northampton North SUE borders these watercourses. The CFMP policy choice for the Northampton Outer sub area is: "take further action to sustain the current level of flood risk into the future." The CFMP considered flood storage on the Brampton Branch upstream of Northampton (in the Upper and Middle Nene sub area unit which includes areas upstream of the Pre-Submission SUEs). However, this was rejected as it was felt there is a lack of potential for storage in this location. The CFMP notes that the Northampton Outer Sub area is heavily urbanised with insufficient space for water to be stored. In urban areas such as Northampton floodplains are often developed leaving little potential for the development of natural floodplain storage. Therefore any runoff from development would have to be attenuated on site which may pose a constraint to development.

233. **Billing Brook** flows south through the Weston Favell/Great Billing area and joins the River Nene at Billing Aquadrome. The floodplain is narrow and areas of flood zones 2 and 3 are therefore of limited width. The Northampton North SUE borders these watercourses. The area is close to Overstone Country Park. Investigations should be made by developers as to whether runoff could be attenuated in the park. However any attenuation should not increase the risk of breach of the embankment forming the Overstone Park Lake. All other ponds along the brook are downstream of the Pre-Submission SUEs and so would not provide any opportunity for attenuation of runoff from the SUEs. Increased attenuation beyond existing greenfield runoff limits could be counter productive as it could adversely affect the phasing of hydrographs on the Nene as the Billing Brook discharges downstream of the Nene Washlands

234. A review of the capacity of Overstone Park Lake should be undertaken before any development takes place in Northampton North. Developers and the Local Development Framework should follow recommendations from the Pitt Review (2007) on flood risk from reservoirs. The recommendation includes: "the Government should provide Local Resilience Forums with the inundation maps for both large and small reservoirs to enable them to assess risks and plan for contingency, warning and evacuation and the outline maps be made available to the public online as part of wider flood risk information." Developers should work with the Local Resilience Forum to implement these recommendations. This may pose a constraint on development of part of Northampton North.

235. The standard of protection of the Billing Brook flood detention pond (operated by Northampton Borough Council) is unknown. The ponds are located downstream of the Northampton North SUE and would not provide any flood protection to the development area. Development of areas upstream of the Billing Brook flood detention ponds should not compromise the operation of the ponds and therefore reduce their capacity for flood water storage.

236. **Ecton Brook** flows south to join the Nene downstream of Northampton and marks the current eastern extension of the town. **Barton Brook** flows south from Sywell Reservoir to join the Nene downstream of Northampton. The floodplain of Barton Brook is narrow and areas of flood zones 2 and 3 are therefore of limited width. There are three small off-line ponds along the west (Northampton) bank of Ecton Brook constructed for amenity purposes. It may be possible to attenuate flows in these ponds or in the Upper and Lower Ponds at Overstone Solarium; this should be investigated by developers. It is unlikely that any flood storage would be feasible upstream of Barton Brook due to the presence of Sywell reservoir and the narrow floodplains. Recommendations from the Pitt Review (2008) on flood risk from reservoirs should be followed for areas downstream of Sywell reservoir.

237. The **River Nene** flows west to east close to the centre of Northampton towards Great Billing. There are defences along the south bank of the Nene near Cogenhoe.

238. Dallington Brook flows to the east through the western part of Northampton and joins the Brampton Branch of the River Nene at Victoria Park. The Pre-Submission SUEs of Northampton West and Northampton Kings Heath are located in the Dallington Brook catchment. There are a series of flood storage areas along Dallington Brook. The main flood storage area 250m upstream of Mill Lane is an off-line flood storage area which is owned and operated by the Environment Agency. It has a capacity of

about 13,000m^3 and is filled from a side spillway weir in the right bank of the brook. The flood storage area is normally kept empty by a low-level culvert through the embankment at the downstream end and spills, when full, back into the brook. There are two smaller on-line ponds on the brook immediately downstream of the reservoir but these are long established amenity ponds and have no flood storage function (Northampton Borough Council SFRA, 2004). Dallington flood storage area was built in the 1980s to accommodate the additional impermeable area runoff from upstream urban development by the year 2000 to a 2% (1 in 50 years) standard. The Environment Agency also has a small flood storage area at Tintern Avenue, circa 1,000m downstream of the Dallington flood storage area.

Pre-Submission SUEs assessment for Northampton

239. Seven Pre-Submission SUEs have been outlined for Northampton; Northampton South, Northampton West, Northampton North, Northampton South of Brackmills, Northampton Upton Park, Northampton North of Whitehills and Northampton King's Heath.

240. The CFMP flood risk management policy for the Upper and Middle Nene (which includes Daventry) is to reduce existing flood risk management actions (accepting that flood risk will increase over time).

241. A high level assessment of current flood risks was undertaken using the Environment Agency's Flood Zones (Figure 5-1). Flood Zones 2 and 3 are present along all watercourses. For sites of 1ha or larger, where part of the development sectors are in Flood Zone 2 and 3, the developer of these sectors should undertake a flood risk assessment to establish the extent of the Flood Zones 2, 3a and 3b for these sectors, and the future extent of these Flood Zones with climate change. Land use within these sectors should be allocated according to the appropriate uses for the Flood Zones according to PPS25.

242. A summary of the recommendations for the Northampton Pre-Submission Joint Core Strategy SUEs is given in Table 5-4.

Northampton South

243. The proposed Pre-Submission SUEs of Northampton South is located between the M1 and the Wootton area of Northampton. Total housing capacity of 1,000 properties is proposed in an area of circa 128 hectares.

244. The land slopes gently north-eastwards, allowing rainfall runoff to flow downhill into Wootton Brook which runs through the northern boundary of the development area. This watercourse is responsible for the area along the northern boundary of the site being classed as Flood Zones 3 and 2 – high and medium flood risk. The rest of the area is classified as Flood Zone 1 (low risk of flooding). Increased runoff from Northampton South development could increase the risk of flooding to Collingtree Park, located on the northern border of the site. Surface water attenuation will be required for the development.

Northampton West

245. The proposed Pre-Submission SUE of Northampton West is located to the east of New Duston. Total housing capacity of 1,500 properties is proposed in an area of circa 82 hectare. A large part of the development site slopes gently northerly, allowing rainfall runoff to flow into the upper reaches of Dallington Brook. A small area bordering Dallington Brook is classed as Flood Zones 3 and 2 – high and medium flood risk. The rest of the area is classified as Flood Zone 1 (low risk of flooding).

246. Surface water attenuation will be required for the development. Dallington flood storage area is located downstream of the proposed development area. Development of flood storage upstream on Dallington Brook could reduce the risk posed by flooding in the future to approximately the same level as at present. This should be investigated as part of a site specific flood risk assessment.

Northampton North

247. The proposed Pre-Submission SUE of Northampton North is located east of the Moulton area of Northampton adjacent to Billing Brook. Total housing capacity of 2,000 properties is proposed in an area of circa 120 hectares. The development site slopes gently southwards, allowing rainfall runoff to drain directly through the Billing area of Northampton into Billing Brook. Unmitigated, the flood risk in Billing is likely to increase due to the increase in impermeable area in the catchment by development of Northampton North.

248. The development site is mostly Flood Zone 1, however, a small area on the east border of Northampton North is within Flood Zones 3 and 2 – high and medium flood risk.

Northampton South of Brackmills

249. The proposed Pre-Submission SUE of Northampton South of Brackmills partly slopes southerly towards Wootton and partly slopes northerly towards Brackmills and the River Nene. Rainfall runoff will flow through either Wootton or Brackmills, increasing the flood risk in these areas unless flows are attenuated. The development site is within Flood Zone 1 (low risk of flooding).

Northampton Upton Park

250. The proposed Pre-Submission SUE of Northampton Upton Park slopes southerly towards the River Nene. Rainfall runoff will flow through Northampton, increasing the flood risk in these areas unless flows are attenuated. The development site is within Flood Zone 1 (low risk of flooding).

Northampton King's Heath

251. The proposed Pre-Submission SUE of Northampton King's Heath is located between Dallington brook and the Brampton Branch of the River Nene. Rainfall runoff will flow through Northampton, increasing the flood risk in these areas unless flows are attenuated. The development site is within Flood Zone 1 (low risk of flooding).

Northampton North of Whitehills

252. The proposed Pre-Submission SUE of Northampton North of Whitehills slopes westerly towards the Brampton Branch of the River Nene. Rainfall runoff will flow through Northampton, increasing the flood risk in these areas unless flows are attenuated. The development site is within Flood Zone 1 (low risk of flooding).

Outline attenuation volumes for the Pre-Submission SUEs in Northampton

253. Outline hydrological analysis has been undertaken for the four Pre-Submission SUEs in Northampton to calculate approximate flood storage volumes for 0.5% AEP flows with provision for climate change. An estimate of 75% PIMP is likely to overestimate of the development area, therefore a detailed site specific Flood Risk Assessment (FRA) should be applied by the developers to determine the specific attenuation volumes required. In addition, no assessment has been undertaken in this study to calculate the attenuation storage that may be required for non residential developments. The Flood Risk Assessment prepared by developers should consider the drainage of the whole site, including non-residential land uses.

254. Table 5-3 below indicates approximate flood storage volumes to attenuate runoff from development up to the 0.5% AEP flow to greenfield rates as calculated using the Defra/Environment Agency technical report W5-074/A/TR/1. For the purposes of the preliminary attenuation calculations development areas were calculated assuming 40 homes per hectare plus 15% open space. A Percentage Impermeable Area (PIMP) of 75% is assumed in the attenuation calculations.

255. An estimate of 75% PIMP is likely to overestimate of the development area, therefore a detailed site specific Flood Risk Assessment (FRA) should be applied by the developers to determine the specific attenuation volumes required. In addition, no assessment has been undertaken in this study to calculate

the attenuation storage that may be required for non residential developments. The Flood Risk Assessment prepared by developers should consider the drainage of the whole site, including non-residential land uses.

Table 5-3 Approximate long term and attenuation storage volumes required for the Pre-Submission SUEs in Northampton, for a 0.5% AEP event with climate change

SUE	Total Housing Capacity to 2026 *	Area of development (ha)#	Long term flood storage (m^3)	Attenuation Storage (m^3), (0.5% AEP)
Northampton South	1000	58	4,100	17,900
Northampton South of Brackmills	1000	46	4,100	16,500
Northampton North	2000	114	12,200	42,000
Northampton North of Whitehills	1000	48.8	6,100	18,100
Northampton Upton Park	1000	86.5	4,100	18,000
Northampton Kings Heath	3500	219.7	21,400	81,900
Northampton West	1500	81.8	9,200	35,700
* As advised by WNJPU Jan 2011 # As advised by WNJPU Jan 2011				

256. It should be noted that the design standard at the development sites is 0.5% AEP (1 in 200 years), to protect Central Northampton . Volumes given above are for the 0.5% AEP flows, following the Defra/Environment Agency's guidance (Preliminary rainfall runoff management for developments, 2005). A detailed site specific Flood Risk Assessment (FRA) should be applied by the developers to determine attenuation volumes required to store the 0.5% AEP flows.

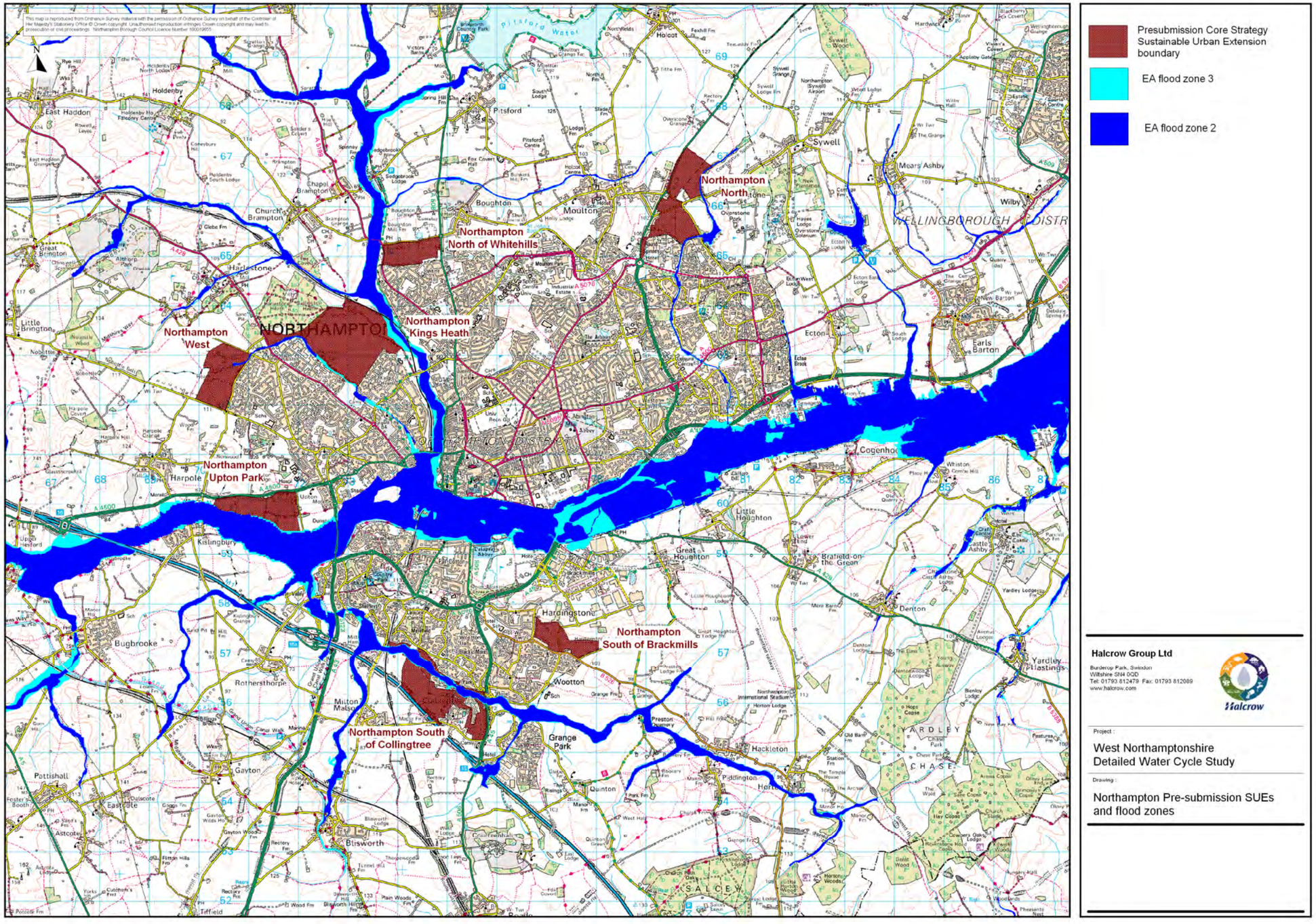


Figure 5-1 Northampton Flood Zone Mapping

Table 5-4 Recommendations for Pre-Submission SUEs - Northampton

Pre-Submission SUE	Flood risk (fluvial, sewerage, surface water)	Flood defences	Future flood risk	Recommendations
Northampton South	Fluvial flood risk to areas adjacent to Wootton Brook and its tributaries (including the Kislingbury Grange Brook and the watercourse running north from Blisworth through Milton Malsor). Recorded surface water flooding in the Wootton Brook catchment.	No formal flood defences. Any defences privately owned.	Future flood risk is likely to increase with climate change. The draft CFMP policy is to continue with existing and alternative actions to manage flood risk at the current level	Attenuate runoff so run off from the development does not increase the risk of flooding to downstream areas. Surface water flooding problem should not be exacerbated by new development. New development must not reduce the capacity of online storage lakes created as part of previous development.
Northampton West	Fluvial flood risk to areas adjacent to Dallington Brook.	Dallington flood storage reservoir. Small flood storage reservoir adjacent to Dallington Brook at Tintern Avenue.	Future flood risk should remain at current levels as the draft CFMP policy is to take further action to sustain the current level of flood risk into the future.	Attenuate runoff so run off from the development does not increase the risk of flooding to downstream areas. On site storage of runoff is recommended through SuDS. Should space be limited on site, developers could investigate the potential for storage upstream on Dallington Brook. However, on site storage is likely to be the most cost effective measure to manage surface water runoff.
Northampton North of Whitehills	Site is within Flood Zone 1 – low flood risk.	No formal flood defences on Brampton Branch of the River Nene adjacent to the site.	Future flood risk should remain at current levels as the draft CFMP policy is to take further action to sustain the current level of flood risk into the future.	Attenuate runoff so run off from the development does not increase the risk of flooding to downstream areas. On site storage of runoff is recommended through SuDS. Should space be limited on site, developers could investigate the potential for storage upstream on Brampton Branch of the River Nene. However, on site storage is likely to be the most cost effective measure to manage surface water runoff.
Northampton King's Heath	Fluvial flood risk to areas adjacent to Dallington Brook and Brampton Branch of the River Nene.	Dallington flood storage reservoir. Small flood storage reservoir adjacent to Dallington Brook at Tintern Avenue. No formal flood defences on Brampton Branch of the River Nene adjacent to the site.	Future flood risk should remain at current levels as the draft CFMP policy is to take further action to sustain the current level of flood risk into the future.	Attenuate runoff so run off from the development does not increase the risk of flooding to downstream areas. On site storage of runoff is recommended through SuDS. Should space be limited on site, developers could investigate the potential for storage upstream on Dallington Brook or Brampton Branch of the River Nene. However, on site storage is likely to be the most cost effective measure to manage surface water runoff.
Northampton Upton Park	Fluvial flood risk to areas adjacent to the River Nene.	No formal flood defences on the River Nene adjacent to the site.	Future flood risk could increase as the flood risk management policy from the Nene CFMP for the River Nene (Weedon to Kislingbury) is: "Take action with others to store water or manage run-off in locations that provide overall flood risk reduction or environmental benefits	Attenuate runoff so run off from the development does not increase the risk of flooding to downstream areas. On site storage of runoff is recommended through SuDS. Should space be limited on site, developers could investigate the potential for storage upstream on the River Nene in line with the CFMP policy.
Northampton North	Fluvial flood risk to areas adjacent to Billing Brook.	Billing Brook flood detention pond (standard of protection unknown). Amenity ponds along Billing Brook.	Future flood risk should remain at current levels as the draft CFMP policy is to take further action to sustain the current level of flood risk into the future.	Attenuate runoff so run off from the development does not increase the risk of flooding to downstream areas. On site storage of runoff is recommended through SuDS. Should space be limited on site, developers may investigate whether runoff could be attenuated in Overstone park or upstream. This should not increase the risk of failure of the embankment forming the Overstone Park Lake.

Pre-Submission SUE	Flood risk (fluvial, sewerage, surface water)	Flood defences	Future flood risk	Recommendations
				However, on site storage is likely to be the most cost effective measure to manage surface water runoff. A review of the capacity of Overstone Park Lake should be undertaken before any development takes place in the locality. Recommendations from the Pitt Review (2007) on flood risk from reservoirs should be followed. Developers should work with the Local Resilience Forum to implement these recommendations. This may pose a constraint on the eastern part of the development area. Developers could investigate whether runoff could be attenuated in amenity ponds along Billing Brook. Development of areas upstream of Billing Brook flood detention ponds should not compromise the operation of the ponds and therefore reduce their capacity for flood water storage. If using existing storage on Billing Brook is not possible then on site attenuation must be provided.
Northampton South of Brackmills	Site is within Flood Zone 1 – low flood risk. Recorded surface water flooding in the Wootton Brook and Nene catchments.	No formal flood defences.	Future flood risk should remain at current levels as the draft CFMP policy is to take further action to sustain the current level of flood risk into the future.	Surface water flooding should not be exacerbated by new development.

5.3 Daventry

257. Daventry is located in the west of the study area, close to the Kislingbury arm of the Nene. The Grand Union Canal is located to the north of Daventry. The canal is supplied with water from the Daventry and Drayton reservoirs. According to the Nene CFMP, the relatively small British Waterways reservoirs (Daventry and Drayton reservoirs) in the upper reaches of the Kislingbury Branch are unlikely to have a significant influence on how the catchment responds.

258. The River Cherwell rises at Hellidon to the south east of Daventry, flowing in a southerly direction through parts of Daventry District and South Northamptonshire.

259. Daventry is, for the most part, located in Flood Zone 1 (less than 1 in 1000 years probability of flooding). However, a small area immediately south and north of Daventry reservoir is classified as Flood Zone 3 (high risk). This area is within the Pre-Submission SUE of Daventry North East.

Pre-Submission SUEs assessment for Daventry

260. One Pre-Submission SUE has been outlined for Daventry; Daventry North East. This sites is located on the periphery of Daventry, close to the commitment site, Daventry Monksmoor. A summary of the recommendations below is provided in Table 5.6. These recommendations reflect the sites proximity to Monksmoor and recognise the development at Monksmoor.

261. The CFMP flood risk management policy for the Upper and Middle Nene (which includes Daventry) is to reduce existing flood risk management actions (accepting that flood risk will increase over time).

Daventry North East

262. The northern flanks of Borough Hill border the southern boundary of the Pre-Submission allocatinon of Daventry North East, therefore creating a flow path for rainfall run off into this area from the south. Further run-off would drain to the west into Daventry reservoir, to the north into the Grand Union Canal and to the east in the direction of the village of Norton. A section of the site in the north west, where a small watercourse flows between Daventry Reservoir and the Grand Union Canal, falls within Flood Zones 3 and 2 – high and medium flood risk. The land in this area is predominantly flat, and lower than surrounding land, creating a natural ponding area for run off. This area is also within a modelled flood extent from a breach of Daventry Reservoir. These flood risk areas are proposed as Pre-Submission SUEs green space. No built development should be permitted in the area at risk of flooding in the event of a breach of Daventry Reservoir.

263. Increased run off from the development could increase the risk of flooding to downstream areas. Some of the run off flowing east would enter Daventry Reservoir, potentially increasing the reservoir discharge and risk of dam break through overtopping. Both would increase the flooding to parts of the site (north west). If increased discharge to the reservoir is proposed, then a review of reservoir capacity would need to be undertaken before any development takes place. Other risks of flooding are the potential for blockage of a culvert/siphon under the canal and canal bank failure. Detailed flood risk assessments should examine all aspects of flood risk for the site, and surface water attenuation will be required for this development.

Outline attenuation volumes for the Pre-Submission SUEs in Daventry

264. Outline hydrological analysis has been undertaken for the two Pre-Submission SUEs to calculate approximate flood storage volumes for the 0.5% AEP flows with provision for climate change. Table 5-5 below indicates approximate flood storage volumes to attenuate runoff from development up to the 0.5% AEP flow to greenfield rates as calculated using the Defra/Environment Agency technical report W5-074/A/TR/1. For the purposes of the preliminary attenuation calculations development areas were calculated assuming 40 homes per hectare plus 15% open space. A Percentage Impermeable Area (PIMP) of 75% is assumed in the attenuation calculations.

265. An estimate of 75% PIMP is likely to overestimate of the development area, therefore a detailed site specific Flood Risk Assessment (FRA) should be applied by the developers to determine the specific attenuation volumes required. In addition, no assessment has been undertaken in this study to calculate the attenuation storage that may be required for non residential developments. The Flood Risk Assessment prepared by developers should consider the drainage of the whole site, including non-residential land uses.

266. It should be noted that the standard of protection at the development sites is 0.5% AEP (1 in 200 years). Volumes given below are for the 0.5% AEP flows, following the Defra/Environment Agency's guidance (Preliminary rainfall runoff management for developments, 2005). A detailed site specific Flood Risk Assessment (FRA) should be applied by the developers to determine attenuation volumes required to store the 0.5% AEP flows.

Table 5-5 Approximate long term and attenuation storage volumes required for the Pre-Submission SUE in Daventry, for a 0.5% AEP event with climate change

SUE	Total Housing Capacity to 2026	Approximate Area of development (ha)#	Long term flood storage (m^3)	Attenuation Storage (m^3), (0.5% AEP)
Daventry North East	2,500	232	10,200	41,400
* As advised by WNJPU Jan 2011 # As advised by WNJPU Jan 2011				

Table 5-6 Recommendations for Pre-Submission SUE – Daventry

Pre-Submission SUE	Flood risk (fluvial, sewerage, surface water)	Flood defences	Future flood risk	Recommendations
Daventry North East	A section of the site in the north west falls within Flood Zones 3 and 2 – high and medium flood risk. This area is also within a modelled flood extent from a breach of Daventry Reservoir. Other risks of flooding include the potential for blockage of a culvert/siphon under the canal and canal bank failure.	No formal flood defences.	The CFMP policy is to reduce existing flood risk management actions (accepting that flood risk will increase over time).	Attenuate runoff so run off from the development does not increase the risk of flooding to downstream areas. No built development should be permitted in the area at risk of flooding in the event of a breach of Daventry Reservoir. If increased discharge to the reservoir is proposed, then a review of reservoir capacity would need to be undertaken before any development takes place.

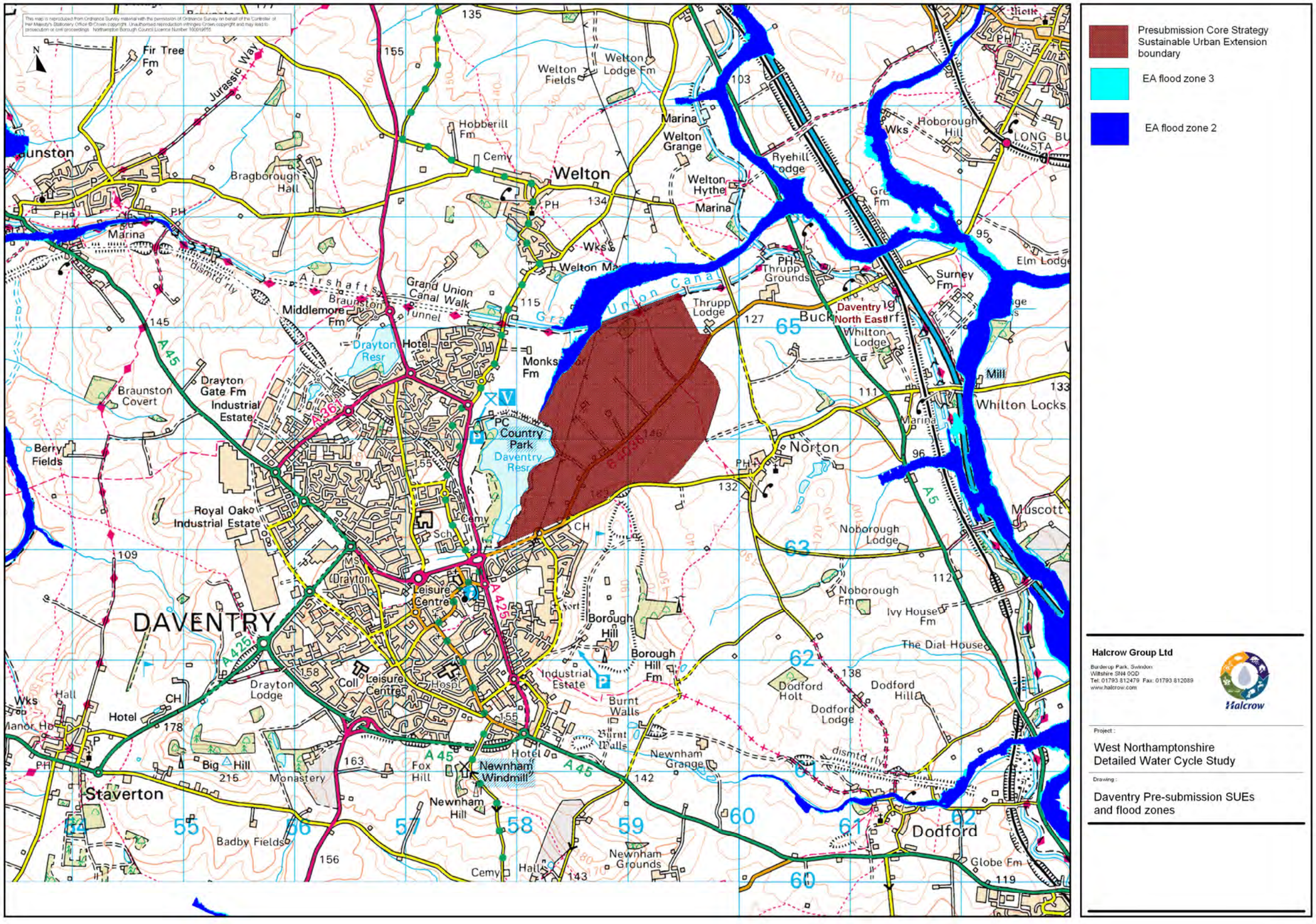


Figure 5-2 Daventry Flood Zone Mapping

5.4 South Northamptonshire

267. Towcester and Brackley are located in the catchment of the River Great Ouse. The River Great Ouse starts in Northamptonshire near Brackley and passes through several towns before it crosses the Fens and flows into the Wash downstream of King's Lynn. The overall catchment area of the River Great Ouse is about 8,596 km^2. The Great Ouse catchment is largely rural and it supports traditional industries such as manufacturing, tourism, and agriculture. However, research and technology, finance and service sectors are becoming more important

268. Towcester is located in the south of the study area, in the district of South Northamptonshire, with the River Tove flowing east through the centre of the town. The River Tove is a tributary of the River Great Ouse. Silverstone Brook has its confluence with Tove in centre of Towcester. Most of the centre of the town is designated as Flood Zone 3, with some areas of Flood Zone 2 towards the south west of the town (Figure 5-3). The Environment Agency, in accordance with the action plan of the Great Ouse CFMP, is to develop a flood risk management study for the River Tove to identify what further actions can be taken to manage flood risk at Towcester.

269. Brackley is located in the south of the study area, in the district of South Northamptonshire. Brackley is in the upper reaches of the River Great Ouse catchment it is bounded on the south and east sides by tributaries of the River Great Ouse. There is some Flood Zones 3 and 2 designations to the south and east of Brackley. Pre-Submission SUEs in the town are in Flood Zone 1 and therefore are considered to be at low risk of flooding from rivers (Figure 2-1). However surface water flooding did occur in the town in summer 2007.

History of flooding in Towcester

270. In Towcester there have also been several significant flood events. An event in 1947 affected the River Tove, Silverstone Brook and Wood Burcote Brook. The 1968 event affected Silverstone and Wood Burcote Brooks and Silverstone Brook. As a result of this event Silverstone Brook from the head of the designated Main River to the confluence with the River Tove, (i.e. through the built up area of Towcester) was improved. The Easter 1998 event caused extensive flooding on Watling Street and surrounding areas from the Tove.

271. After extremely heavy and prolonged rainfall on 20 July 2007, the catchment of the Upper Ouse and Tove became saturated. In July, the Environment Agency recorded that 101.8mm of rain fell on Towcester. The average rainfall for July is 50.3mm. Towcester initially flooded from surface water on 20 July, this overwhelmed the existing drainage system. No properties were flooded.

Current flood protection in Towcester

272. Towcester has a recently constructed Flood Alleviation Scheme on the River Tove which has a 2% AEP (1 in 50 years) standard of protection. The Towcester Flood Storage Reservoir is an impounding reservoir with a capacity of 105,000 m^3.

Pre-Submission SUEs assessment for Towcester

273. There is one Pre-Submission SUE in Towcester; Towcester South. A summary of the recommendations from this assessment is included in Table 5.6.

Towcester South

274. The location of Towcester South borders the south of the town surrounding the village of Wood Burcote in its extent. The area is also known as Towcester Vale as a result of a previous planning application. The land slopes gently westwards, allowing rainfall run off to flow downhill into the small watercourse (Silverstone Brook) that runs close to the western boundary of the site. This watercourse is responsible for this area of the site being classed as Flood Zone 3. The rest of the area is classified as

Flood Zone 1 (low risk of flooding). The east of the site is primarily flat with a small watercourse (Wood Burcote Brook) running northwards, although this is not classed as within a Flood Zone. However this watercourse is known to flood and therefore must be considered as a source of flood risk. Rainfall is likely to flow into this watercourse, being the natural drainage feature on the site. The northern portion of the site falls within an area of DG5 (flooding of foul sewers due to lack of capacity as reported to OFWAT), which AWS has indicated as being at risk of foul water flooding. It should be stressed that the DG5 Register only indicates the impact location of the flooding and not the source/cause.

275. Outline planning applications have been submitted for the Towcester South area (reference name 'Towcester Vale'). If planning permission is not granted or revised permission is sought, any new developer would have to undertake their own new flood risk assessment in line with PPS25.

276. Level 1 of the West Northamptonshire SFRA was published in August 2007 by Scott Wilson. It was updated in January 2009. No level 2 assessment was required for the site. An FRA including modelling of the Silverstone Brook within the west of the site and Wood Burcote Brook within the east of the site was undertaken as part of a detailed planning application in November 2007. The FRA was not approved by the Environment Agency who subsequently objected to the planning application on flood risk grounds. It is therefore recommended that a review of the modelling work and comments raised by the Environment Agency be undertaken as part of a site specific FRA undertaken in support of any future planning application.

Outline attenuation volumes for the Pre-Submission SUEs in Towcester

277. Table 5-7 indicates approximate storage volumes for the Towcester South area to attenuate 1%AEP runoff from development to greenfield rates as calculated using the Defra/Environment Agency technical report W5-074/A/TR/1. For the purposes of the preliminary attenuation calculations development areas were calculated assuming 40 homes per hectare plus 15% open space. A Percentage Impermeable Area (PIMP) of 75% is assumed in the attenuation calculations. Initial high level consideration was given to providing additional strategic attenuation on Silverstone Brook to alleviate the flood risk through Towcester but it is considered that additional attenuation could adversely delay the phasing of the smaller Silverstone Brook catchment compared to the larger Tove catchment to the detriment of flood risk downstream of Towcester.

278. Areas of development were calculated from the Pre-Submission Core Strategy using a Percentage Impermeable Area (PIMP) of 75%. An estimate of 75% PIMP is likely to overestimate of the development area, therefore a detailed site specific Flood Risk Assessment (FRA) should be applied by the developers to determine the specific attenuation volumes required. In addition, no assessment has been undertaken in this study to calculate the attenuation storage that may be required for non residential developments. The Flood Risk Assessment prepared by developers should consider the drainage of the whole site, including non-residential land uses.

Table 5-7 Approximate long term and attenuation storage volumes required for the Pre-Submission SUE in Towcester, for a 1% AEP event with climate change

Site	Total Housing Capacity to 2026*	Approximate Area of development (ha)#	Long term storage (m^3)	Attenuation Storage (m^3), (1% AEP)
Towcester South	1500	189.5	6,100	25,800
* As advised by WNJPU Jan 2011 # As advised by WNJPU Jan 2011				

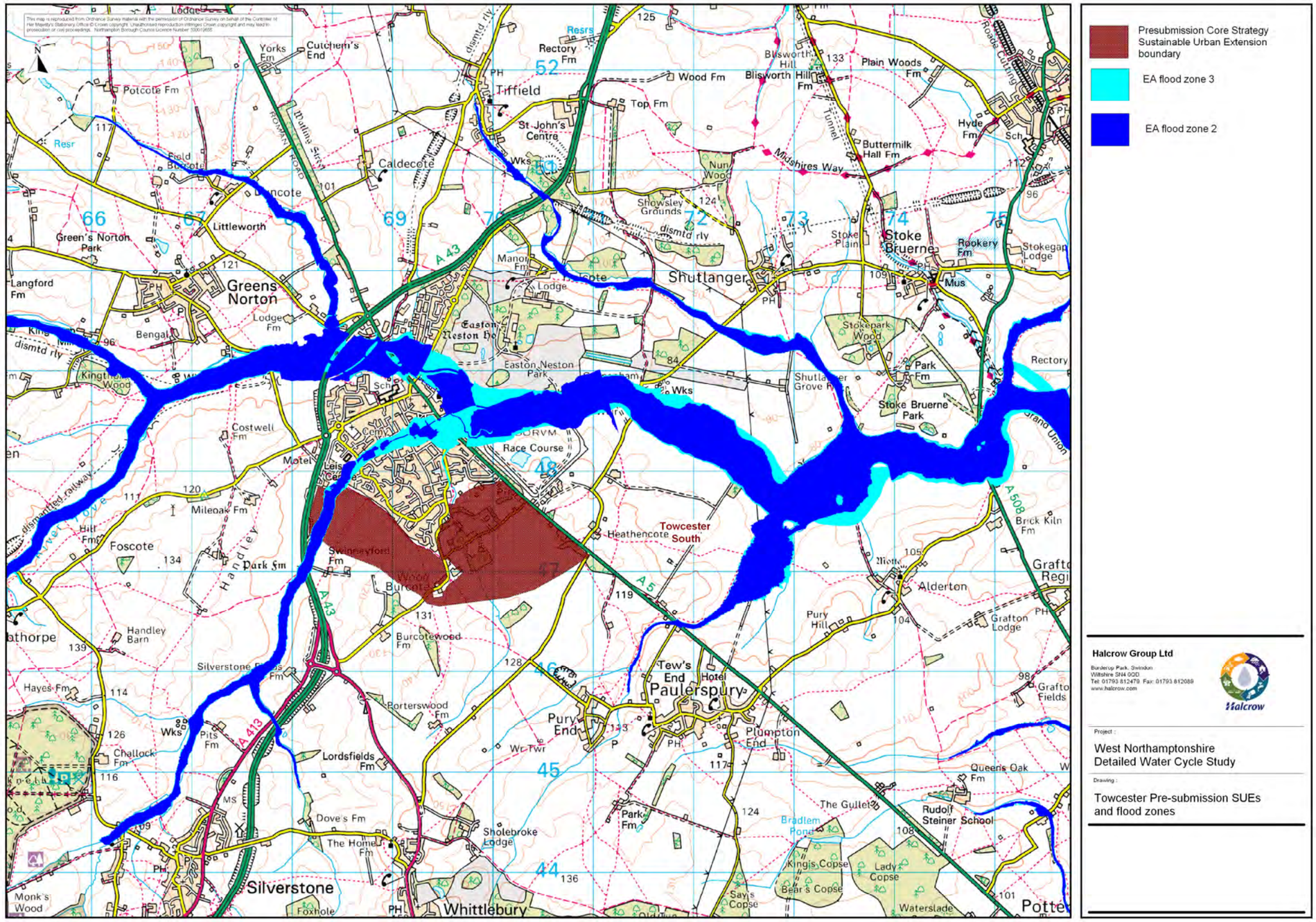


Figure 5-3 Towcester Flood Zone Mapping

Table 5-8 Recommendations for Pre-Submission SUEs: Towcester

Pre-Submission SUE	Flood risk (fluvial, sewerage, surface water)	Flood defences	Future flood risk	Recommendations
Towcester South	The small watercourse (Silverstone Brook) that runs close to the western boundary of the site creates an area of Flood Zone 3. The rest of the area is classified as Flood Zone 1 (low risk of flooding). Wood Burcote Brook is located in the east of the site; this is not classed as within a Flood Zone. However this watercourse is known to flood and therefore must be considered as a source of flood risk. The northern portion of the site falls within an area of DG5 (flooding of foul sewers due to lack of capacity as reported to OFWAT), which AWS has indicated as being at risk of foul water flooding.	No formal flood defences.	Future flood risk is likely to increase with climate change. The draft CFMP policy is to continue with existing and alternative actions to manage flood risk at the current level (accepting that flood risk will increase over time from the baseline).	Attenuate runoff so run off from the development does not increase the risk of flooding to downstream areas. A review of the modelling work and comments raised by the Environment Agency to a detailed planning application (submitted November 2007) should be undertaken as part of a site specific FRA undertaken in support of any future planning application.

Pre-Submission SUE assessment for Brackley

279. There are two Pre-Submission SUEs in Brackley and these are shown on Figure 5-4. A summary of recommendations for Brackley is given in Table 5-10.

Brackley North

280. The Brackley North Pre-Submission SUE is located to the north of Brackley and is within Flood Zone 1 – low risk of flooding. Runoff from this area would flow south east into the small watercourse running past Old Glebe Farm and alongside the A43. Runoff from this area should not exacerbate flood risk to Old Glebe Farm or the A43.

Brackley East

281. The Brackley East Pre-Submission SUE is located to the east of Brackley and is generally within Flood Zone 1 – low risk of flooding. The south eastern area of the site is adjacent to an area of Flood Zone 2. Runoff from this area would flow south east into the small watercourse running alongside the A43. This is the same watercourse that would receive runoff from development area of Brackley North.

Outline attenuation volumes for the Pre-Submission SUEs in Brackley

282. Table 5-9 indicates approximate storage volumes for the Pre-Submission SUEs in Brackley to attenuate 1%AEP runoff from development to greenfield rates as calculated using the Defra/Environment Agency technical report W5-074/A/TR/1. For the purposes of the preliminary attenuation calculations development areas were calculated assuming 40 homes per hectare plus 15% open space.

283. A Percentage Impermeable Area (PIMP) of 75% is assumed in the attenuation calculations. An estimate of 75% PIMP is likely to overestimate of the development area, therefore a detailed site specific Flood Risk Assessment (FRA) should be applied by the developers to determine the specific attenuation volumes required. In addition, no assessment has been undertaken in this study to calculate the attenuation storage that may be required for non residential developments. The Flood Risk Assessment prepared by developers should consider the drainage of the whole site, including non-residential land uses.

284. With Brackley North and Brackley East draining via the same watercourse there is potential for strategic flood storage to be combined for both sites; this could be combined with additional flood storage to alleviate existing flood risk to areas downstream of the development sites, e.g. downstream of Buckingham Road Bridge in Brackley.

Table 5-9 Approximate long term and attenuation storage volumes required for the Pre-Submission SUEs in Brackley, for a 1% AEP event with climate change

Site	Total Housing Capacity to 2026*	Approximate Area of development (ha)#	Long term storage (m^3)	Attenuation Storage (m^3), (1% AEP)
Brackley North	1380	57	5,600	24,700
Brackley East	380	31.9	1,600	6,800
* As advised by WNJPU Jan 2011 # As advised by WNJPU Jan 2011				

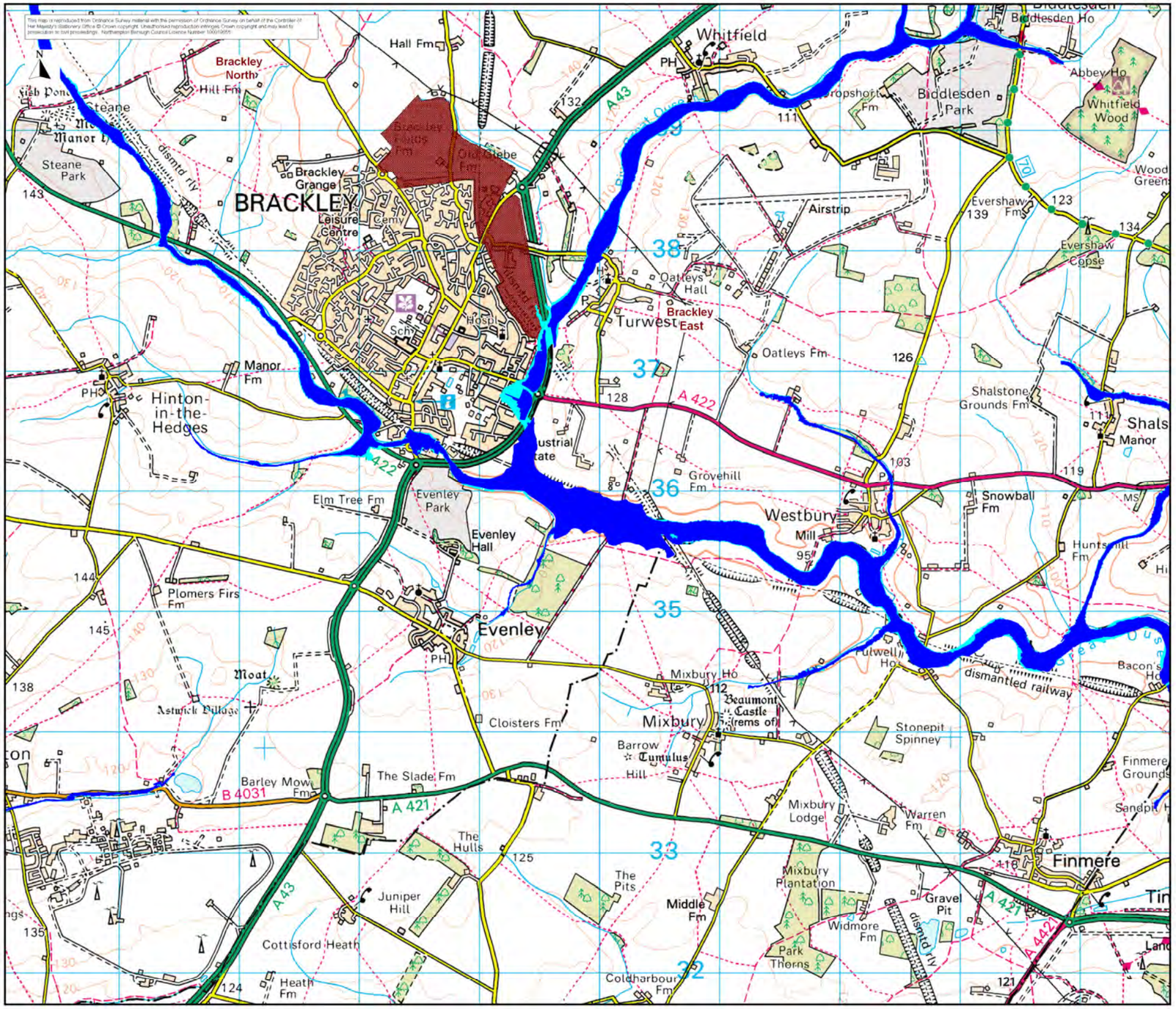

BRACKLEY
Brackley North
Brackley Grange
Brackley Leisure Centre
Steane Park
Steane
Hall Fm
Whitfield
PH
Biddlesden Ho
Abbey Ho
Biddlesden Park
Whitfield Wood
Wood Green
Airstrip
Evershaw Fm
Evershaw Copse
Oatleys Hall
Brackley East
Turweston
Oatleys Fm
Manor Fm
Hinton-in-the-Hedges
A 43
A 422
A 421
B 4031
Shalstone Grounds Fm
Shalstone Manor
Grovehill Fm
Snowball Fm
Westbury Mill
Elm Tree Fm
Evenley Park
Evenley Hall
Evenley
Plomers Firs Fm
Moat
Astwick Village
Cloisters Fm
Mixbury Ho
Mixbury
Beaumont Castle (remains of)
Barrow Tumulus
Hill
Stonepit Spinney
Pulwell Ho
dismantled railway
Barley Mow Fm
The Slade Fm
The Hulls
Juniper Hill
Cottisford Heath
Heath Fm
Coldharbour Fm
The Pits
Middle Fm
Mixbury Plantation
Mixbury Lodge
Warren Fm
Gravel Pit
Widmore Fm
Park Thorns
Finmere
Finmere Grounds
Sandpit
Bacon's Ho
Hunts Mill Fm
Dropshort Fm
Presubmission Core Strategy Sustainable Urban Extension boundary
EA flood zone 3
EA flood zone 2
Halcrow Group Ltd
Burderop Park, Swindon
Wiltshire SN4 0QD
Tel: 01793 812479 Fax: 01793 812089
www.halcrow.com
Project :
West Northamptonshire Detailed Water Cycle Study
Drawing :
Brackley Pre-submission SUEs and flood zones

Figure 5-4 Brackley Flood Zone Mapping

Table 5-10 Recommendations for Pre-Submission SUEs - Brackley

Pre-Submission SUE	Flood risk (fluvial, sewerage, surface water)	Flood defences	Future flood risk	Recommendations
Brackley North	The site falls in Flood Zone 1 and therefore is considered to be at low risk of flooding from rivers.	No formal flood defences.	The CFMP policy is to reduce existing flood risk management actions (accepting that flood risk will increase over time).	Attenuate runoff so run off from the development does not increase the risk of flooding to downstream areas.
Brackley East	The site generally falls in Flood Zone 1 and therefore is considered to be at low risk of flooding from rivers. Although the south eastern area of the site is adjacent to an area of Flood Zone 2.	No formal flood defences.	The CFMP policy is to reduce existing flood risk management actions (accepting that flood risk will increase over time).	Attenuate runoff so run off from the development does not increase the risk of flooding to downstream areas. Land use within the south eastern development sector should be allocated according to the appropriate uses for the Flood Zones according to PPS25.

6 Groundwater and Sustainable Drainage Systems

6.1 Introduction

285. This Water Cycle Study aims to provide a high level indication of what type of SuDS (infiltration, attenuation or a combination) may be suitable based upon underlying geology, source protection zones (SPZs), and aquifer characteristics. Detailed site geological surveys should be undertaken by developers as required, as a part of planning application process to define the most suitable SuDS options.

286. Where the geology does not permit infiltration then the volume of detention storage required at a local or strategic site will increase as no runoff can be lost to ground. This is also the case when numerous small scale source control elements are not used, e.g. permeable paved driveways/paths, as the major attenuation elements then need to store the full volume of runoff.

6.2 Geological and Hydrogeological Setting

287. The geological and hydrogeological setting provides a background both for an evaluation of the potential for groundwater flooding and for an understanding of the role of infiltration drainage either as part of SuDS systems, or within the overall natural water cycle.

288. A review of the geological and hydrogeological setting in the study area has been undertaken and is contained in Appendix F.

6.3 SuDS for the West Northamptonshire Area

289. It is likely that SuDS systems for large scale drainage within new development in West Northamptonshire will be dependent on surface based systems, with discharge to existing watercourses and incorporating ponds or similar detention areas for storage and flow attenuation. Space will need to be allowed for these features during the planning process.

290. However, there is a possibility that there will be potential for some large infiltration schemes, particularly around the Upton Park SUE. There also appears to be some localised potential for infiltration schemes in South Northamptonshire. Again, space will need to be allowed for these features in the planning process.

291. Site investigations should identify these potential areas that could be used for infiltration, both large scale and localised. There is potential across the developments in Northampton and South Northamptonshire but the actual groundwater levels in Northampton will also influence the possibility of these schemes.

292. Adopting the stormwater management train approach, described in Appendix C may allow the identification and development of prevention or source control techniques that limit the requirement for disposal into water courses, hence reducing the need for additional, downstream flood control measures.

293. This prevention/control strategy should be adopted at the earliest possible stage in the planning process. The recognition of the benefits of SuDS for groundwater resource protection, ecological enhancement and flood management is important for regional spatial planning.

6.4 Sustainable Drainage and Planning

294. For sustainable drainage to be most effective it is necessary to have a series of elements in succession with the runoff passing through them. This is known as the treatment train. Therefore whilst it is often necessary to have ponds or wetlands to store large volumes of runoff SuDS elements should be introduced at house or street level to provide source control. The smaller scale elements are most

typically a soakaway. However it should be noted that soakaways are only normally designed to attenuate runoff for up to 1 in 10 year events. Building Regulations require an assessment to be made to determine if soakaways can be utilised. An overall site strategy will be required and this may show them to be unnecessary.

6.4.1 Choosing the Right SuDS

295. The ideal SuDS option for a development site will vary in each situation, depending upon:

- the goals of the local planning authority and the developer,
- the geological and topographical characteristics of the site, and
- the requirements of the Environment Agency (EA) and Internal Drainage Boards (IDBs).
- the potential mechanism for adoption/maintenance

296. SuDS solutions may be selected and implemented to achieve many environmental objectives including:

- Pollution control arising from surface water runoff;
- Reducing pollutant infiltration into groundwater;
- Maintaining recharge to groundwater;
- Reduce construction;
- Providing natural amenity and green spaces within development;
- Maintaining or restoring natural flow regimes of a receiving watercourse.

6.4.2 Flood Risk Mitigation

297. One of the primary applications of SuDS with respect to PPS25 is mitigation against flood risk. This may be achieved through attenuation or filtration ponds, wetlands, or through a number of smaller scale infiltration and site specific SuDS such as porous pavements, green roofs, or rainwater harvesting.

298. The Code for Sustainable Homes requires that peak run-off rates and annual volumes of run-off are no greater than the previous conditions for the development site. The majority of West Northamptonshire strategic growth sites are on greenfield and brownfield sites, hence careful planning of flood risk mitigation will be required within the planning process.

299. It is the developer's responsibility to undertake the analysis required to provide the evidence base to prove that flood risk will not be exacerbated as a result of their development. This should be included within the planning application.

6.4.3 SuDS in design

300. To maximise the benefits of SuDS these should be integrated into the strategy and be an essential feature of any development process.

301. The cost effectiveness of SuDS benefits enormously from integration into design at the earliest possible stage.

302. Adoption of the "stormwater management train" concept will allow identification of the most appropriate approach at an early stage. This hierarchical concept comprises, in order of preference:

Prevention	application at individual sites, e.g. use of rainwater harvesting, management to prevent accumulation of pollutants.
Source Control	e.g. through permeable pavements, green roofs, soakaways etc.
Site Control	management of water from several sub catchments - e.g. by routing water from roofs, pavements etc. to swales or small infiltration ponds.
Regional Control	management of water from a number of sites, e.g. by routing to larger infiltration ponds or wetlands.

(After CIRIA 2004)

303. Thus a wide range of systems may be incorporated from small scale (e.g. at the level of a single dwelling) to more regional management (e.g. infiltration ponds serving larger areas). The appropriate system is dependant on the scale of the development and hydrogeological and other environmental constraints, and the selection of the SuDS system should be an integral part of the planning process.

304. SuDS design will incorporate measures to manage and attenuate stormwater run-off and mitigate potential flood risk from drainage, prevent pollutants reaching natural water systems and provide opportunities for development of biodiversity and amenity features. Appendix I shows the various SuDS techniques and gives commentary on each.

305. Infiltration drainage is not suitable for contaminated land, i.e. some previously developed sites. If the ground conditions have not been fully characterised and shown to be appropriate, infiltration drainage would not be approved as this could promote migration of contamination to the groundwater table.

306. Failure to manage and maintain SuDS sufficiently can lead to increased risk of flooding and cause deterioration in water quality. Therefore, it is essential that maintenance and management processes are considered at an early stage of design, and should be allowed for in any strategic development.

6.4.4 SuDS Maintenance and Adoption

307. Currently, no standard framework exists for adoption and maintenance of SuDS infrastructure, however in the DEFRA publication 'Making Space for Water' it is advised that a long term adoption strategy is crucial for the success of SuDS measures. This implies the involvement of a "durable, accountable organisations that can be expected to have the financial capacity to meet their responsibilities in the longer term." We recommend that a Supplementary Planning Document or similar is investigated to identify how SuDS can be adopted.

308. The planning, design, construction and initial maintenance of SuDS are the responsibility of the developer. The 'Interim Code of Practice for Sustainable Drainage Systems' developed by the National SuDS Working Group (2004) states that an adopting authority will require the SuDS to be developed to an appropriate standard, and that they are in an acceptable condition at handover. A developer must also provide comprehensive owners manual, covering annual maintenance tasks as well as long-term remedial solutions.

309. The current arrangements with regards to adoption of drainage are:

- The local water company will adopt SuDS elements that are in compliance with Sewers for Adoption (SFA) 6th Edition where the storage capacity does not exceed that required to attenuate storms any larger than a 1 in 30 year storm. The key clauses are:

Part 1 – General

- Clause 1.14 covers flow attenuation and details the design parameters to be achieved. It also excludes any above ground items.
- Clause 1.19 which relates to Sustainable Drainage Systems (SuDS)

Part 2 – Design

- Clause 2.13 Hydraulic Design - Surface Water on Site
- Clause 2.14 Hydraulic Design – Protection Against Flooding, which relates to sewer flow capacity and defines the 1 in 30 year no flood level of protection.
- Clause 2.15 Control of Surface Water Discharges, which relates to PPS25 and the need to provide a sustainable solution.
- The Highway Authority will adopt engineered grassed channels that are similar to swales and vegetated wetlands, so long as both are in accordance with the provisions of DMRB.

310. Sustainable surface water drainage should be adopted for all new developments (including redevelopment of brownfield land). Surface water runoff volume and peak flow rate from the development sites should not exceed greenfield runoff rate and volume up to and including the 100 year, 6 hour rainfall event (including an allowance for climate change). In brownfield developments, it may not be possible to achieve greenfield runoff rate and volume, but a reduction in surface water runoff should be achieved after the redevelopment and developers should agree the surface water drainage requirements with the respective planning authority and the Environment Agency early on in the development application process.

311. The Flood and Water Management Act 2010 has brought about significant legislative changes to the management of surface water. Until the Act is fully enacted through secondary legislation, the Core Strategy can ensure it adopts policies which are in line with the clauses outlined in the Bill. A summary of the key clauses in the Act related to sustainable drainage is outlined.

- Upper tier and unitary authorities will become responsible for the adoption and maintenance of new build SUDS; new build includes all new development and redevelopment.
- Upper tier and unitary authorities will become the approving body (SAB) for all new build SUDS. The requirements for approving new build SUDS will be outlined in forthcoming national standards on the construction and operation of surface water drainage.
- There will be a removal of the automatic 'right to connect' surface water drainage to the public sewerage network. New surface water drainage systems will need to be approved in line with the National Standards before any connection to the public sewerage network is made.
- Where possible, runoff should be infiltrated to the ground. Surface water drainage to a watercourse or public sewer is considered to provide successively less desirable solutions.

312. Should surface water runoff be required to be connected to a watercourse consideration needs to be given to the location of the development site in relation to the nearest watercourse. There will be cases where surface water runoff will need to be routed through private land in order to connect to the watercourse. Under the Flood and Water Management Act 2010, upper tier and unitary authorities will become the SAB, and would therefore be responsible for purchasing land or compensating land owners to allow surface water runoff to be routed through land, and connect to a watercourse. Given these considerations, development may be more suitable in locations which are closer to watercourses, and hence reduce the potential costs and difficulties of routing surface water through private land.

6.4.5 Costs of sustainable surface water drainage

313. The CIRIA SUDS manual (C697) provided indicative construction costs, and operation and maintenance costs for various elements of sustainable drainage systems. Inevitably, the costs are influenced by multiple factors, but the SUDS manual does indicate that the "total volume or area of a component is likely to be a strong predictor of cost." Indicative capital costs, and operation and maintenance costs, are provided in Table 6-1 (it should be noted that these are 2004 prices).

Table 6-1 Capital costs and operation and maintenance costs (from SUDS manual)

Component	Capital cost		Operation and maintenance cost	
	Cost (£)	Unit	Annual Cost* (£)	Unit
Filter drain	£100-£140	/m³ stored volume	£0.2-£1	/m² of filter surface area
Infiltration trench	£55-£65	/m³ stored volume		
Soakaway	>£100	/m³ stored volume	£0.1	/m² of treated area
Permeable pavement	£30-£40	/m² permeable surface	£0.5-£1	/m³ of storage volume
Infiltration basin	£10-£15	/m³ detention volume	£0.1-£0.3	/m² detention basin area
Detention basin	£15-£20	/m³ detention volume		
Wetland	£25-£30	/m³ treatment volume	£0.1	/m² of wetland surface area
Retention Pond	£15-£25	/m³ treatment volume	£0.5-£1.5	/m² of retention pond surface area
Swale	£10-£15	/m² swale area	£0.1	/m² of swale surface area
Filter strip	£2-£4	/m² filter strip area	£0.1	/m² of filter surface area

* Annual cost (for regular maintenance only)

6.5 Suitability of infiltration or attenuation system

6.5.1 SuDS suitability

314. This section considers whether there is potential for infiltration or attenuation systems. Infiltration systems are generally preferred in reducing and attenuating run-off in areas where there are suitable ground and groundwater conditions. Whilst this gives an indication of the SuDS design that may be suitable, site specific investigations are needed to identify the best SuDS design.

315. For each development site area, the bedrock and superficial geology, the location of groundwater source protection zones (SPZ's), and the location of designated aquifers have been considered. It is assumed that areas with predominately permeable bedrock and superficial geology that are designated as

aquifers are suitable for design of an infiltration system. The presence of source protection zones may rule out the possibility of infiltration type SuDS because of strict water quality requirements.

316. From 1 April 2010, the Environment Agency's groundwater Protection Policy has been using aquifer designations that are consistent with the Water Framework Directive. The new aquifer designation reflects the important of aquifers in terms of groundwater as a resource and their role in support surface water flows and wetland ecosystems. In terms of SuDS design, the aquifer designation maps determine areas where infiltration SuDS may be feasible as they are based on geological mapping provided by the British Geological survey.

317. The maps display the following aquifer designations:

- Principal Aquifers: Layers of rock or drift deposits that have high inter-granular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale. In most cases, principal aquifers are aquifers previously designated as major aquifer.
- Secondary A: permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers;
- Secondary B: predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering. These are generally the water-bearing parts of the former non-aquifers.
- Secondary Undifferentiated: has been assigned in cases where it has not been possible to attribute either category A or B to a rock type. In most cases, this means that the layer in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type.

6.5.2 SuDS design: Northampton

318. A summary of the SuDS suitability in the Northampton area is shown in Figure 6-1 and accompanied by Table 6-2.

319. The SuDS suitability assessment determined that there are no SPZ's (which place additional requirements on water quality) designated in the vicinity of the development areas. Infiltration systems may be possible on Northampton North, Northampton North of Whitehills and Upton Park whilst a combined infiltration and attenuation systems may be possible in Northampton West, Northampton South of Brackmills, Northampton South of Collingtree and Northampton Kings Heath subject to site specific assessments including aquifer vulnerability and soakage tests in line with BRE Digest 365 or CIRIA 156.

320. In locations where we have identified infiltration potential is limited, there still remains the option to carry out smaller scale geological ground condition testing in the area, as the geological maps are very broad-scale. Where this is not possible, other types of SuDS, such as runoff attenuation, will be required. Should surface water runoff be required to be connected to a watercourse consideration needs to be given to the location of the SUE in relation to the nearest watercourse.

Table 6-2 A table supplementing Figure 6-1 assessing the suitability of SuDS systems in Northampton

SUE	SuDS suitability
Northampton Kings Heath	Combined system: Half of the development site area overlays permeable Bedrock (a Secondary A aquifer) so an infiltration system may be suitable. The second half of the development overlies less permeable geology limiting the area where infiltration is possible therefore attenuation will be required.
Northampton North	Combined system. All of the development area overlies permeable bedrock (a Secondary A aquifer), however the soil type is clay and loam suggesting low permeability of the subsurface. Therefore a combined system should be explored with the amount of infiltration depending on the permeability of the superficial deposits.
Northampton North of Whitehills	Combined system. All of the development area overlies permeable bedrock (a Secondary A aquifer), however the soil type is clay and loam suggesting low permeability of the subsurface. Therefore a combined system should be explored with the amount of infiltration depending on the permeability of the superficial deposits.
Northampton South	Combined system: Half of the development site area overlays permeable Bedrock (a Secondary A aquifer) so an infiltration system may be suitable. The second half of the development overlies less permeable geology limiting the area where infiltration is possible therefore attenuation will be required.
Northampton South of Brackmills	Combined system: A large proportion of the development site area overlies permeable bedrock (some of this designated a Principal aquifer). However there are some areas of less permeable bedrock and a wide covering of less permeable superficial geology limiting the area where infiltration is possible, therefore attenuation will be required.
Northampton Upton Park	Combined system. All of the development area overlies permeable bedrock (a Secondary A aquifer), however the soil type is clay and loam suggesting low permeability of the subsurface. Therefore a combined system should be explored with the amount of infiltration depending on the permeability of the superficial deposits.
Northampton West	Combined system: All of the development site area overlies permeable bedrock geology (some of this designated a Principal aquifer). However, there is less permeable superficial geology to the north and south borders of the site limiting the area where infiltration is possible therefore attenuation will be required.

6.6 SuDS design: Daventry

321. A summary of the SuDS suitability in Daventry is shown in Figure 6-2 and accompanied by Table 6-3. The SuDS suitability assessment determined that there are no designated SPZ's (which place additional requirements on water quality) in the vicinity of the development areas. Combined infiltration and attenuation may be suitable in Daventry North East subject to site specific assessments including aquifer vulnerability and soakage tests in line with BRE Digest 365 or CIRIA 156.

322. In locations where have identified infiltration potential is limited, there still remain the options to:

- a) carry out smaller scale geological ground condition testing in the area, as the geological maps are very broad-scale, and;
- b) develop non-infiltration SuDs methods.

Table 6-3 A table supplementing Figure 6-2 assessing the suitability of SuDS systems in Daventry

SUE	SuDS suitability
Daventry North East	Combined system: All of the development site area overlies less permeable bedrock geology (mostly a Secondary Undifferentiated aquifer). However, there is permeable superficial geology to the east of the site offering some potential for an infiltration system. Attenuation will be required.

6.7 SuDS design: South Northamptonshire

323. A summary of the SuDS suitability in South Northamptonshire is shown in Figure 6-1 and accompanied by Table 6.4. The SuDS suitability assessment determined that there are no designated SPZ's (which place additional requirements on water quality) in the vicinity of the development areas. An infiltration system is likely to be most suitable in Brackley East whilst combined infiltration and attenuation may be suitable in Towcester South and Brackley North subject to site specific assessments including aquifer vulnerability and soakage tests in line with BRE Digest 365 or CIRIA 156.

324. In locations where have identified infiltration potential is limited, there still remain the options to:

- a) carry out smaller scale geological ground condition testing in the area, as the geological maps are very broad-scale, and;
- b) develop non-infiltration SuDs methods.

Table 6-4 A table supplementing Figure 6-1 assessing the suitability of SuDS systems in South Northamptonshire

SUE	SuDS suitability
Towcester South	Combined system: Half of the development site area overlays permeable Bedrock (a Principal aquifer) so an infiltration system may be suitable. However, half of the site overlays less permeable bedrock geology and some less permeable superficial geology limiting the area where infiltration would be possible.
Brackley North	Combined system: All of the development site area overlaps permeable bedrock (Principal aquifer); however, this is overlaid by less impermeable superficial geology. A site specific assessment should determine the potential for infiltration.
Brackley East	Infiltration system: All of the development site area overlies permeable bedrock geology (a Principal aquifer) with little less permeable superficial geology.

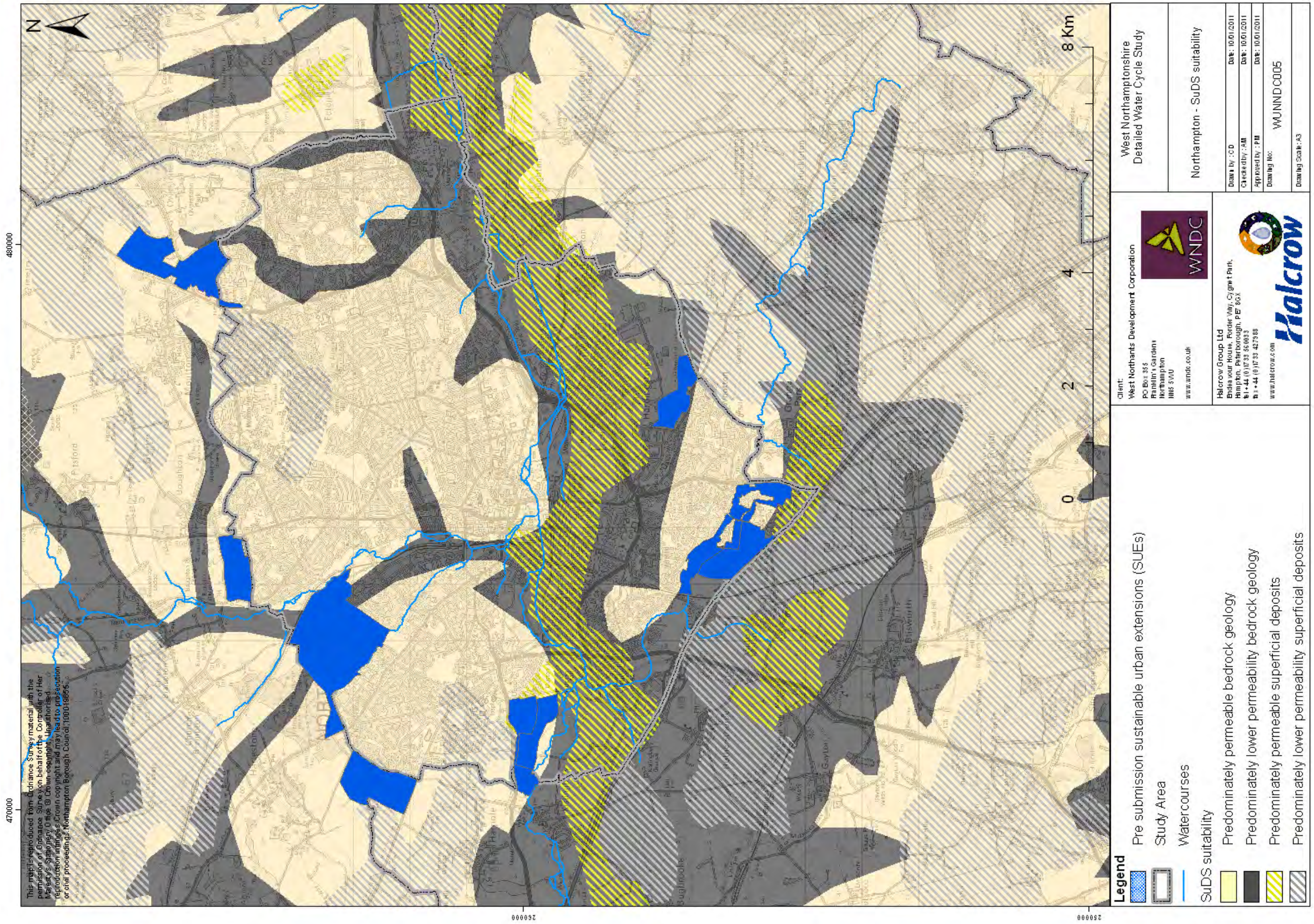
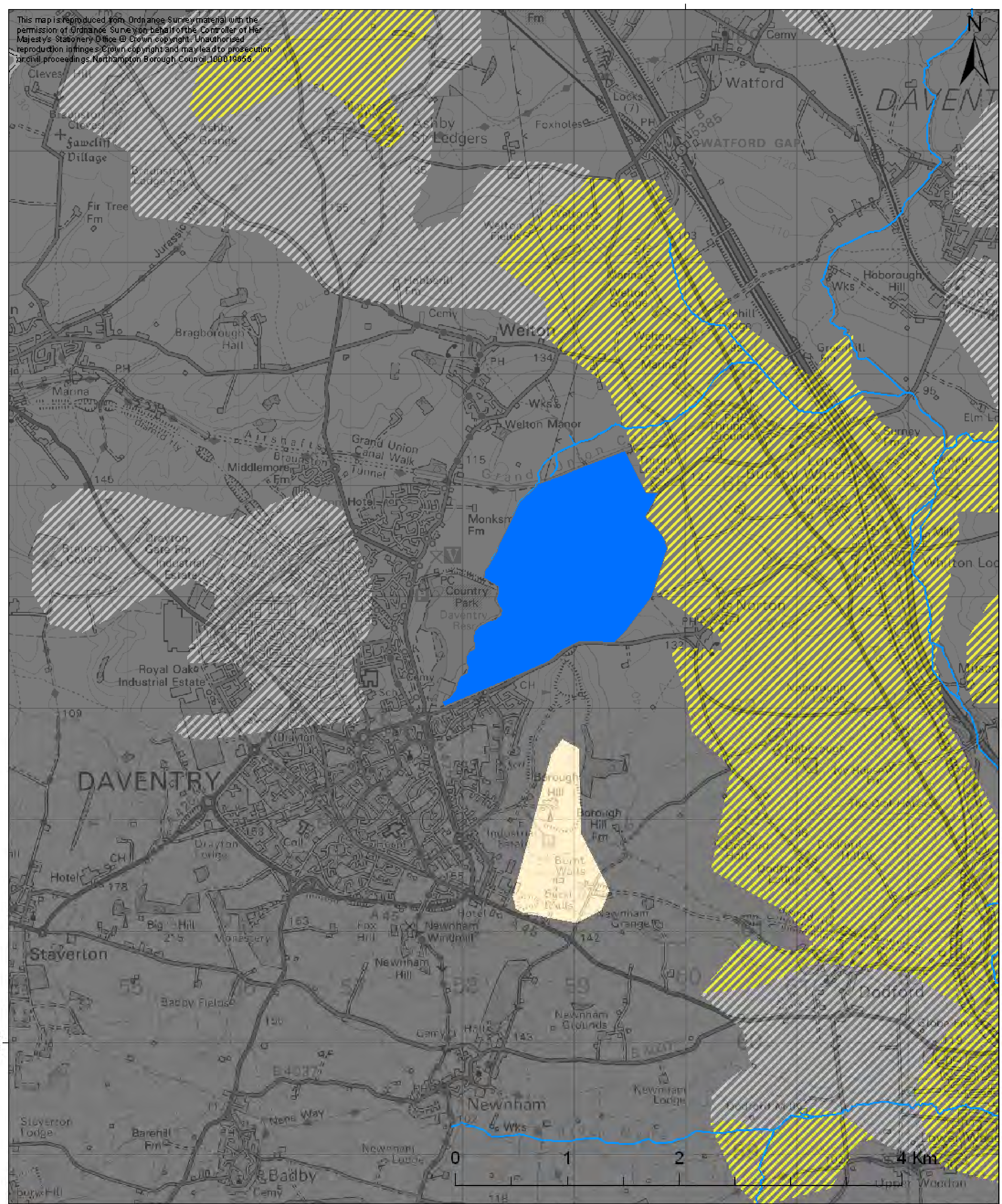


Figure 6-1 Assessment of the suitability of SuDS systems Northampton



Legend

- Pre-submission Sustainable Urban Extensions (SUEs)
- Study Area
- Watercourses

SuDS suitability

- Predominately permeable bedrock geology
- Predominately lower permeability bedrock geology
- Predominately permeable superficial deposits
- Predominately lower permeability superficial deposits

Client:
West Northants Development Corporation
PO Box 355
Franklin's Gardens
Northampton
NN5 5WU
www.wndc.co.uk

WNDC

Halcrow Group Ltd
Endeavour House, Forder Way, Cygnet Park,
Hampton, Peterborough, PE7 8GX
Tel +44 (0)1733 560033
Fax +44 (0)1733 427988
www.halcrow.com

Halcrow

West Northants
Detailed Water Cycle Study

Daventry - SuDS suitability

Drawn by : CD	Date: 10.01/2011
Checked by : AM	Date: 10.01/2011
Approved by :	Date:
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Drawing Scale: A3	

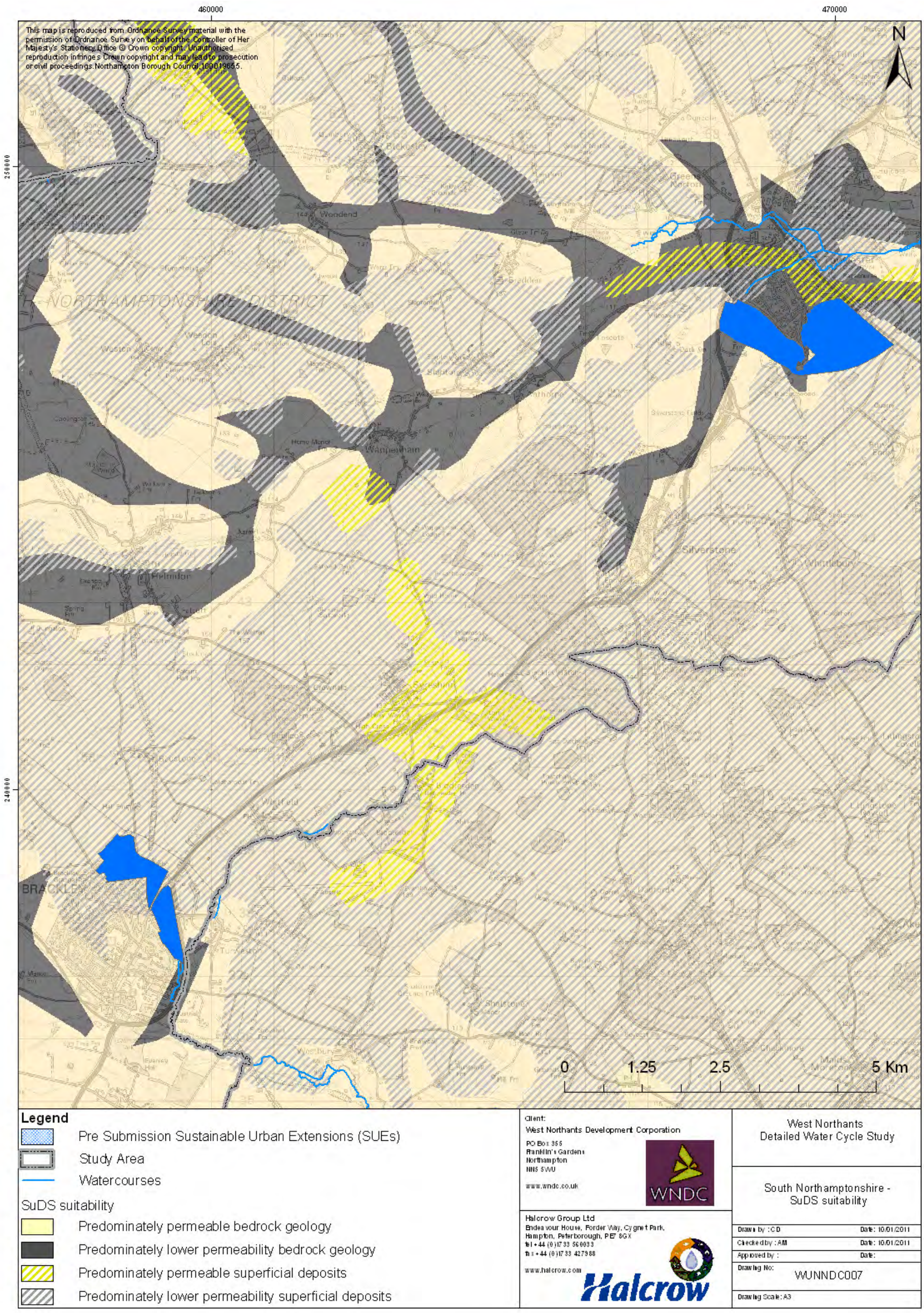


Figure 6-3 Assessment of the suitability of SuDS systems South Northamptonshire

7 Water services infrastructure capacity

7.1 Introduction

325. The following sections review the water services infrastructure capacity for Northampton, Daventry, Brackley and Towcester. Each section is split into subsections covering wastewater treatment works consented capacity, wastewater treatment infrastructure capacity, wastewater network capacity and water supply network capacity.

326. A single Red Amber Green (RAG) assessment has been undertaken to combine wastewater treatment works consented capacity and wastewater treatment infrastructure capacity and delivery. This WCS has assessed the feasibility of providing the additional wastewater infrastructure that would be required to meet the WwTW consents identified in Chapter 3 – Environmental Capacity. The feasibility assessment is based on:

- Land availability within the WwTW boundary for additional infrastructure outside the high risk flood zone
- Any known engineering difficulties in providing the infrastructure to meet the environmental capacity consent
- Time available to provide the additional capacity
- Any known planning or environmental health difficulties in delivering WwTW extensions, such as odour problems

327. The capacity assessment has followed a Red, Amber, Green (RAG) process (see Text Box 7.1 for an explanation of the RAG assessment process).

RED	Major constraint (e.g. unresolved water resource issue, or cost of upgrading the supply network may significantly outweigh the benefit (e.g. new main required in an urban area to serve a small number of properties)
AMBER	Strategic and/or local upgrades likely to be required
GREEN	Existing capacity sufficient (local connection only)

Figure 7-1 Water supply infrastructure RAG criteria

328. A further RAG assessment has been undertaken for the water supply asset capacity for each of the Pre-Submission SUEs. The assessment is presented as a table and identifies if there is current infrastructure capacity for the planned developments to 2016. If additional infrastructure is required the assessment also identifies whether it is feasible to provide the infrastructure by the time that it is needed. The criteria for water supply RAG is shown in Figure 7-1.

TEXT BOX 7.1 Waste Water Treatment Works Capacity Assessment

Assessment	RED	AMBER	GREEN
Consented capacity	There is no consented capacity and there are no plans to seek a new consent	Consented capacity is forecast to be breached within the current AMP period but a revised consent has been agreed	Consented capacity is will not be breached in the current AMP period
5 Year infrastructure capacity	There is no existing infrastructure capacity for planned growth and no plans to provide the capacity	Infrastructure is planned to be provided within the current AMP period to provide capacity for 5yr housing land supply forecast	There is infrastructure capacity for the 5yr housing land supply forecast
2026 capacity	NA	Infrastructure extensions will be required post 2016 to provide additional capacity, but these have not yet been planned	All growth forecast to 2026 can be provided without additional infrastructure being required
Odour risk[1]	There are existing odour problems/complaints and work extensions will take the WwTW closer to major population centre	There are existing odour problems at the WwTW, but extensions will not exacerbate the situation, OR, there are no known odour problems, but proximity of planned extensions to populations centre may increase odour complaints	There are no odour issues
Land availability	No land is available for necessary WwTW extension out of flood zones	AWS do not own land outside of flood zone for additional infrastructure, but have identified land suitable for purchase	AWS own land for new infrastructure outside flood zone
Downstream flood risk	Flows above current or agreed WwTW discharge consent will cause an increase in flood risk downstream of WwTW and no mitigation has been identified	Flows above current or agreed WwTW discharge consent may cause increase in flood risk DS of WwTW, but mitigation measures have been assessed as being feasible	There will be no impact on downstream flood risk caused by additional WwTW flows above consent

[1] If the WwTW needs to be expanded beyond the existing site boundary the works may need planning permission. Odour is one of the issues that the planning authority will need to consider during the application process as it may affect amenity value.

7.2 Northampton town

7.2.1 Northampton Great Billing wastewater treatment consented capacity

329. The new AMP5 consent discussed in section 3.4.2 above does not include an allowance for growth. Therefore a new consent will be required in the future unless the flows from the population and drainage area to the WwTW can be reduced.

330. Anglian Water have identified that unaccounted for flows, or infiltration in the catchment are higher than expected.

331. The infiltration or unaccounted for flows at Great Billing WwTW are significantly higher than expected. The typical value AWS would expect is 45 litre per person per day. The calculations at Great Billing suggest a value of 137 l/p/day.

332. The WCS considers that it is not sustainable in the long term, in terms of energy use, resource use or water quality to pump and treat clean water or infiltration at the WwTW. Therefore the WCS supports AWS preferred approach to reduce infiltration in preference to providing additional treatment capacity.

333. If no action is taken to reduce the infiltration in this catchment the theoretical flow at the WwTW may exceed the revised AMP5 flow consent by 2013.

334. If AWS are able to trace and reduce unaccounted for flows to 'typical' levels by 2016, the point at which theoretical flows would be greater than the revised AMP5 consent is extended until approximately 2017 – 2018 rather than 2013.

335. A twin track approach to assessing and managing unaccounted for flows and infrastructure planning is therefore required over the AMP5 period to both reduce unaccounted for flows and plan for future upgrade. This twin track approach should include a scenario for the early agreement of a revised consent should the management of unaccounted for flows provide unfeasible.

7.2.2 Northampton Great Billing wastewater treatment infrastructure capacity

336. AWS have confirmed that Great Billing WwTW has infrastructure capacity for development forecast in the AMP5 period (2010-2015) provided that the capital maintenance improvements planned and funded in AMP5 are delivered.

337. Further infrastructure is likely to be required post 2015, and the following sections discuss the feasibility of providing this additional infrastructure.

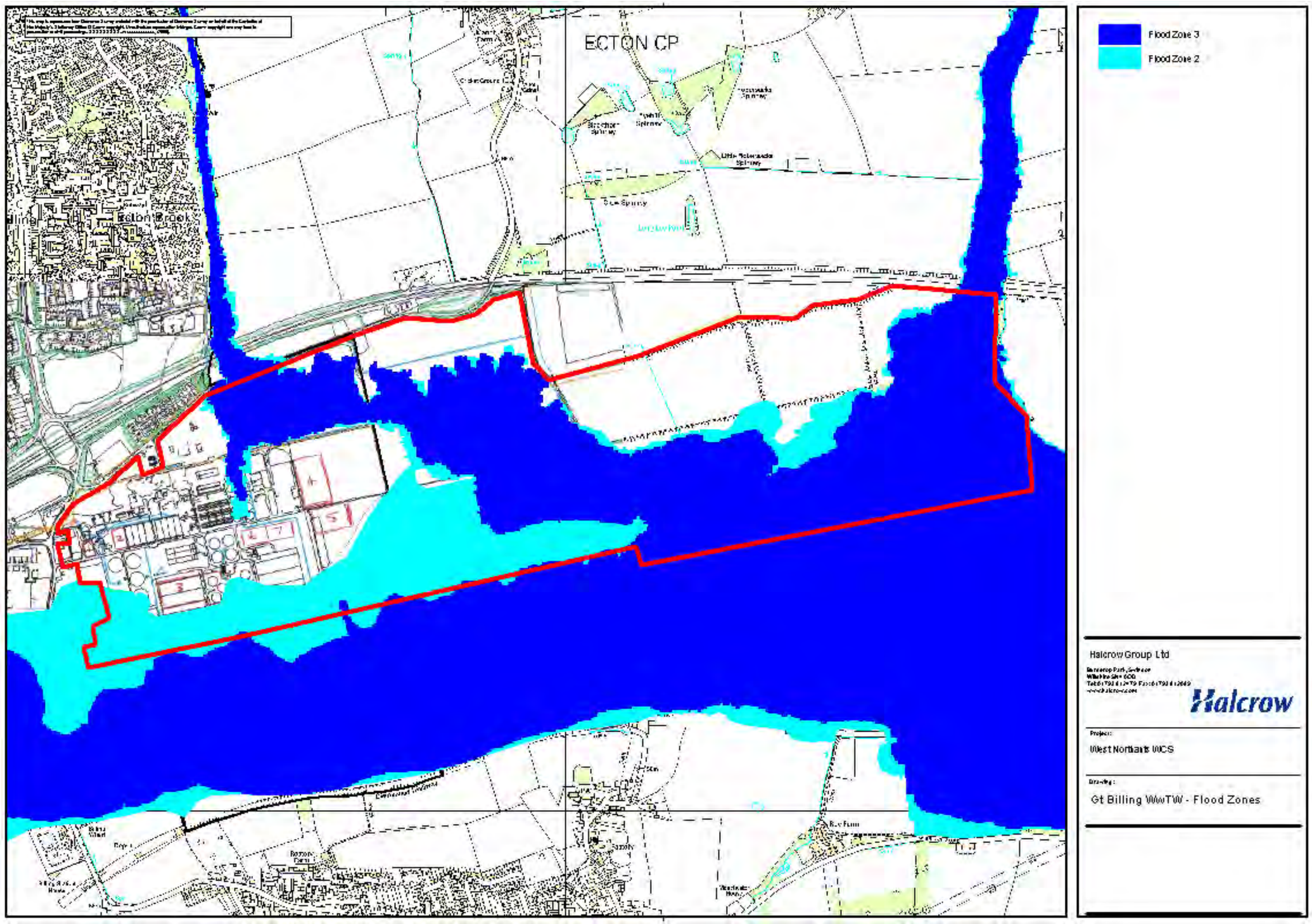


Figure 7-2 Additional WwTW infrastructure required to meet the no deterioration environmental capacity consent to 2026

7.2.3 Northampton Great Billing wastewater treatment land availability

338. An infrastructure planning assessment has shown that the additional infrastructure required to meet the 2026 environmental capacity consent can be provided within the Great Billing WwTW site boundary and without requiring construction in Flood Zone 3 (see Figure 7-2). AWS assessment of additional infrastructure required is shown as red numbered units in the Figure.

339. Following this assessment, it has become apparent that some land within the AWS WwTW boundary has been allocated in the Joint Waste and Minerals Core Strategy as a waste site. This site is not directly related to the wastewater treatment works processes, and the additional wastewater treatment works processes will need to be located outside this allocated land. The current plans for the Minerals and Waste Allocation and AWS plans for additional infrastructure do overlap. However, AWS currently own approximately 75 Ha of land extending up to 1.5km to the east of the existing treatment site boundary. Approximately 5 Ha of this land, in the area bordering the current site boundary, may be taken up by the proposed waste park. As a result the new sludge cake storage bay that would be required to replace one of the existing bays (demolished to make way for additional activated sludge treatment) would need to be moved further to the east on the other side of the waste park. Although this is feasible in terms of land availability it would result in additional costs for the provision and operation of a conveying system to transfer the treated cake from the sludge treatment centre, around or across the waste park, to the new storage area.

340. There may be an opportunity to combine the council's waste recycling operations with AWS', which could mean that the cake could actually be stored and processed at the waste park avoiding the need for additional transport and storage altogether. We recommend that AWS and Northamptonshire County Council progress plans for this site in close collaboration.

7.2.4 Northampton Great Billing wastewater treatment discharge and flood risk

341. If a revised higher flow consent is needed for the WwTW to meet the growth requirements, there may be a requirement to mitigate the impact that the additional flow exerts on flood risk. This section aims to quantify the volume of additional effluent discharge from the Great Billing Wastewater Treatment Work (WwTW) due to growth and how this compares to the existing flow in the watercourse during a flood event.

342. The methodology for this assessment is based on agreed methodology between the Environment Agency and Anglian Water as proposed through the recent Environmental Capacity Assessment undertaken by Halcrow Group Limited for Anglian Water Services (Phase 1, December 2008). The full methodology is included in Appendix J. Tables J-1 and J-2 in Appendix J provides further detail regarding the hydrological assumptions and input used in this assessment.

343. The phase 1 environmental capacity study assessed the impact of the additional effluent discharged on the Ecton Brook, a tributary of the River Nene. The assessment identified that the overall risk factor, based on a population growth of 72,000, was moderate. This information was not included in the phase 1 water study as it had not been completed and agreed in advance of the publication of the draft outline WCS.

344. The outline WCS did not consider the scale of risk from the additional effluent, but did undertake an analysis to identify how much attenuation storage would be required to mitigate any increase in risk, no matter how small the risk was. This technical analysis and the volume of storage was never agreed by Anglian Water, who did not consider that the provision of mitigation was appropriate unless it was accompanied by an assessment of the actual flood risk (both flood hazard and flood consequence) that the additional effluent would lead to. The volume of storage was calculated to be approximately 25,000m^3.

345. In July 2010, the Environment Agency Anglian Region and Anglian Water published a number of position statements within the Water Cycle Study Framework. One of these related to 'Increased flood risk from wastewater treatment works discharge flows.' The statement recommends that water cycle studies should be required to follow the method identified in the Environmental Capacity Study, and that works which have a total risk score of greater than 2.5 (at 40% flow weighting) should be investigated further. This should be via consultation with interested parties to verify the sensitivity and impact scoring used in the risk assessment. WwTWs with a score lower than 2.5 should be checked to ensure there are no local site specific issues which should have been identified in the risk assessment.

346. We have undertaken the assessment, using the river flow values as calculated in the Environmental Capacity study, and using the forecast future peak flows that will be discharged from the WwTW. The peak flows have been calculated by applying a 'peaking' factor to the 2026 dry weather flows used in the water quality and wastewater assessment. The total population increase 2006 to 2026 calculated to drain to Great Billing WwTW is 44,300, which includes all known and forecast development, including Pre-Submission SUEs and commitments. This is significantly less than the 72,000 assessed in the Environmental capacity study and the outline water cycle study.

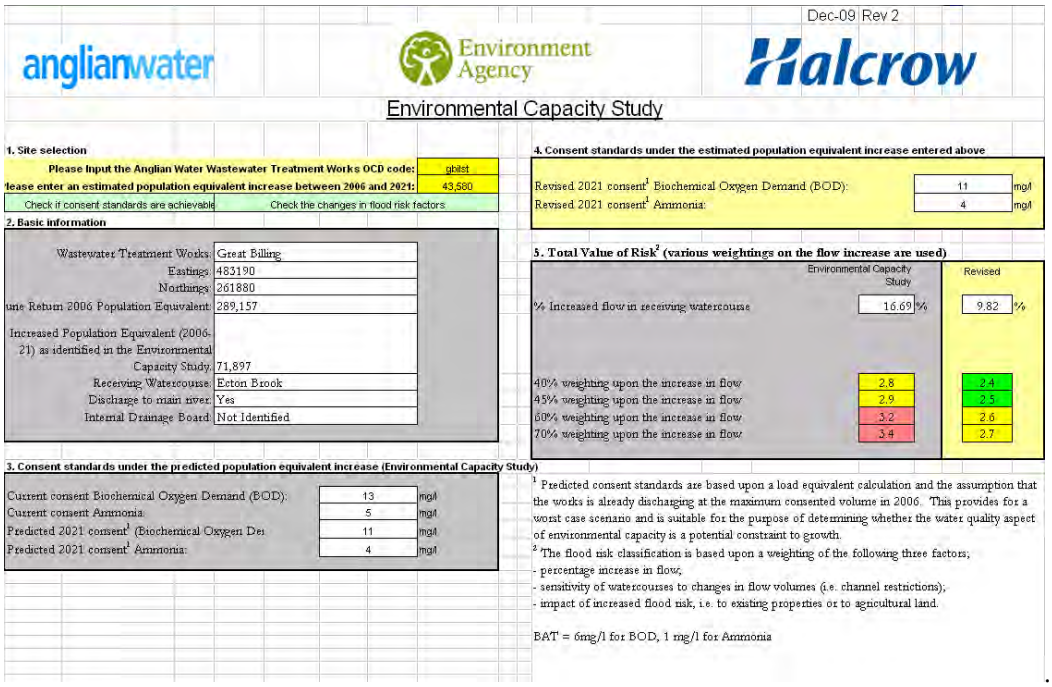
347. Great Billing WwTW discharges to Ecton Brook which flows into the River Nene. There are minor flood risk implications of the additional growth on the River Nene, with the additional flow to the Nene being calculated to be less than 1% in a 2year return period event.

348. The additional effluent in 2026 equates to less than a 10% increase in mean discharge from Great Billing WwTW.

349. The risk value for the Environmental Capacity assessment for this discharge is now less than 2.5, and therefore falls within the low risk category. The change in risk factor from medium (in the 2008 Environmental capacity assessment) to low is due the reduction in the number of properties now being forecast in the Pre-Submission Core Strategy, which has reduced the percentage increase in flow in the Ecton Brook to below 10%.

350. When the scope of this water cycle study stage was being prepared, it specifically excluded detailed modelling of the impact of the additional discharge from wastewater treatment works using river models. Whilst this study was being completed, a new River model of the River Nene system has been developed for the Environment Agency for Flood mapping and flood assessment purposes.

351. Although the study has confirmed that the risk is low, further work is required to conclude that increases in treated wastewater effluent will not increase downstream increase flood risk. An implementation group will be set up, comprising the appropriate partners to conclude this matter.



Dec-09 Rev 2

anglianwater Environment Agency Halcrow

Environmental Capacity Study

1. Site selection

Please Input the Anglian Water Wastewater Treatment Works OCD code: gbilst

Please enter an estimated population equivalent increase between 2006 and 2021: 43,580

Check if consent standards are achievable | Check the changes in flood risk factors

2. Basic information

Wastewater Treatment Works:	Great Billing
Eastings:	483190
Northings:	261880
une Return 2006 Population Equivalent:	289,157
Increased Population Equivalent (2006-21) as identified in the Environmental Capacity Study.	71,897
Receving Watercourse:	Ecton Brook
Discharge to main river:	Yes
Internal Drainage Board:	Not Identified

3. Consent standards under the predicted population equivalent increase (Environmental Capacity Study)

Current consent Biochemical Oxygen Demand (BOD):	13	mg/l
Current consent Ammonia:	5	mg/l
Predicted 2021 consent[1] (Biochemical Oxygen Dem	11	mg/l
Predicted 2021 consent[1] Ammonia:	4	mg/l

4. Consent standards under the estimated population equivalent increase entered above

Revised 2021 consent[1] Biochemical Oxygen Demand (BOD):	11	mg/l
Revised 2021 consent[1] Ammonia:	4	mg/l

5. Total Value of Risk[2] (various weightings on the flow increase are used)

	Environmental Capacity Study	Revised
% Increased flow in receiving watercourse	16.69 %	9.82 %
40% weighting upon the increase in flow	2.8	2.4
45% weighting upon the increase in flow	2.9	2.5
60% weighting upon the increase in flow	3.2	2.6
70% weighting upon the increase in flow	3.4	2.7

[1] Predicted consent standards are based upon a load equivalent calculation and the assumption that the works is already discharging at the maximum consented volume in 2006. This provides for a worst case scenario and is suitable for the purpose of determining whether the water quality aspect of environmental capacity is a potential constraint to growth.

[2] The flood risk classification is based upon a weighting of the following three factors;
- percentage increase in flow;
- sensitivity of watercourses to changes in flow volumes (i.e. channel restrictions);
- impact of increased flood risk, i.e. to existing properties or to agricultural land.

BAT = 6mg/l for BOD, 1 mg/l for Ammonia

352. We do not consider that the attenuation of treated wastewater effluent within the wastewater treatment works boundary is appropriate. If future assessment shows that the risk is greater than low, attenuation should be provided through the creation of additional flood plain within the same river reach as the wastewater treatment discharge, or through the additional attenuation of surface water runoff from developments beyond that required to mitigate for the risk of surface drainage increasing flood risk.

353. In the Daventry appeals, The Environment Agency, the Daventry appeals appellants and Anglian Water came to agreement with respect to the provision of necessary mitigation, and agreed that mitigation could be provided through additional surface water attenuation within a development boundary, if either a strategic solution was not appropriate or possible, thereby setting a precedent for the provision of effluent flood risk mitigation through additional surface water runoff attenuation.

354. With respect to Northampton Great Billing WwTW, the option for additional surface water attenuation storage within development boundaries would not mitigate for any increase in flood risk to the Ecton Brook; there are no developments being assessed in this water cycle study that would drain surface water directly to the Ecton Brook catchment. Therefore, the only feasible option for Great Billing would be to consider additional flood plain storage or flood reservoirs in the Ecton Brook catchment.

STW Name	Consented capacity	5 year infrastructure capacity	2026 capacity	Odour risk	Land availability	Downstream flood risk	Overall assessment
Gt Billing	A new consent may be needed by 2016 dependant on the success of the unnaccounted for flow reduction scheme.	Capital maintenance improvements planned in AMP5				Low risk of increased flooding (No further study recommended)	In the short term, subject to the planned capital maintenance improvements being delivered, the STW has capacity for the 5 yr housing land supply. In the longer term a new consent will be required, and additional infrastructure will need to funded and delivered through the AWS business planning process, but the environmental capacity assessment and infrastructure feasibility assessment have not identified any constraints to providing this infrastructure.

Figure 7-3 Great Billing WwTW infrastructure capacity

7.2.5 Northampton wastewater network

355. A wastewater network analysis has been undertaken to understand:

- The capacity within the existing wastewater network for committed developments to 2016
- Immediate wastewater network infrastructure solutions that are required to be delivered by AWS, either through the business planning process or through agreement with developers to deliver the commitments
- The capacity within the existing wastewater network for committed developments, expected applications and Pre-Submission sustainable urban extensions to 2026
- Options for strategic infrastructure improvements to serve the plan period to 2026

356. Anglian Water Services are currently completing a drainage area plan (DAP) and drainage strategy for Northampton. The DAP is an extensive modelling exercise, which involves constructing a sewerage network model of every sewer pipe in Northampton, carrying out extensive physical and hydraulic surveys of the network, and verifying the model so that it robustly and predicts the flow, velocity and depth of sewage in the network, both during dry weather periods and wet weather periods. The model can then be used to predict the risk of foul sewage flooding, and combined sewer overflow during wet weather conditions, and can accurately identify where additional infrastructure is required to both resolve existing issues, and to accommodate growth.

357. This DAP modelling exercise is in the process of completion, and an initial modelling exercise has been carried out to undertake the four tasks identified above. The results are presented below and in Table 7-1. Figures 7.7 to 7.9 show the location of the Pre-Submission sustainable urban extensions, commitments and applications and how they interact with the major wastewater network assets.

358. The Northampton sewerage system has a number of Combined Sewer Overflows (CSOs) that act as a relief valve to prevent foul sewage flooding property during times of extreme rainfall. The overflows discharge storm sewage (sewage that has been diluted by a large volume of rainwater that has entered the system) into watercourses during such times. Although in most circumstances, the volume of rainfall in the storm sewage has diluted it to such an extent that it does not have an adverse environmental impact on our watercourses, it is very difficult to quantify the possible impact without detailed modelling. We are currently working with Anglian Water Services on an Urban Pollution Management (UPM) study for Northampton. The aim of this study is to develop a model to assess the impact of the CSOs on the watercourses in Northampton. This model will allow Anglian Water to develop a robust wastewater strategy that provides the infrastructure needed to support the proposed development sites without causing a water quality deterioration. The UPM is progressing in parallel to the DAP and cannot complete until the DAP has completed.

359. Although a detailed wastewater strategy cannot be developed until such time as the DAP and UPM have completed Table 7-1 details the results of the wastewater network analysis undertaken for this study. This summarises local issues, and short and longer term solutions to providing wastewater capacity at each of the Pre-Submission strategy SUEs.

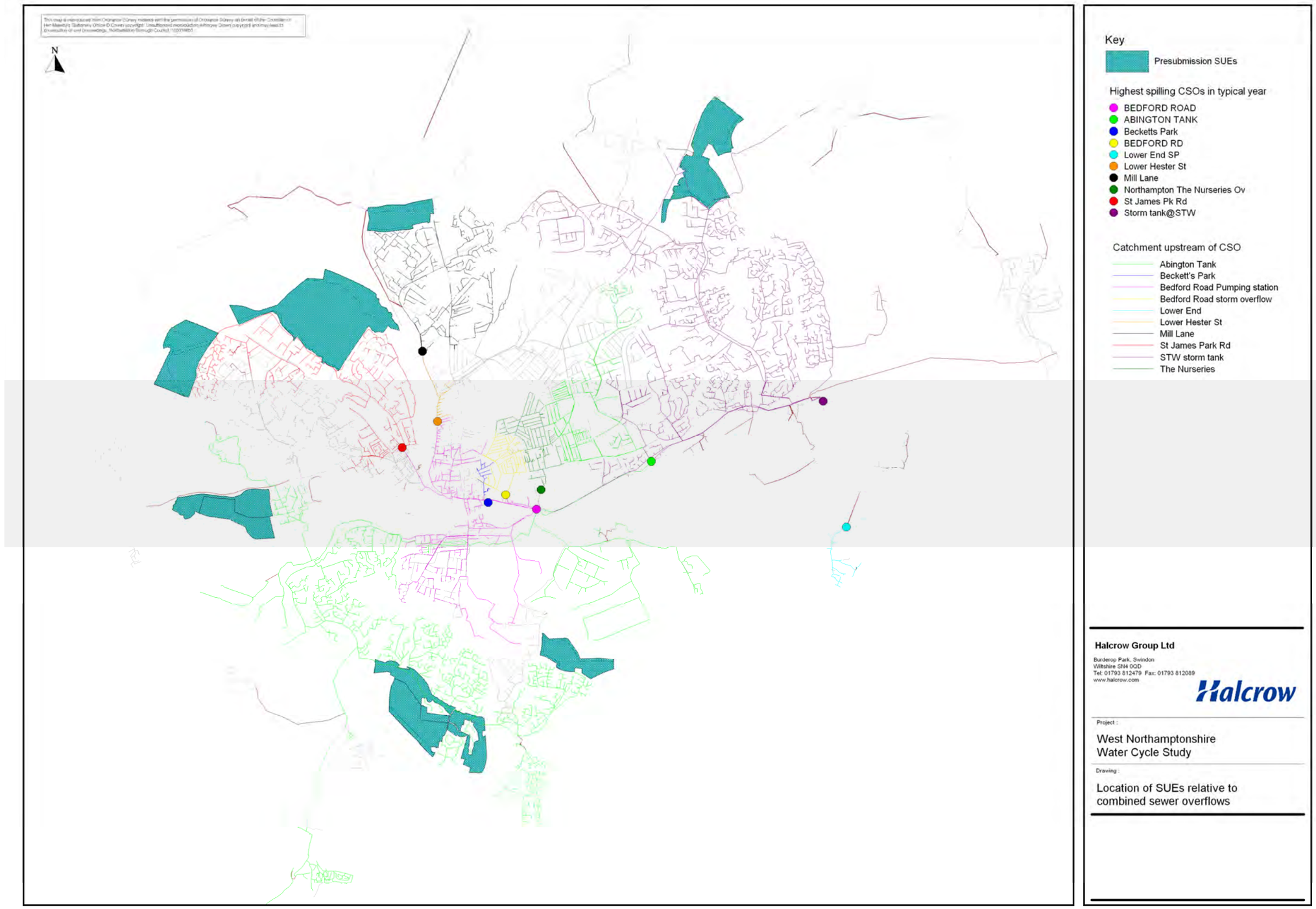


Figure 7-4 Core Strategy Pre-Submission sustainable urban extensions and combined sewer overflows

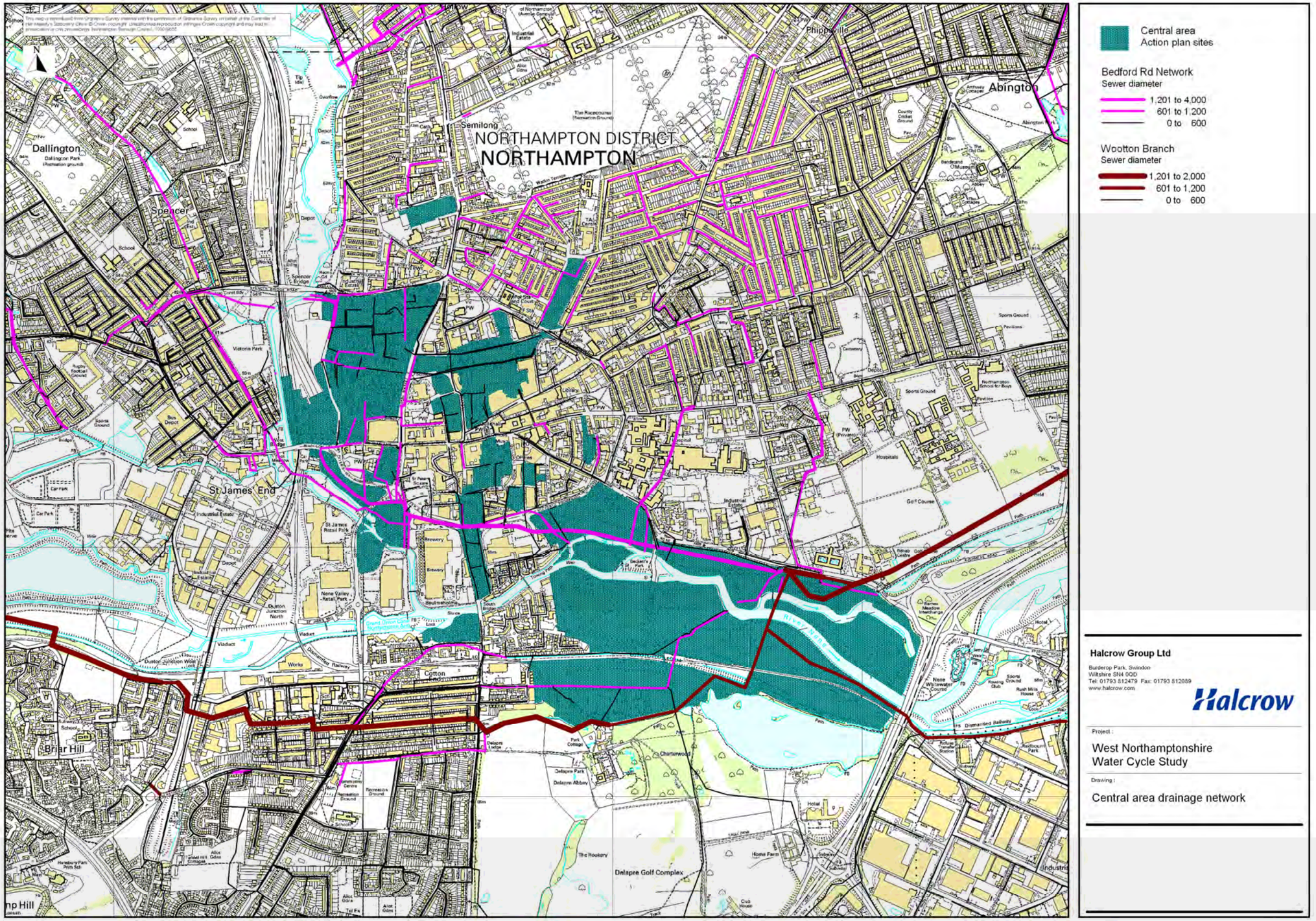


Figure 7-5 Town centre development allocations – sewer network

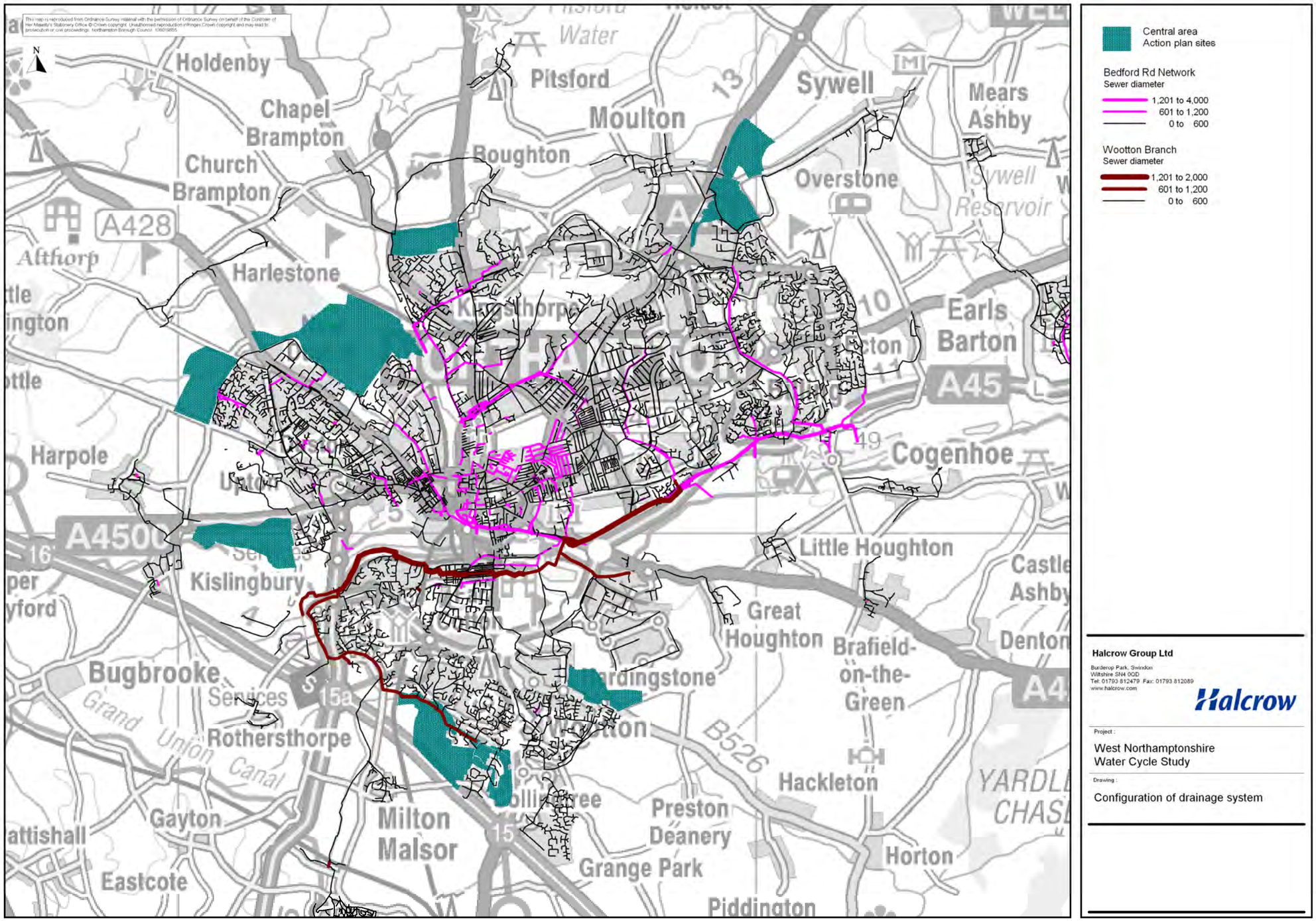


Figure 7-6 Wastewater network configuration

Table 7-1 Summary of the possible options for sewerage of the Pre-Submission Joint Core Strategy SUEs in Northampton

Location	Local issues	Short term solution	Long term solution
Northampton North Northampton North of Whitehills	Previous modelling studies by AWS have identified that there is capacity within the network between the Northampton North area and the treatment works for up to 5,400 properties without any increase in foul flooding or increase in discharges from local combined sewer overflows. The new completed DAP model confirms that there are no CSOs on any possible connection routes to Great Billing WwTW.	The modelling has identified that there are no strategic constraints to delivering this development. AWS will not begin detailed planning of drainage service to this location until they are approached by a developer under the requisition process. It is expected that any additional infrastructure required can be funded and delivered through the requisition process without impacting the viability of this SUE. Such infrastructure typically would be delivered 12 to 24 months following requisition	
Northampton West	There is no local connection from the natural collection point of this area into the drainage network. Therefore a new sewer connection would need to be requisitioned by the developer. Infrastructure of this scale typically would take 18 months to fund and deliver, subject to the wider strategic issues being resolved. The natural drainage of this area would allow for connection to the Wootton Branch trunk sewer. However, the location of the SUE means that the development could also potentially be drained by the Bedford Rd PS catchment. This will need to be confirmed by detailed modelling following site allocation and adoption of the Core Strategy.	The Northampton DAP modelling shows that there is capacity in the short term for the 5 year housing land supply within the Wootton Branch or the Bedford PS catchments to serve these developments. Connection to an appropriate point in the network will need to be agreed by site developers in conjunction with Anglian Water through the requisition process, and will need to ensure that connections are not upstream of local or minor combined sewer overflows.	The modelling identifies that there is capacity within the Bedford Rd and Wootton Branch trunk networks to serve this development without causing an increase in the incidence of foul flooding. However, there will be an associated minor increase in spills from combined sewer overflows from Abington tank CSO and Bedford RD PS CSO. Any wastewater strategy will need to ensure any increase in spill from overflows does not pose a downstream water quality or flood risk. The long term strategy to serve development in Northampton will be modelled and confirmed by AWS during AMP5 (by 2015). Based on initial modelling results from the Northampton DAP, the long term strategy is likely to require both infrastructure improvements and demand management (surface water removal and infiltration reduction).
Northampton Kings Heath	Anglian Water have agreed a local short term solution to providing capacity for this development with the developer.	The Northampton DAP modelling shows that there is capacity in the short term for the 5 year housing land supply within the Wootton Branch or the Bedford PS catchments to serve these developments. Connection to an appropriate point in the network will need to be agreed by site developers in conjunction with Anglian Water through the requisition process, and will need to ensure that connections are not upstream of local or minor combined sewer overflows.	The modelling identifies that there is capacity within the Bedford Rd and Wootton Branch trunk networks to serve this development without causing an increase in the incidence of foul flooding. However, there will be an associated minor increase in spills from combined sewer overflows from Abington tank CSO and Bedford RD PS CSO. Any wastewater strategy will need to ensure any increase in spill from overflows does not pose a downstream water quality or flood risk. The long term strategy to serve development in Northampton will be modelled and confirmed by AWS during AMP5 (by 2015). Based on initial modelling results from the Northampton DAP, the long term strategy is likely to require both infrastructure improvements and demand management (surface water removal and infiltration reduction).
Northampton Upton Park	There is no local connection from the natural collection point of this area into the drainage network. Therefore a new sewer connection would need to be requisitioned by the developer. This should not take more than 18 months to fund and deliver, subject to the wider strategic issues being resolved.	Subject to a requisition being agreed between developer and AWS initial modelling results indicate that there is capacity within the Wootton branch sewer to serve these developments.	The modelling identifies that there is capacity within the Bedford Rd and Wootton Branch trunk networks to serve this development without causing an increase in the incidence of foul flooding. However, there will be an associated minor increase in spills from combined sewer overflows from Abington tank CSO and Bedford RD PS CSO. Any wastewater strategy will need to ensure any increase in spill from overflows does not pose a downstream water quality or flood risk. The long term strategy to serve development in Northampton will be modelled and confirmed by AWS during AMP5 (by 2015). Based on initial modelling results from the Northampton DAP, the long term strategy is likely to require both infrastructure improvements and demand management (surface water removal and infiltration reduction).
Northampton South	This SUE would naturally drain to the Wootton Branch, although capacity in the local network to connect to the Wootton Branch is uncertain. A new local system or system upgrades to connect to the Wootton Branch may need to be requisitioned by the developer. Infrastructure of this scale typically takes 18 months to fund and deliver, subject to the wider strategic issues being resolved. There may be capacity in the local system for early stages of development although this would need to be agreed with AWS.		
Northampton South of Brackmills	There site could drain to either the Bedford Rd PS network or the Wootton Branch. Capacity in the local network to connect to either is uncertain. A new local system or system upgrades to connect to the most major network may need to be requisitioned by the developer.		The long term strategy to serve development in Northampton will be modelled and confirmed by AWS during AMP5 (by 2015). Based on initial modelling results from the Northampton DAP, the long term strategy is likely to require both infrastructure

Location	Local issues	Short term solution	Long term solution
	Infrastructure of this scale typically takes 18 months to fund and deliver, subject to the wider strategic issues being resolved. There may be capacity in the local system for early stages of development although this would need to be agreed with AWS.		improvements and demand management (surface water removal and infiltration reduction).

7.2.6 Northampton water supply infrastructure

360. A RAG assessment has been undertaken for the water supply asset capacity for each of the Northampton Pre-Submission sustainable urban extensions and is shown in Table 7-2. The table shows if there is current infrastructure capacity for the planned developments, and, if additional infrastructure is required in the longer term, whether it is feasible to provide the infrastructure by the time that it is needed.

Table 7-2 Northampton Water Supply RAG Assessment

Pre-Submission Core Strategy SUE	Projections	Water		
		RAG assessment	Comments	Planning and delivery notes
Northampton West SUE	1500 dwellings, 1 school , 1 local centre	AMBER	To supply the first phase of 300 dwellings will require Harpole WT pumps to be upgraded and 1.5km of 250mmID reinforcement main to be laid from Harpole WT to the dvelopment. These reinforcements would also be able to supply the whole of this development of 1,500 dwellings.	This scheme will go ahead once a requisition or firm commitment has been received from the developer, and the anticipated timescale to deliver this scheme is in the order of 18months. However, depending upon the timing of the development they maybe capacity to supply the first phases of this development from the existing network.
Northampton Kings Heath SUE	3500 dwellings, 3 schools, 1 local centre, employment	AMBER	To supply the whole thus development will require 1.3km long 355mm main from the existing 24in trunk main to the development.	This scheme will go ahead once a requisition or firm commitment has been received from the developer, and the anticipated timescale to deliver this scheme is in the order of 12months.
Northampton North of Whitehills SUE	1000 dwellings, 1 local centre	AMBER	Boughton West pumping station needs to be upgraded and a 270m long 180mm main will be required from the Harborough Road North to the site	This scheme will go ahead once a requisition or firm commitment has been received from the developer, and the anticipated timescale to deliver this scheme is in the order of 6months.
Northampton North SUE	2000 dwellings, 7 Ha employment, schools, at least one local centre	AMBER	Approximatley 200 dwellings can be supplied from the existing network, to supply 2,500 dwellings & 3040 jobs will require approximatley 5km of 450mmID main to be laid from Hannington WR to the development along side the A43.	This scheme will go ahead once a requisition or firm commitment has been received from the developer, and the anticipated timescale to deliver this scheme is in the order of 18months.
Northampton South of Brackmills SUE	1000 dwellings, school, 1 local centre	Green	No off-site works required.	n/a
Northampton South SUE	1000 dwellings, 1 school, 1 local centre	AMBER	The first 200 dwellings can be supplied from the existing network, but to supply the whole of the development it will be necessary to lay approximately 2.23km of 225mmOD main from the the 450mm DI main in Newport Pagnell Road along Wooldale Road to the north east boundary of the site boundary, which may involve crossing the A45.	This scheme will go ahead once a requisition or firm commitment has been received from the developer, and the anticipated timescale to deliver this scheme is in the order of 6months.
Northampton Upton Park SUE	1000 dwellings, 1 school, 1 local centre	AMBER	The required off-site reinforcements for this development would be 800metres of new 450mm reinforcement main along Tollgate Way, and a new water booster with additional storage at Pitsford WTW.	This scheme will go ahead once a requisition or firm commitment has been received from the developer, and the anticipated timescale to deliver this scheme is in the order of 12months, although the off-site works could be phased with some completed works allowing early phases of the development to go ahead.

361. Anglian Water Services have identified that all of the Pre-Submission SUEs tested can be delivered through minor water supply infrastructure schemes delivered through the regulated requisition process. **Therefore water supply infrastructure in Northampton should not be considered a constraint to growth.**

7.3 Brackley

7.3.1 Brackley wastewater treatment consented capacity

362. As mentioned in the water quality capacity assessment, the method of measuring Dry Weather Flow has recently changed to a statistical method based on the 10%ile flow. As part of the change consents are

being revised. The revised consent came into force on 5th March 2010. For this assessment the revised AMP5 consent has been used. The revised consent includes an allowance for statistical variations but does not include any allowance for growth.

363. The new AMP5 consent identified in above does not include an allowance for growth. Therefore a new consent will be required during AMP5 unless the flows from the population and drainage area to the WwTW can be reduced.

364. Anglian Water have identified that unaccounted for flows, or infiltration in the catchment are higher than expected. Anglian Water are investigating why unaccounted for flows are higher than expected during the AMP5 period, and this will inform the AMP6 / PR14 business plan.

7.3.2 Brackley wastewater treatment infrastructure capacity

365. The capacity assessment has followed the Red Amber Green (RAG) process described in text box 7.1 and the outputs are shown in Figure 7-7 below.

STW Name	Consented capacity	5 year infrastructure capacity	2026 capacity	Odour risk	Land availability	Downstream flood risk	Overall assessment
Brackley	A new consent may be needed by 2016 dependant on the success of the unnaccounted for flow reduction scheme.					Low risk of increased flooding (No further study recommended)	In the short term the STW has capacity for the 5 yr housing land supply. In the longer term a new consent will be required, and additional infrastructure will need to funded and delivered through the AWS business planning process. The infrastructure feasibility assessment has not identified any constraints to providing this infrastructure, subject to a new consent being able to be agreed within environmental capacity.

Figure 7-7 Brackley WwTW infrastructure capacity RAG assessment

7.3.3 Brackley wastewater treatment land availability

366. An infrastructure planning assessment has shown that the additional infrastructure require to meet the 2026 environmental capacity consent can be provided within the WwTW site boundary and without requiring construction in Flood Zone 3 (see Figure 7-8)

7.3.4 Brackley wastewater treatment discharge and flood risk

367. If a revised higher flow consent is needed for the WwTW to meet the growth requirements, there may be a requirement to mitigate the impact that the additional flow exerts on flood risk. This section aims to quantify the volume of additional effluent discharge from Brackley Wastewater Treatment Work (WwTW) due to growth and how this compares to the existing flow in the watercourse during a flood event.

368. The methodology for this assessment is based on agreed methodology between the Environment Agency and Anglian Water as proposed through the recent Environmental Capacity Assessment undertaken by Halcrow Group Limited for Anglian Water Services (Phase 1, December 2008). The full methodology is included in Appendix J. Tables J-1 and J-2 in Appendix J provides further detail regarding the hydrological assumptions and input used in this assessment.

369. The phase 1 environmental capacity study only assessed screened high priority sites, and Brackley was not one such site.

370. The outline WCS did not consider the scale of risk from the additional effluent, but did undertake an analysis to identify how much attenuation storage would be required to mitigate any increase in risk, no matter how small the risk was. This technical analysis and the volume of storage was never agreed by Anglian Water, who did not consider that the provision of mitigation was appropriate unless it was accompanied by an assessment of the actual flood risk (both flood hazard and flood consequence) that

the additional effluent would lead to. The volume of storage was calculated to be 0m^3, because of the relatively small discharge flow compared to the large flow in the River Great Ouse.

371. In July 2010, the Environment Agency Anglian Region and Anglian Water published a number of position statements within the Water Cycle Study Framework. One of these related to 'Increased flood risk from wastewater treatment works discharge flows.' The statement recommends that water cycle studies should be required to follow the method identified in the Environmental Capacity Study, and that works which have a total risk score of greater than 2.5 (at 40% flow weighting) should be investigated further. This should be via consultation with interested parties to verify the sensitivity and impact scoring used in the risk assessment. WwTWs with a score lower than 2.5 should be checked to ensure there are no local site specific issues which should have been identified in the risk assessment.

372. We have undertaken the assessment, using the river flow values as calculated in the Environmental Capacity study, and using the forecast future peak flows that will be discharged from the WwTW. The peak flows have been calculated by applying a 'peaking' factor to the 2026 dry weather flows used in the water quality and wastewater assessment. The total population increase 2006 to 2026 calculated to drain to Brackley WwTW is 4,313, which includes all known and forecast development, including Pre-Submission SUEs and commitments.

373. Brackley WwTW discharges to the Great Ouse. The additional effluent forecast in 2026 equates to less 0.3% increase in river flow during the 1 in 2 year event, and the results of the Environmental capacity methodology are shown below. The risk value for this assessment is less than 2.5, and therefore falls within the low risk category

Dec-09 Rev 2

anglianwater Environment Agency Halcrow

Environmental Capacity Study

1. Site selection

Please Input the Anglian Water Wastewater Treatment Works OCD code:	brakst
lease enter an estimated population equivalent increase between 2006 and 2021:	4,313
Check if consent standards are achievable	Check the changes in flood risk factors

2. Basic information

Wastewater Treatment Works:	Brackley
Eastings:	460060
Northings:	235840
une Return 2006 Population Equivalent:	21,625
Increased Population Equivalent (2006-21) as identified in the Environmental Capacity Study:	NA
Receiving Watercourse:	River Great Ouse
Discharge to main river:	Yes
Internal Drainage Board:	Not Identified

3. Consent standards under the predicted population equivalent increase (Environmental Capacity Study)

Current consent Biochemical Oxygen Demand (BOD):	12	mg/l
Current consent Ammonia:	5	mg/l
Predicted 2021 consent[1] (Biochemical Oxygen Dei	11	mg/l
Predicted 2021 consent[1] Ammonia:	5	mg/l

4. Consent standards under the estimated population equivalent increase entered above

Revised 2021 consent[1] Biochemical Oxygen Demand (BOD):	10	mg/l
Revised 2021 consent[1] Ammonia:	4	mg/l

5. Total Value of Risk[2] (various weightings on the flow increase are used)

	Environmental Capacity Study	Revised
% Increased flow in receiving watercourse	0 %	0.03 %
40% weighting upon the increase in flow	NA	2.2
45% weighting upon the increase in flow	NA	2.1
60% weighting upon the increase in flow	NA	1.8
70% weighting upon the increase in flow	NA	1.6

[1] Predicted consent standards are based upon a load equivalent calculation and the assumption that the works is already discharging at the maximum consented volume in 2006. This provides for a worst case scenario and is suitable for the purpose of determining whether the water quality aspect of environmental capacity is a potential constraint to growth.

[2] The flood risk classification is based upon a weighting of the following three factors;
- percentage increase in flow;
- sensitivity of watercourses to changes in flow volumes (i.e. channel restrictions);
- impact of increased flood risk, i.e. to existing properties or to agricultural land.

BAT = 6mg/l for BOD, 1 mg/l for Ammonia

374. Although the study has confirmed that the risk is low, further work is required to conclude that increases in treated wastewater effluent will not increase downstream increase flood risk. An implementation group will be set up, comprising the appropriate partners to conclude this matter.

375. We do not consider that the principle of attenuation of treated wastewater effluent within the wastewater treatment works boundary is appropriate. If future assessment shows that the risk is greater than low, attenuation should be provided through the creation of additional flood plain within

the same river reach as the wastewater treatment discharge, or through the additional attenuation of surface water runoff from developments beyond that required to mitigate for the risk of surface drainage increasing flood risk.

376. In the Daventry appeals, The Environment Agency, the Daventry appeals appellants and Anglian Water came to agreement with respect to the provision of necessary mitigation, and agreed that mitigation could be provided through additional surface water attenuation within a development boundary, if either a strategic solution was not appropriate or possible, thereby setting a precedent for the provision of effluent flood risk mitigation through additional surface water runoff attenuation.

377. With respect to Brackley WwTW, the option for additional surface water attenuation storage within development boundaries could potentially mitigate for any increase in flood risk to the Great Ouse. There are no Pre-Submission SUEs being assessed for Brackley that include or are adjacent to the River Great Ouse Floodplain, therefore there are limited opportunities through the development management process to provide flood reservoirs on the River Great Ouse. However, Brackley East does lie adjacent to a tributary of the River Great Ouse (upstream of the WwTW discharge point), and it may be possible to provide flood storage within this development area.

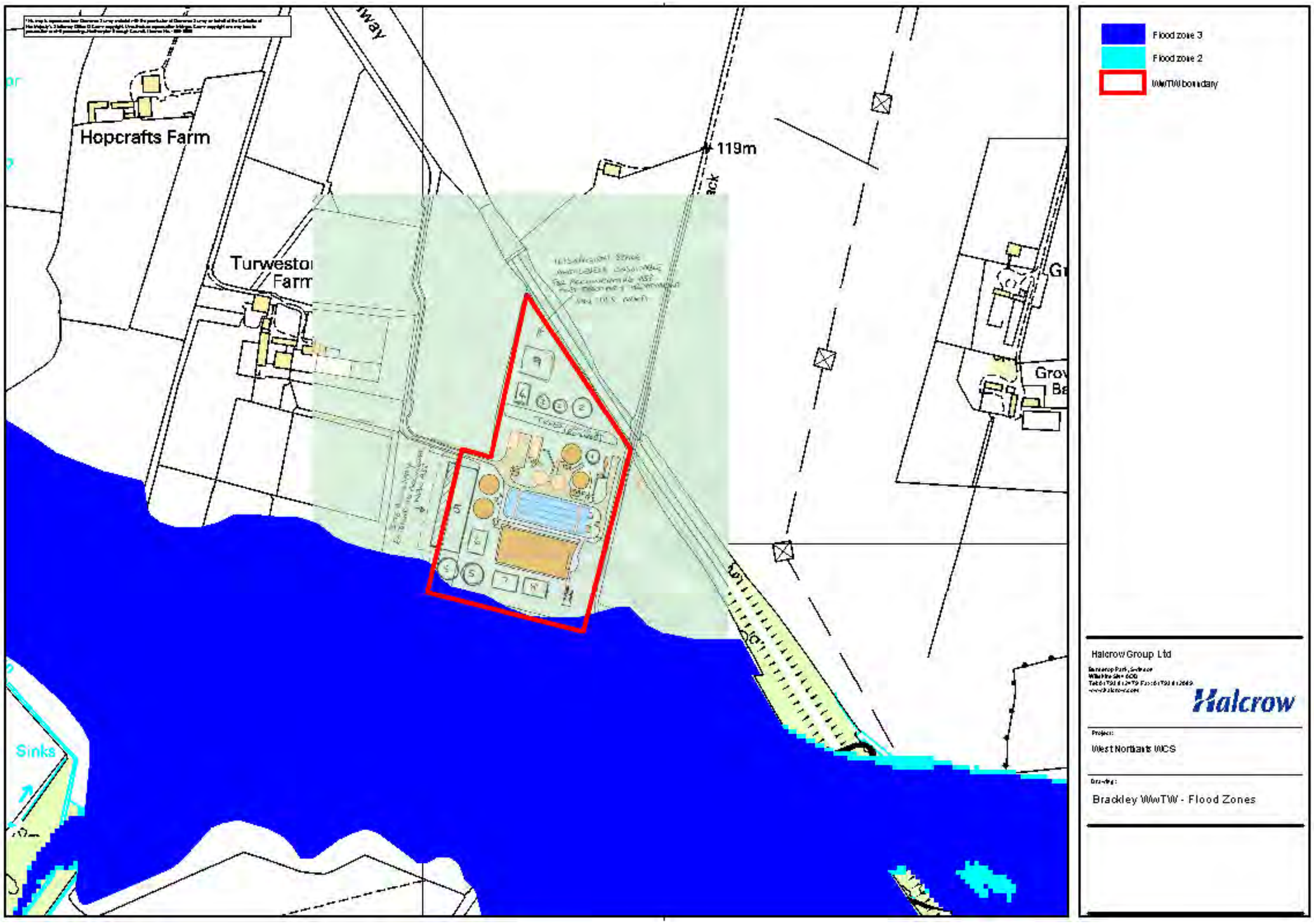


Figure 7-8 Additional WwTW infrastructure required to meet the no deterioration Environmental Capacity consent to 2026

7.3.5 Brackley wastewater network infrastructure

378. Brackley WwTW is situated on the Eastern side of the town and the Brackley North SUE is about 3.5km from the WwTW. If the SUEs are to be served by the existing sewerage network through the existing urban area, it has been identified that they would have a negative impact on Banbury Road Pumping station, Reynard Centre Pumping station, Brackley Link 40 Pumping station, Brackley Old Works Pumping Station, Brackley Football Ground storm sewer overflow, Old Town Road Combined sewer overflows and Brackley Terminal Pumping Station. A potential strategic solution was identified in Phase 1 of the WCS whereby a new sewer would extend from the east of Brackley to the WwTW which could service both of the SUEs. An indicative outline of this solution is shown in Figure 7-9 below.

379. Anglian Water Services have advised that further detailed planning of this infrastructure will not be commenced until either they are consulted on Detailed Site allocations under LDF or when a developer seeks to requisition. Delivery of infrastructure of this scale would typically take between 12 and 24 months.

7.3.6 Brackley water supply infrastructure

380. A RAG assessment has been undertaken for the water supply asset capacity for each of the Brackley Pre-Submission SUEs, and is shown in Table 7-3. Additional infrastructure can be provided through the requisition process and Table 7.3 provides an estimated timeframe to provide this infrastructure.

Table 7-3 Brackley Water Supply RAG Assessment

Pre-Submission Core Strategy SUE	Projections	Water		
		RAG assessment	Comments	Planning and delivery notes
North Substainable Urban Extension	1380 dwellings, school and local centre	AMBER	This development of 1,250 dwellings would require 5.3km of 355mmOD main and 3.3km of 250mmOD main to be laid, and the strategic scheme Deanshanger to Greatworth main would need to be completed, phase 2 of this scheme would need to be triggered by a requisition from a developer. It should be noted that due to operational changes with network in this area the scope of work required to supply the growth in this area has changed.	This scheme will go ahead once a requisition or firm commitment has been received from the developer, and the anticipated timescale to deliver this scheme is in the order of 18months, although the off-site works could be phased with some completed works allowing early phases of the development to go ahead.
East Sustainable Urban Extension	380, B1, B8	AMBER	This development of 380 dwellings and 650 jobs it would require 1.5km of 180mmOD main and 0.8km of 250mmOD main to be laid, and the strategic scheme Deanshanger to Greatworth main would need to be completed, phase 2 of this scheme would need to be triggered by a requisition from a developer. It should be noted that due to operational changes with network in this system the scope of work required to supply the growth in this area has changed.	This scheme will go ahead once a requisition or firm commitment has been received from the developer, and the anticipated timescale to deliver this scheme is in the order of 12months, although the off-site works could be phased with some completed works allowing early phases of the development to go ahead.

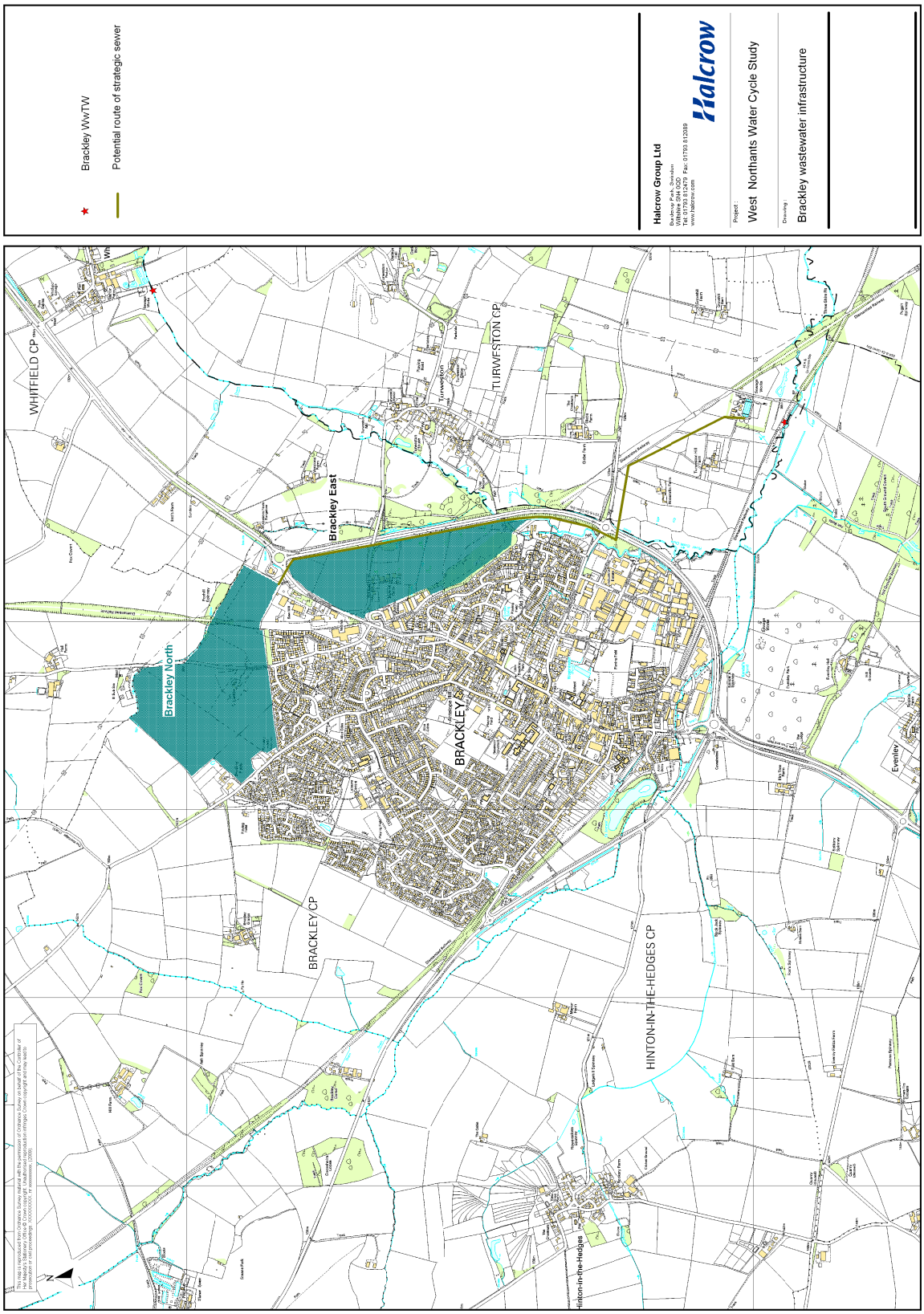


Figure 7-9 Brackley indicative wastewater network requirements

7.4 Towcester

7.4.1 Towcester wastewater treatment consented capacity

381. The proposed growth in housing and population within the Towcester Pre-Submission sustainable urban extensions area over the following three AMP periods will deliver 1,500 additional houses through the delivery of Towcester South.

382. The current DWF consent is not predicted to be breached due to increased development until AMP 7. A new consent will be needed to be sought in advance of this, and the water quality capacity assessment in Chapter 7 discusses the issues associated with this.

7.4.2 Towcester wastewater treatment infrastructure capacity

383. The capacity assessment has followed a Red Amber Green (RAG) process and the outputs are shown below.

STW Name	Consented capacity	5 year infrastructure capacity	2026 capacity	Odour risk	Land availability	Downstream flood risk	Overall assessment
Towcester					Land is not available within AWS ownership, but land purchase has been identified and the land is available	low risk of increased flooding (No further study recommended)	In the short term the STW has capacity for the 5 yr housing land supply. In the longer term additional infrastructure will need to funded and delivered through the AWS business planning process. The infrastructure feasibility assessment has not identified any constraints to providing this infrastructure, subject to land being made available for additional infrastructure.

Figure 7-10 Towcester WwTW infrastructure capacity RAG assessment

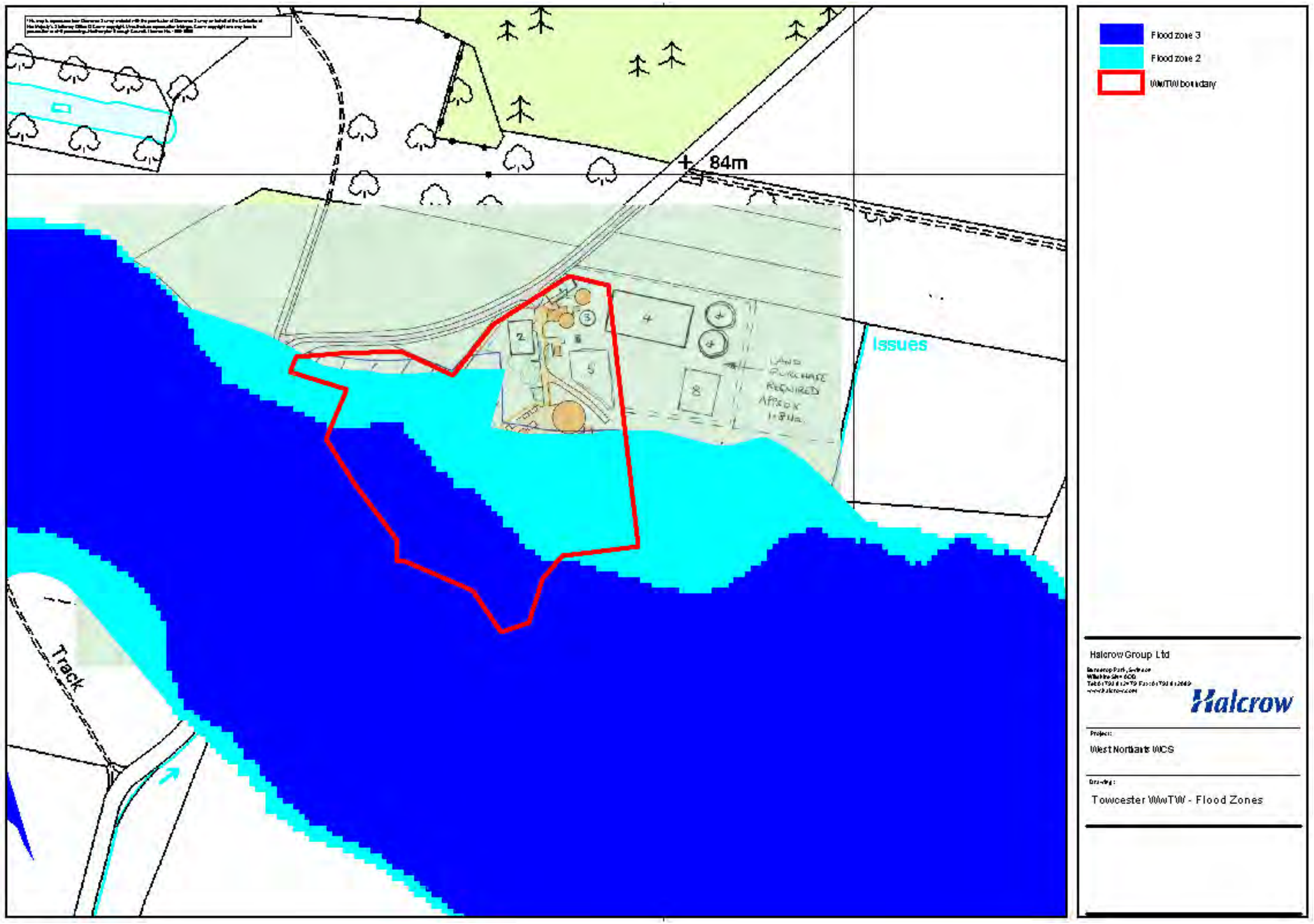


Figure 7-11 Additional WwTW infrastructure required to meet the no deterioration Environmental Capacity consent to 2026

7.4.3 Towcester wastewater treatment land availability

384. An infrastructure planning assessment has shown that the additional infrastructure required to meet the 2026 environmental capacity consent cannot be provided within the WwTW site boundary and without requiring construction in Flood Zone 3 (see Figure 7-11). Anglian Water have identified that infrastructure provision is feasible on adjacent land outside of the high flood risk zone. Anglian Water will need to confirm their preferred option for provision of additional wastewater treatment infrastructure in due course, and where required seek planning approval for an extension of the WwTW. If AWS consider that additional land is in fact required, we recommend that AWS begin discussions about the requirements for planning approval at the earliest possible occasion.

7.4.4 Towcester wastewater treatment discharge and flood risk

385. If a revised higher flow consent is needed for the WwTW to meet the growth requirements, there may be a requirement to mitigate the impact that the additional flow exerts on flood risk. This section aims to quantify the volume of additional effluent discharge from the Towcester Wastewater Treatment Work (WwTW) due to growth and how this compares to the existing flow in the watercourse during a flood event.

386. The methodology for this assessment is based on agreed methodology between the Environment Agency and Anglian Water as proposed through the recent Environmental Capacity Assessment undertaken by Halcrow Group Limited for Anglian Water Services (Phase 1, December 2008). The full methodology is included in Appendix J. Tables J-1 and J-2 in Appendix J provides further detail regarding the hydrological assumptions and input used in this assessment.

	Environmental Capacity Study	Revised
% Increased flow in receiving watercourse	0.12 %	0.12 %
40% weighting upon the increase in flow	1	1
45% weighting upon the increase in flow	1	1
60% weighting upon the increase in flow	1	1
70% weighting upon the increase in flow	1	1

387. The phase 1 environmental capacity study assessed the impact of the additional effluent discharged on the River Tove. The assessment identified that the overall risk factor, based on a population growth of 8,405 was low. This information was not included in the phase 1 water study as it had not been completed and agreed in advance of the publication of the draft outline WCS.

388. The outline WCS did not consider the scale of risk from the additional effluent, but did undertake an analysis to identify how much attenuation storage would be required to mitigate any increase in risk, no matter how small the risk was. This technical analysis and the volume of storage was never agreed by Anglian Water, who did not consider that the provision of mitigation was appropriate unless it was accompanied by an assessment of the actual flood risk (both flood hazard and flood consequence) that the additional effluent would lead to. The volume of storage was calculated to be approximately 5,000m^3.

389. In July 2010, the Environment Agency Anglian Region and Anglian Water published a number of position statements within the Water Cycle Study Framework. One of these related to 'Increased flood risk from wastewater treatment works discharge flows.' The statement recommends that water cycle studies should be required to follow the method identified in the Environmental Capacity Study, and that works which have a total risk score of greater than 2.5 (at 40% flow weighting) should be investigated further. This should be via consultation with interested parties to verify the sensitivity and impact

scoring used in the risk assessment. WwTWs with a score lower than 2.5 should be checked to ensure there are no local site specific issues which should have been identified in the risk assessment.

390. We have undertaken the assessment, using the river flow values as calculated in the Environmental Capacity study, and using the forecast future peak flows that will be discharged from the WwTW. The peak flows have been calculated by applying a 'peaking' factor to the 2026 dry weather flows used in the water quality and wastewater assessment. The total population increase 2006 to 2026 calculated to drain to Towcester is 3,301, which includes all known and forecast development, including Pre-Submission SUEs and commitments. This is significantly less than the 8,405 assessed in the environmental capacity study and the outline water cycle study.

391. The additional effluent in 2026 equates to less than a 0.03% increase in river flows during a 2 year flood event, and the results of the Environmental capacity methodology are shown below. The risk value for this assessment is less than 2.5, and therefore falls within the low risk category.

392. Although the study has confirmed that the risk is low, further work is required to conclude that increases in treated wastewater effluent will not increase downstream increase flood risk. An implementation group will be set up, comprising the appropriate partners to conclude this matter.

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Environmental Capacity Study

1. Site selection

Please Input the Anglian Water Wastewater Treatment Works OCD code:	towost
Please enter an estimated population equivalent increase between 2006 and 2021:	3,301
Check if consent standards are achievable	Check the changes in flood risk factors

2. Basic information

Wastewater Treatment Works:	Towcester
Eastings:	471730
Northings:	248640
June Return 2006 Population Equivalent:	9,795
Increased Population Equivalent (2006-21) as identified in the Environmental Capacity Study:	8,405
Receiving Watercourse:	River Tove
Discharge to main river:	Yes
Internal Drainage Board:	Not Identified

3. Consent standards under the predicted population equivalent increase (Environmental Capacity Study)

Current consent Biochemical Oxygen Demand (BOD):	15	mg/l
Current consent Ammonia:	5	mg/l
Predicted 2021 consent (Biochemical Oxygen Demand (BOD):	10	mg/l
Predicted 2021 consent Ammonia:	3	mg/l

4. Consent standards under the estimated population equivalent increase entered above

Revised 2021 consent Biochemical Oxygen Demand (BOD):	12	mg/l
Revised 2021 consent Ammonia:	4	mg/l

5. Total Value of Risk[1] (various weightings on the flow increase are used)

	Environmental Capacity Study	Revised
% Increased flow in receiving watercourse	0.12 %	0.05 %
40% weighting upon the increase in flow	1	1
45% weighting upon the increase in flow	1	1
60% weighting upon the increase in flow	1	1
70% weighting upon the increase in flow	1	1

Predicted consent standards are based upon a load equivalent calculation and the assumption that the works is already discharging at the maximum consented volume in 2006. This provides for a worst case scenario and is suitable for the purpose of determining whether the water quality aspect of environmental capacity is a potential constraint to growth.

[1] The flood risk classification is based upon a weighting of the following three factors;
- percentage increase in flow;
- sensitivity of watercourses to changes in flow volumes (i.e. channel restrictions);
- impact of increased flood risk, i.e. to existing properties or to agricultural land.

BAT = 6mg/l for BOD, 1 mg/l for Ammonia

393. We do not consider that the attenuation of treated wastewater effluent within the wastewater treatment works boundary is appropriate. If future assessment shows that the risk is greater than low, attenuation should be provided through the creation of additional flood plain within the same river reach as the wastewater treatment discharge, or through the additional attenuation of surface water runoff from developments beyond that required to mitigate for the risk of surface drainage increasing flood risk.

394. In the Daventry appeals, The Environment Agency, the Daventry appeals appellants and Anglian Water came to agreement with respect to the provision of necessary mitigation, and agreed that mitigation could be provided through additional surface water attenuation within a development boundary, if either a strategic solution was not appropriate or possible, thereby setting a precedent for the provision of effluent flood risk mitigation through additional surface water runoff attenuation.

395. With respect to Towcester WwTW, the option for additional surface water attenuation storage within development boundaries could potentially mitigate for any increase in flood risk to the River Tove as they fall within the Tove and its upstream tributary's hydrological catchment. The Western section of the Towcester Pre-Submission SUE is adjacent to the Silverstone Brook upstream of its confluence with the River Tove. Therefore if future assessment identifies that additional floodplain or reservoir storage is required, it may be possible to provide this through development management policies within the boundaries of the Pre-Submission SUE.

7.4.5 Towcester wastewater network

396. The phase 1 outline study identified the most likely strategy to serve this area was via connection to the trunk main flowing to Towcester WwTW. However, the drainage model is not of sufficient quality to model this solution in detail. Because of this constraint a proposed strategic solution was also put forward in phase 1, rather than using the existing network. This removes the need for a verified drainage model. The solution, shown in Figure 7-12 below, provides a new sewer to convey the new flows around the eastern side of the catchment to the WwTW.

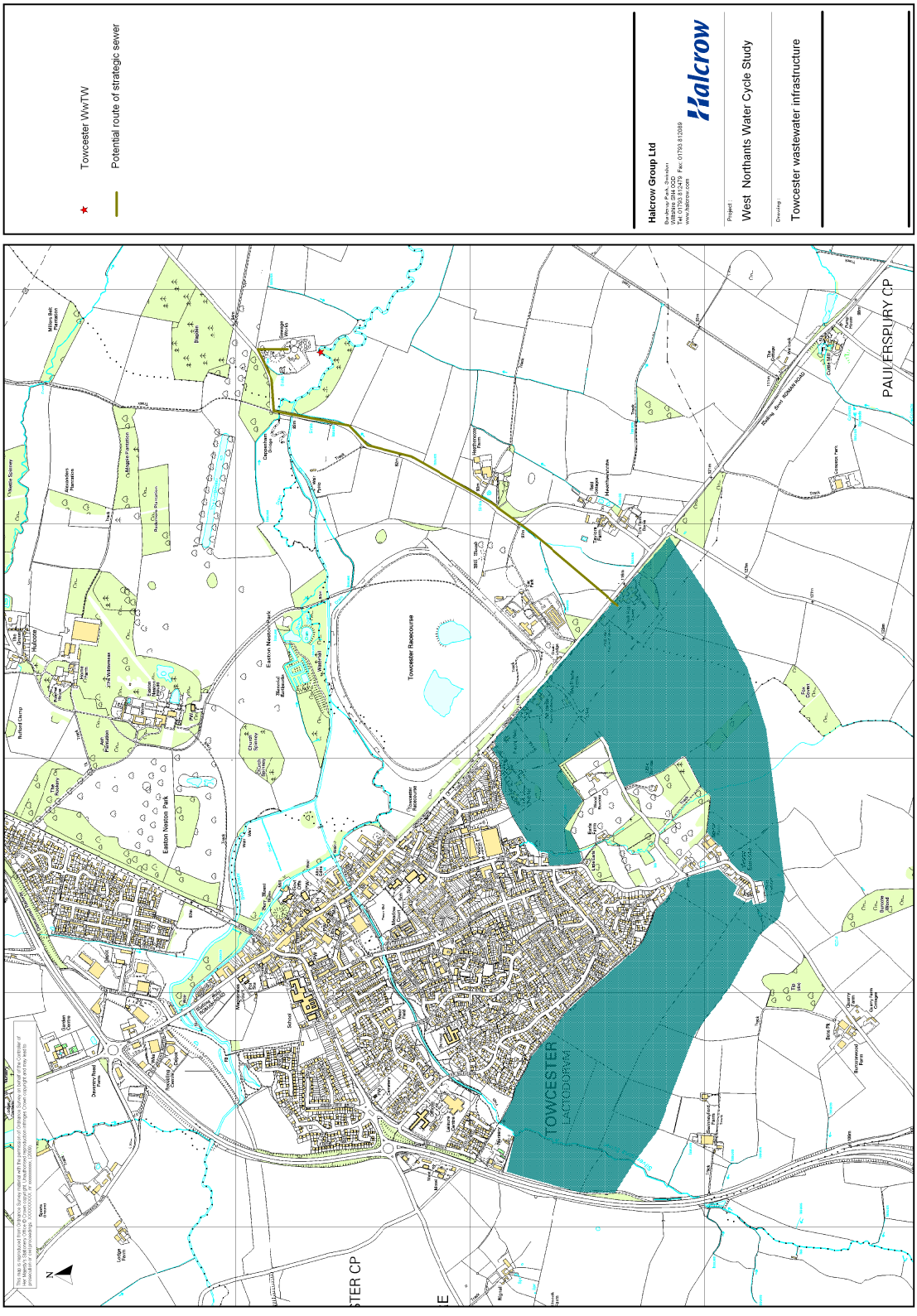


Figure 7-12 Solution provides a new sewer which could convey the new flows around the eastern side of the catchment to the WwTW

397. Anglian Water Services have advised that further detailed planning of this infrastructure will not be commenced until either the sites are allocated by the adopted Core Strategy or they receive a direct approach from developers seeking to request connection to the drainage network. The requisition and delivery of new sewerage infrastructure of this scale will take of the order of 18 months.

7.4.6 Towcester water supply infrastructure

398. A RAG assessment has been undertaken for the water supply asset capacity for each of the Towcester Pre-Submission SUEs, and is shown in Table 7-4. Additional infrastructure can be provided through the requisition process and Table 7-4 provides an estimated timeframe to provide this infrastructure.

Table 7-4 Towcester Water Supply RAG Assessment

Pre-Submission Core Strategy SUE	Projections	Water		
		RAG assessment	Comments	Planning and delivery notes
South Sustainable Urban Extension	3300 dwellings, 3 schools, 2 local centres	AMBER	To supply the whole of this development of 3,290 dwellings and 2,670 jobs would require 9km of 300mmID main from Deanshanger water reservoir to the development and install a new booster station at Deanshanger reservoir site.	This scheme will go ahead once a requisition or firm commitment has been received from the developer, and the anticipated timescale to deliver this scheme is in the order of 18months. However, depending upon the timing of the development they maybe capacity to supply the first phases of this development from the existing network.

7.5 Daventry

7.5.1 Daventry Whilton wastewater treatment consented capacity

399. AWS are currently progressing a growth scheme in AMP5 to provide capacity for growth until approximately 2026. An indicative consent has already been confirmed with the Environment Agency as part of this process (see Table 7-5 for consent details).

Table 7-5 Daventry Whilton WwTW growth scheme details

Parameter	Value
Confirmed growth consent (confirmed in final determination under a growth driver)	Dry Weather Flow 8500 m^3/day BOD 12mg/l Ammonia 3mg/l
Design capacity of growth scheme	11,635 (population equivalent)
Delivery date	Required to be completed by 2015 to meet Ofwat requirements. Planned completion date 2013

7.5.2 Daventry Whilton wastewater treatment infrastructure capacity

400. AWS are in the process of developing their growth scheme at Daventry Whilton WwTW. Agreement of an indicative consent by the Environment Agency, and the inclusion of the scheme in the final determination of the business plan by Ofwat (November 2009) shows widespread regulatory approval of this scheme.

401. The capacity assessment has followed a Red Amber Green (RAG) process and the outputs are shown in Figure 7-13 below.

STW Name	Consented capacity	5 year infrastructure	2026 capacity	Odour risk	Land availability	Downstream flood risk	Overall assessment
Daventry	A new consent for the planned growth scheme has been agreed in principle by the Environment Agency	A growth scheme is funded and planned for delivery in AMP5 (by 2015)				There is a moderate risk of a change in downstream flooding if additional effluent flows are not mitigated. The Daventry Appeals Statements of Common ground have agreed that if mitigation is required, it could be provided through development on-site attenuation of surface water in lieu of additonal wastewater effluent flows.	There are immediate capacity constraints at Daventry Whilton STW, but these will be resolved by the delivery of the growth scheme planned for AMP5.

Figure 7-13 Daventry Whilton WwTW infrastructure capacity

7.5.3 Daventry Whilton wastewater treatment land availability

402. An infrastructure planning assessment has shown that the additional infrastructure require to meet the 2026 environmental capacity consent can be provided within the WwTW site boundary and without requiring construction in Flood Zone 3 (see Figure 5-2)

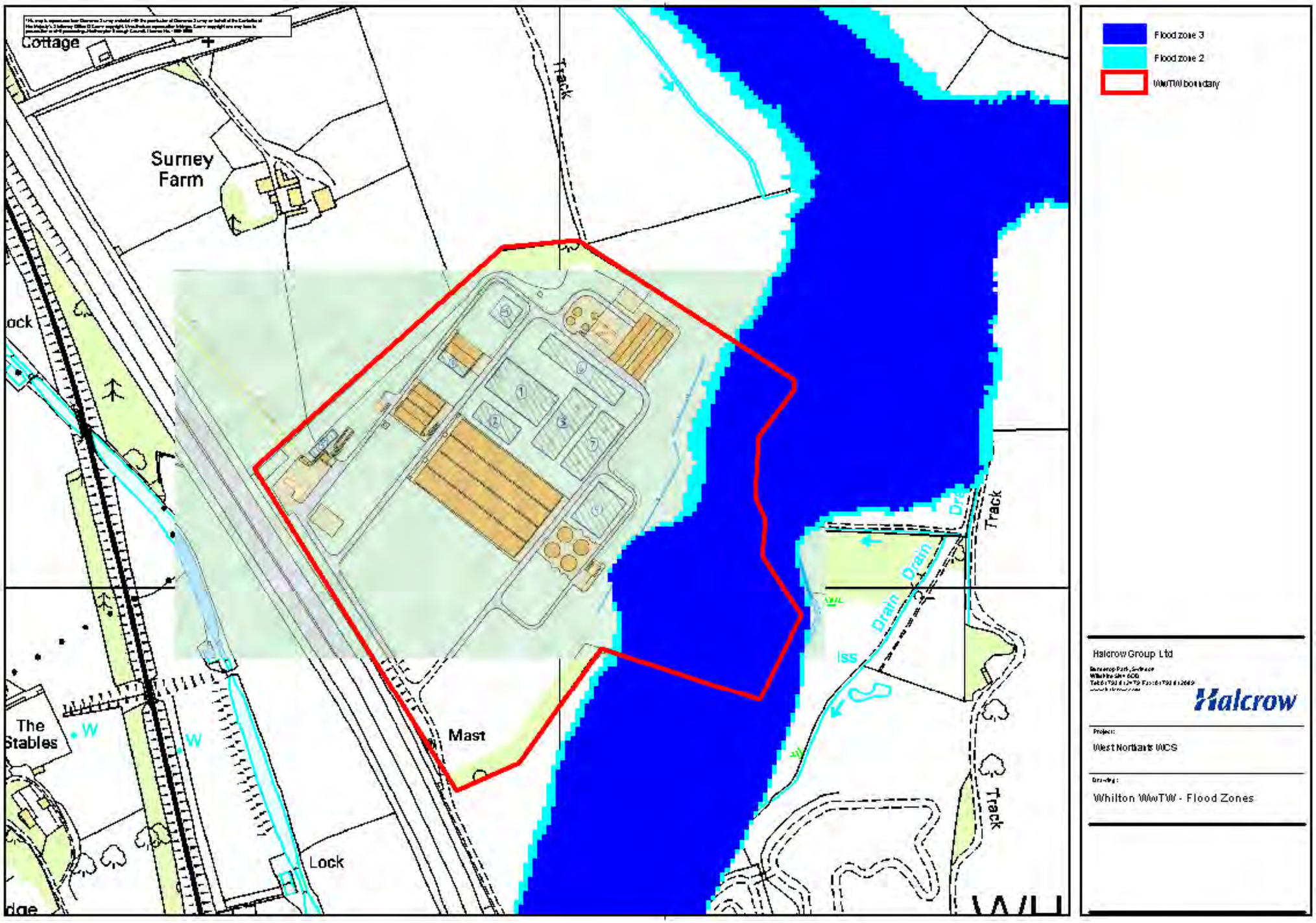


Figure 7-14 Additional WwTW infrastructure required to meet the no deterioration Environmental Capacity consent to 2026

7.5.4 Daventry Whilton wastewater discharge and flood risk

403. If a revised higher flow consent is needed for the WwTW to meet the growth requirements, there may be a requirement to mitigate the impact that the additional flow exerts on flood risk. This section aims to quantify the volume of additional effluent discharge from the Whilton Wastewater Treatment Work (WwTW) due to growth and how this compares to the existing flow in the watercourse during a flood event.

404. The methodology for this assessment is based on agreed methodology between the Environment Agency and Anglian Water as proposed through the recent Environmental Capacity Assessment undertaken by Halcrow Group Limited for Anglian Water Services (Phase 1, December 2008). The full methodology is included in Appendix J. Tables J-1 and J-2 in Appendix J provides further detail regarding the hydrological assumptions and input used in this assessment.

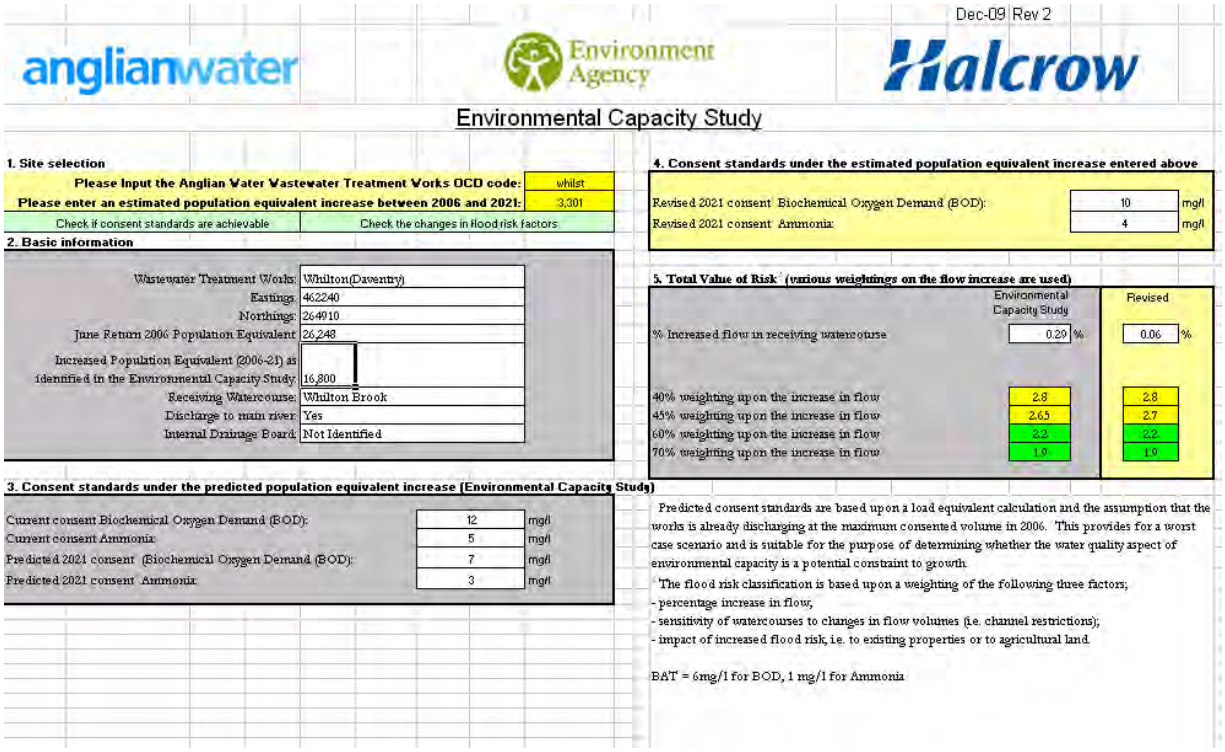
405. The phase 1 environmental capacity study assessed the impact of the additional effluent discharged on the Whilton Brook. The assessment identified that the overall risk factor, based on a population growth of 16,800, was moderate. This information was not included in the phase 1 water study as it had not been completed and agreed in advance of the publication of the draft outline WCS.

406. The outline WCS did not consider the scale of risk from the additional effluent, but did undertake an analysis to identify how much attenuation storage would be required to mitigate any increase in risk, no matter how small the risk was. This technical analysis and the volume of storage was never agreed by Anglian Water, who did not consider that the provision of mitigation was appropriate unless it was accompanied by an assessment of the actual flood risk (both flood hazard and flood consequence) that the additional effluent would lead to. The volume of storage was calculated to be approximately 14,000m^3.

407. In July 2010, the Environment Agency Anglian Region and Anglian Water published a number of position statements within the Water Cycle Study Framework. One of these related to 'Increased flood risk from wastewater treatment works discharge flows.' The statement recommends that water cycle studies should be required to follow the method identified in the Environmental Capacity Study, and that works which have a total risk score of greater than 2.5 (at 40% flow weighting) should be investigated further. This should be via consultation with interested parties to verify the sensitivity and impact scoring used in the risk assessment. WwTWs with a score lower than 2.5 should be checked to ensure there are no local site specific issues which should have been identified in the risk assessment.

408. We have undertaken the assessment, using the river flow values as calculated in the Environmental Capacity study, and using the forecast future peak flows that will be discharged from the WwTW. The peak flows have been calculated by applying a 'peaking' factor to the 2026 dry weather flows used in the water quality and wastewater assessment. The total population increase 2006 to 2026 calculated to drain to Daventry Whilton WwTW is 8,522, which includes all known and forecast development, including Pre-Submission SUEs and commitments. This is significantly less than the 16,800 assessed in the environmental capacity study and the outline water cycle study.

409. The additional effluent in 2026 equates to an approximate 0.06% increase in the river flows for 2 year return period event, and the results of the Environmental capacity methodology are shown below. Although the river flow for a 2 year flood flow event only increases by less than 0.1%, the total risk value for this assessment is 2.8, which falls into the moderate category. The moderate risk factor is driven by the downstream assessment of Sensitivity and Impact derived from the Environmental Capacity Study. These risk factors were High and Medium respectively. Sensitivity describes sensitivity of flood levels to increasing flows, and impact describes the likely impact of flood levels to increasing flows, and is based on the sensitivity of the receptors.



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anglianwater Environment Agency Halcrow

Environmental Capacity Study

1. Site selection

Please Input the Anglian Water Wastewater Treatment Works OCD code:	whilst
Please enter an estimated population equivalent increase between 2006 and 2021:	3,301
Check if consent standards are achievable	Check the changes in flood risk factors

2. Basic information

Wastewater Treatment Works:	Whilton(Daventry)
Eastings:	462240
Northings:	264910
June Return 2006 Population Equivalent	26,248
Increased Population Equivalent (2006-21) as identified in the Environmental Capacity Study:	16,800
Receiving Watercourse:	Whilton Brook
Discharge to main river:	Yes
Internal Drainage Board:	Not Identified

3. Consent standards under the predicted population equivalent increase (Environmental Capacity Study)

Current consent Biochemical Oxygen Demand (BOD):	12	mg/l
Current consent Ammonia:	5	mg/l
Predicted 2021 consent (Biochemical Oxygen Demand (BOD):	7	mg/l
Predicted 2021 consent Ammonia:	3	mg/l

4. Consent standards under the estimated population equivalent increase entered above

Revised 2021 consent Biochemical Oxygen Demand (BOD):	10	mg/l
Revised 2021 consent Ammonia:	4	mg/l

5. Total Value of Risk (various weightings on the flow increase are used)

	Environmental Capacity Study	Revised
% Increased flow in receiving watercourse	0.29 %	0.06 %
40% weighting upon the increase in flow	2.8	2.8
45% weighting upon the increase in flow	2.65	2.7
60% weighting upon the increase in flow	2.2	2.2
70% weighting upon the increase in flow	1.9	1.9

Predicted consent standards are based upon a load equivalent calculation and the assumption that the works is already discharging at the maximum consented volume in 2006. This provides for a worst case scenario and is suitable for the purpose of determining whether the water quality aspect of environmental capacity is a potential constraint to growth.

The flood risk classification is based upon a weighting of the following three factors;
- percentage increase in flow,
- sensitivity of watercourses to changes in flow volumes (i.e. channel restrictions);
- impact of increased flood risk, i.e. to existing properties or to agricultural land.

BAT = 6mg/l for BOD, 1 mg/l for Ammonia

410. In the Daventry appeals, The Environment Agency, the Daventry appeals appellants and Anglian Water came to agreement with respect to the provision of necessary mitigation, and agreed that mitigation could be provided through additional surface water attenuation within a development boundary, if either a strategic solution was not appropriate or possible, thereby setting a precedent for the provision of effluent flood risk mitigation through additional surface water runoff attenuation.

411. With respect to Whilton WwTW, the option for additional surface water attenuation storage within development boundaries could mitigate for any increase in flood risk to the Whilton Brook as the developments fall within the same hydrological catchment as the WwTW. The Daventry North East Pre-Submission SUE lies adjacent to the Whilton brook upstream of the wastewater treatment works, therefore it may be possible to provide the additional reservoir or flood plain attenuation in lieu of the additional treated wastewater effluent, through the development management process. However, given the marginal increase in river flow during the 2 year flood event (less than 0.1%), we would recommend that a detailed river modelling, risk assessment and cost benefit exercise is undertaken to confirm the value of providing mitigation. An implementation group will be set up, comprising the appropriate partners to conclude this matter

7.5.5 Daventry wastewater network

412. The existing trunk sewer to Whilton WwTW is considered to be operating at capacity. AWS have expressed that they require a joint strategy by all developers connecting to a dedicated new trunk sewer.

413. An outline design for this scheme was initially developed for the outline WCS and confirmed as part of the Daventry appeals. Figure 7-15 below shows the indicative outline WCS scheme for the Daventry appeals. This strategy will need review by Anglian Water Services following the adoption of the Core Strategy SUEs.

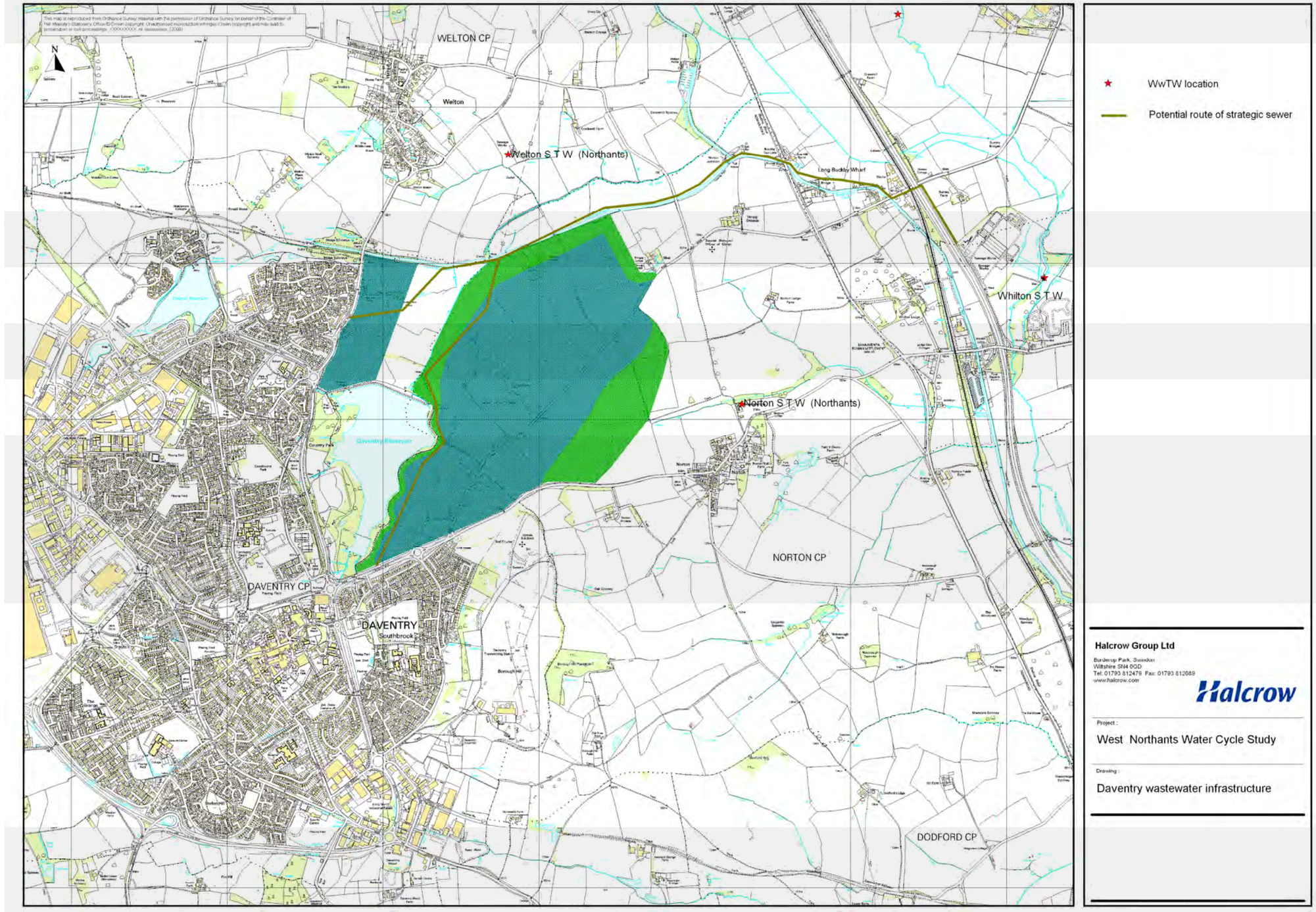

Figure 7-15 Indicative outline WCS scheme from Phase 1 WCS

414. Anglian Water Services have advised that further detailed planning of this infrastructure will not be commenced until either the sites are allocated by the adopted Core Strategy or they receive a direct approach from developers seeking to request connection to the drainage network.

7.5.6 Daventry water supply infrastructure capacity

415. A RAG assessment has been undertaken for the water supply asset capacity for the Daventry Pre-Submission sustainable urban extension and is shown in Table 7-6. The table identifies what water supply infrastructure is required to facilitate the development, and the timeframe to provide the infrastructure.

Table 7-6 Daventry Water Supply RAG Assessment

Pre-Submission allocation	Total to 2026	RED/AMBER/ GREEN Status	Comments	Planning and delivery notes
Daventry North East	2,500	AMBER	To supply this development of 2,500 dwellings it will be necessary to lay 6.5km of 450mmOD main from Harpole WR to Weedon WR, modify the inlet pipework at Weedon WR and upgrade the pumping station at Weedon, increase the storage at Borough Hill WR and Weedon WR and lay 1.6km of 300mmID main from Borough Hill WR to the development.	There may be special engineering difficulties due to the scale of the work required (the development would need a new main under the M1 motorway). This scheme will go ahead once a requisition or firm commitment has been received from the developer, and the anticipated timescale to deliver this scheme is in the order of 18months, although the off-site works could be phased with some completed works allowing early phases of the development to go ahead. Infrastructure may be required for existing commitments in the Daventry North East area, and the provision of infrastructure for commitments may facilitate early phases of this

8 Conclusions

Location	Region wide
Element	**Water resources**
Regional water resource availability	
The Ruthamford water resource zone which covers the West Northamptonshire WCS study area is currently in surplus. Without the implementation of Anglian Water Services preferred water resources strategy, the zone will be in deficit within the Core Strategy Period. The development numbers and population growth is based on the timeline and quantum of houses in the East Midlands Plan. The Pre-Submission Joint Core Strategy is now proposing lower housing numbers than the East Midlands Plan. The WRMP assumes the proposed implementation of the code for sustainable homes standards. If there remains any political uncertainty about the mandatory implementation of these standards through national amendments to building regulations, the Core Strategy should include these requirements as local policies to ensure water resource availability for the West Northamptonshire area. Water resource availability should therefore not be considered a constraint to the Core Strategy implementation, subject to the implementation of the Code for Sustainable Homes standards through Building Regulations or through local policy.	
Water neutrality	
The Environment Agency water cycle studies guidance recommends that local authorities consider water neutrality as an option. Our analysis shows that the greatest reduction in water demand can be achieved by reducing demand in the existing population and without this action it will not be possible to achieve water neutrality. Although measures such as CSH targeted at new developments have a positive impact upon demand, they should be used in conjunction with proposals for the existing population in order to achieve maximum reductions in total demand. A combination of measures is required to achieve water neutrality by 2026. These include AWS proposals for meter penetration(90% by 2031), the immediate implementation of the demand management requirements of CSH level 3 for new homes and a reduction in the existing PCC of the existing population of 1.4 l/h/d each year. This equates to an existing PCC reduction to 106 l/h/d by 2026, the equivalent of CSH level 3. This reduction in existing PCC is a very large challenge and the required levels are unlikely to be realised without strong policy over and above that currently proposed and should include further measures for retrofitting, education, tariff management and encouraging use of water efficient devices. Anglian Water's WRMP does not require water neutrality to ensure that that the Ruthamford WRZ remains in surplus. Overall, whilst AWS have plans in place to increase the amount of water available, it must be recognised that water availability is finite and good practice should be adopted now to avoid adverse environmental consequences at a later date. It is critical that planning policies are adopted by West Northamptonshire Joint Strategic Planning Committee to ensure that all new developments (including greenfield and brownfield) are built to a minimum of CSH level 3 (105 l/h/d), and preferably higher. Furthermore, the evidence from the demand management scenarios indicates the importance of reducing demand in the existing housing stock. This needs to be achieved through an ongoing partnership approach by West Northamptonshire authorities, the Environment Agency and AWS, to identify and implement the optimal mechanism for reducing demand in the existing housing stock. Appendix D identifies an indicative action plan of activities to be explored to manage demand.	

Regional water supply infrastructure
Anglian Water Service's WRMP and the AMP5 business plan have details of both a long term strategy and a short term funded plan to ensure that major water supply infrastructure is provided in line with the planned increase in demand forecast by the WRMP. The WRMP also includes an allowance for climate change when forecasting demand. Therefore major water supply systems should not be considered a constraint to the Core Strategy.

Element	**Flood risk and surface water management**
Compliance with Catchment Flood Management Plan	
The Core Strategy will not prejudice the preferred policies of the Catchment Flood Management plan, subject to the recommendations made in the area flood risk management conclusions.	
Strategic Flood Risk Assessment	
This WCS provides advice for planners and developers on the implementation of some of the SFRA and CFMP recommendations. This WCS should be read in conjunction with the relevant SFRA.	
Flood and Water Management Act and surface water management plans	
The Flood and Water Management Act bestows specific duties on upper tier authorities with respect to flood risk and surface water management. These duties can be delegated or shared with lower tier authorities where appropriate. These duties include undertaking the Preliminary Flood Risk Appraisal and preparing surface water management plans. Upper tier and unitary authorities will become responsible for the adoption and maintenance of new build SUDS; new build includes all new development and redevelopment. It is not a requirement of a sound Core Strategy to have completed these assessments or plans. The recommendations made in Chapter 5 and SuDS guidance in Chapter 6 when combined with the requirements of PPS25 will ensure that new developments do not create flood risk within those developments or increase flood risk downstream of these developments.	
Sustainable drainage	
It is likely that SuDS systems for large scale drainage within new development in West Northamptonshire will be dependent on surface based systems, with discharge to existing watercourses and incorporating ponds or similar detention areas for storage and flow attenuation. Space will need to be allowed for these features during the planning process. Should surface water runoff be required to be connected to a watercourse consideration needs to be given to the location of the option in relation to the nearest watercourse. There will be cases where surface water runoff will need to be routed through private land in order to connect to the watercourse. Under the Flood and Water Management Act, upper tier and unitary authorities will become the SAB, and would therefore be responsible for purchasing land or compensating land owners to allow surface water runoff to be routed through land, and connect to a watercourse. Given these considerations, development may be more suitable in locations which are closer to watercourses, and hence reduce the potential costs and difficulties of routing surface water through private land. There will be a removal of the automatic 'right to connect' surface water drainage to the public sewerage network. New surface water drainage systems will need to be approved in line with the National Standards before any	

connection to the public sewerage network is made.

The study has provided guidance for developers and planners on the likely suitability of different SuDS methods (Chapter 5 and Chapter 6). This is strategic guidance and must be reviewed by developer as part of their site specific flood risk assessments and drainage strategies. The drainage strategies must also include an operation and maintenance strategy. Operating and maintaining SUDS will become the responsibility of upper tier authorities through the enactment of the Flood and Water Management Act.

Element	**Water quality and wastewater treatment**
Compliance with Water Framework Directive	

The WCS has determined that achieving good ecological status, with respect to Biochemical Oxygen Demand and Ammonia will not be jeopardised by the Core Strategy plans, subject to additional wastewater treatment infrastructure being provided in certain locations. The WCS identifies when new consents will be required to ensure flow compliance at those works. At such time, if not before, the Environment Agency and Anglian Water Services will need to determine if the quality consent, which regulates the quality of the treated wastewater discharge, will need to be tightened. Should additional infrastructure be required to secure WFD compliance, this will be funded through the National Environment Programme and the Periodic Review, and agreed by Ofwat, the Environment Agency and the Water Companies.

It is not possible to achieve good ecological status in a number of locations with respect to the phosphate determinand, and it is not possible to prevent deterioration of current classification with respect to phosphate. Compliance with good status us an issue even without any development, and in most cases it is not possible to achieve good status for phosphate even if wastewater treatment works were upgraded to the best that can be achieved with current technology. Therefore, the Core Strategy must have regard to risk of the impact on WFD, and be satisfied that development policies are in place to remove or mitigate this risk.

Location	Northampton
Element	**Flood risk management**
Site specific flood risk assessments	
Site specific flood risk assessments will be needed for all SUEs considered in this study. Table 5-4 provides advice and recommendations for these flood risk assessments.	
Land set aside for drainage and flood risk management	
Policy recommendation	We recommend that the Core Strategy include a policy or recommendation stating that the required level of protection for site specific Flood Risk Assessments and drainage strategies should be consistent with the Environment Agency's local standard of protection.
Sustainable drainage	
It is likely that SuDS systems for large scale drainage within new development in Northampton will be dependent on surface based systems, with discharge to existing watercourses and incorporating ponds or similar detention areas for storage and flow attenuation. Space will need to be allowed for these features during the planning process. However, there is a possibility that there will be potential for some large infiltration schemes, particularly around the Upton Lodge area in Northampton. Again, space will need to be allowed for these features in the planning process. Site investigations should further identify these potential areas that could be used for infiltration, both large scale and localised. There is potential across the developments in Northampton but the actual groundwater levels in Northampton will also influence the possibility of these schemes. In locations where this study has identified infiltration potential is limited, there still remains the option to carry out smaller scale geological ground condition testing in the area, as the geological maps are very broad-scale. Where this is not possible, other types of SuDS, such as runoff attenuation, will be required. Should surface water runoff be required to be connected to a watercourse, consideration needs to be given to the location of the option in relation to the nearest watercourse. There will be cases where surface water runoff will need to be routed through private land in order to connect to the watercourse. Under the Flood and Water Management Act, upper tier and unitary authorities will become the SAB, and would therefore be responsible for purchasing land or compensating land owners to allow surface water runoff to be routed through land, and connect to a watercourse. Given these considerations, development may be more suitable in locations which are closer to watercourses, and hence reduce the potential costs and difficulties of routing surface water through private land. There will be a removal of the automatic 'right to connect' surface water drainage to the public sewerage network. New surface water drainage systems will need to be approved in line with the National Standards before any connection to the public sewerage network is made. The study has provided guidance for developers and planners on the likely suitability of different SuDS methods within the Northampton area. This is strategic guidance and must be reviewed by developer as part of their site specific flood risk assessments and drainage strategies. The drainage strategies must also include an operation and maintenance strategy. Operating and maintaining SUDS will become the responsibility of upper tier authorities through the enactment of the Flood and Water Management Act. Tables 5.4 and 6.2 summarises the recommendations for the Pre-Submission SUEs in Northampton.	

Element	Water quality and wastewater treatment
WFD compliance	
At Northampton Great Billing WwTW, there are no absolute environmental capacity constraints to the Pre-Submission Joint Core Strategy housing trajectory. However, a new tighter consent to ensure no deterioration and good status will be needed. This will need to happen either when AWS next need to apply for a revised flow consent or during the next National Environment Plan and periodic review of water company prices, due to publish in 2015.	
Great Billing WwTW capacity	
Anglian Water have identified that unaccounted for flows, or infiltration in the catchment are higher than expected and wish to reduce these flows in preference to providing more capacity at the WwTW. The WCS considers that it is not sustainable in the long term, in terms of energy use, resource use or water quality to pump and treat clean water or infiltration at the WwTW. Therefore the WCS supports AWS preferred approach to reduce infiltration before providing additional treatment capacity. A twin track approach to assessing and managing unaccounted for flows and infrastructure planning is therefore required over the AMP5 period to both reduce unaccounted for flows and plan for future upgrade. This twin track approach should include a scenario for the early agreement of a revised consent should the management of unaccounted for flows provide unfeasible. A new consent may be needed by 2016 dependant on the success of the unaccounted for flow reduction scheme AWS have confirmed that Great Billing WwTW has infrastructure capacity for development forecast in the AMP5 period (2010-2015) provided that the planned capital maintenance improvements planned and funded in AMP5 are delivered. In the longer term a new consent will be required, and additional infrastructure will be needed to funded and delivered through the AWS business planning process, but the environmental capacity assessment and infrastructure feasibility assessment have not identified any constraints to providing this infrastructure.	
Wastewater discharge and flood risk	
We have assessed the impact of the discharge of additional treated effluent on flood risk following the EA and AWS agreed Environmental Capacity Assessment methodology. The total risk value for this assessment is less than 2.5, and therefore falls within the low risk category. The change in risk factor from medium (in the 2008 Environmental capacity assessment) to low is due the reduction in the number of properties now being forecast in the Pre-Submission Core Strategy, which has reduced the percentage increase in flow in the Ecton Brook to below 10%. If the low risk identified in this water cycle study has not fully resolved the matter to the satisfaction of the WCS steering group, a detailed risk assessment of the flood hazard and flood consequence of the additional effluent should be undertake using detailed river modelling. If this is required, we recommend that a working group be set up, comprising the lead local flood authority (Northamptonshire County Council), the planning authorities, (WNDC, SNDC, DDC and NBC), the EA and AWS to fully quantify the risk before mitigation measures are considered.	
Wastewater treatment and Minerals and Waste Core Strategy	
Land within the AWS WwTW boundary has been allocated in the Joint Waste and Minerals Core Strategy as a waste site. This site is not directly related to the wastewater treatment works processes, and the additional wastewater treatment works processes will need to be located outside this allocated land.	

There may be an opportunity to combine the council's waste recycling operations with AWS', which could mean that the cake could actually be stored and processed at the waste park avoiding the need for additional transport and storage altogether. We recommend that AWS and Northamptonshire County Council progress plans for this site in close collaboration.
Wastewater network
The Northampton DAP modelling shows that there is capacity within the major trunk network to serve the Pre-Submission SUEs. Connection to an appropriate point in the network will need to be agreed by site developers in conjunction with Anglian Water through the requisition process, and any assessment will need to ensure that connections are not upstream of local or minor combined sewer overflows. AWS consider that any additional infrastructure to support short term development can be delivered by requisition within two years of infrastructure being requisitioned. The long term strategy to serve development in Northampton will be modelled and confirmed by AWS during AMP5 (by 2015). Based on initial modelling results from the Northampton DAP, the long term strategy is likely to require both infrastructure improvements and demand management (surface water removal and infiltration reduction).
Intermittent water quality central area
UPM modelling suggests intermittent discharge quality problems in Central Area. A drainage strategy is underway for the Central area to consider removing surface water connections from the combined system and find alternative discharge locations. Anglian Water's plans for the drainage of the Central Area must have regard to this study.

Element	**Water supply**
Water supply infrastructure capacity	
Anglian Water Services have identified that all of the Pre-Submission SUEs tested can be delivered through minor water supply infrastructure schemes delivered through the regulated requisition process. Therefore water supply infrastructure in Northampton should not be considered a constraint to growth.	
The typical timescale for the provision of infrastructure of this scale required through requisition is: Northampton North: 18 months Northampton South of Brackmills: No upgrades needed Northampton West: 18 months Northampton South: 6 months Northampton Kings Heath: 12 months Northampton Upton Park: 12 months Northampton North of Whitehills: 6 months	

Location	**Daventry**
Element	**Flood risk management**
Site specific flood risk assessments	
Site specific flood risk assessments will be needed for all pre-submission SUEs considered in this study. Table 5.5 provides advice and recommendations for these flood risk assessments. The study has provided guidance for developers and planners on the likely suitability of different SuDS methods within the Daventry area. This is strategic guidance and must be reviewed by developers as part of their site specific flood risk assessments and drainage strategies. The drainage strategies must also include an operation and maintenance strategy. Operating and maintaining SUDS will become the responsibility of upper tier authorities through the enactment of the Flood and Water Management Act. Table 5.5 and Table 6.3 summarise the recommendations for the Pre-Submission SUE in Daventry	
Land set aside for drainage and flood risk management	
Policy recommendation	We recommend that the Core Strategy include a policy or recommendation stating that the required level of protection for site specific Flood Risk Assessments and drainage strategies should be consistent with the Environment Agency's local standard of protection.
Element	**Water quality and wastewater treatment**
WFD compliance	
At Daventry Whilton WwTW, the Pre-Submission Joint Core Strategy housing trajectory will not cause deterioration of the current status of the waterbody. However, the consent may need to be tightened to ensure good status for Ammonia. Additionally, it is not possible with current conventional technology to achieve good status for phosphate in the downstream waterbody, although development does not make it more difficult to achieve good status in the future if wastewater treatment technology changes. If the Core Strategy proceeds to submission and is adopted, the technical feasibility and disproportionate cost of achieving good status for phosphate will need to be examined as part of the National Environment Plan. If it is not technically feasible or economically viable to achieve good status, then the waterbody will fail to achieve its RBMP objective.	
Daventry Whilton WwTW capacity	
AWS are in the process of developing their growth scheme at Daventry Whilton WwTW. Agreement of an indicative consent by the Environment Agency, and the inclusion of the scheme in the final determination of the business plan by Ofwat (November 2009) shows widespread regulatory approval of this scheme. The scheme has a design capacity of 11635 population, and is due for completion by December 2013.	
Wastewater discharge and flood risk	
The additional effluent in 2026 equates to an approximate 0.06% increase in the river flows for 2 year return period event. Although the river flow for a 2 year flood flow event only increases by less than 0.1%, the total risk value for this assessment is 2.8, which falls into the moderate category. The moderate risk factor is driven by the downstream assessment of Sensitivity and Impact derived from the Environmental Capacity Study. These risk factors were High and Medium respectively. Sensitivity describes sensitivity of flood levels to increasing flows, and impact describes the likely impact of flood levels to increasing flows, and is based on the sensitivity of the receptors.	

In the Daventry appeals, The Environment Agency, the Daventry appeals appellants and Anglian Water came to agreement with respect to the provision of necessary mitigation, and agreed that mitigation could be provided through additional surface water attenuation within a development boundary, if either a strategic solution was not appropriate or possible, thereby setting a precedent for the provision of effluent flood risk mitigation through additional surface water runoff attenuation. With respect to Whilton WwTW, the option for additional surface water attenuation storage within development boundaries could mitigate for any increase in flood risk to the Whilton Brook as the developments fall within the same hydrological catchment as the WwTW. The Daventry North East Pre-Submission SUE lies adjacent to the Whilton brook upstream of the wastewater treatment works, therefore it may be possible to provide the additional reservoir or flood plain attenuation in lieu of the additional treated wastewater effluent, through the development management process. However, given the marginal increase in river flow during the 2 year flood event (less than 0.1%), we would recommend that a detailed river modelling, risk assessment and cost benefit exercise is undertaken to confirm the value of providing mitigation.
Wastewater network
The existing trunk sewer to Whilton WwTW is considered to be operating at capacity. AWS have expressed that they require a joint strategy by all developers connecting to a dedicated new trunk sewer. An outline design for this scheme was initially developed for the outline WCS and confirmed as part of the Daventry appeals. This strategy will need review by Anglian Water Services following the adoption of the Pre-Submission Joint Core Strategy SUEs

Element	**Water supply**
Water supply infrastructure capacity	
Anglian Water Services have identified that the Daventry North East Pre-Submission SUE can be delivered through minor water supply infrastructure schemes delivered through the regulated requisition process. The typical timescale for the provision of infrastructure of the scale required to serve this development is 18 months. Therefore water supply infrastructure in Daventry should not be considered a constraint to growth.	

Location	**Brackley**
Element	**Flood risk management**
Site specific flood risk assessments	
Site specific flood risk assessments will be needed for all SUEs considered in this study. Table 5.8 provides advice and recommendations for these flood risk assessments. Site investigations should identify these potential areas that could be used for infiltration, both large scale and localised. The study has provided guidance for developers and planners on the likely suitability of different SuDS methods within the Brackley area. This is strategic guidance and must be reviewed by developer as part of their site specific flood risk assessments and drainage strategies. The drainage strategies must also include an operation and maintenance strategy. Operating and maintaining SUDS will become the responsibility of upper tier authorities through the enactment of the Flood and Water Management Act. Table 5.8 and Table 6.4 summarise the recommendations for the Pre-Submission SUEs in Brackley.	
Land set aside for drainage and flood risk management	
Policy recommendation	We recommend that the Core Strategy include a policy or recommendation stating that the required level of protection for site specific Flood Risk Assessments and drainage strategies should be consistent with the Environment Agency's local standard of protection
Element	**Water quality and wastewater treatment**
WFD compliance	
At Brackley WwTW, the Pre-Submission Joint Core Strategy housing trajectory may lead to a deterioration of the current status of the waterbody for ammonia and phosphate by 2026 unless a tighter consent is applied to the WwTW. Additionally, it is not possible with current conventional technology to prevent a deterioration of status of phosphate, or to achieve good status for phosphate. However, development does not make it more difficult to achieve good status in the future if wastewater treatment technology changes. If the Core Strategy proceeds to submission and is adopted, the technical feasibility and disproportionate cost of achieving good status for phosphate will need to be examined as part of the National Environment Plan. If it is not technically feasible or economically viable to achieve good status, then the waterbody will fail to achieve its RBMP objective. The application of a tighter consent for ammonia will need to happen either when AWS next need to apply for a revised flow consent, or during the next National Environment Programme and periodic review of water company prices, due to publish in 2015.	
Brackley WwTW capacity	
In the short term the STW has capacity for the 5year housing land supply. In the longer term a new consent will be required and additional infrastructure will need to be funded and delivered through the AWS business planning process. The infrastructure feasibility assessment has not identified any constraints to providing this infrastructure, subject to a new consent being able to agreed within environmental capacity constraints.	

Wastewater discharge and flood risk
We have undertaken the assessment using the Environmental Capacity Assessment methodology agreed between the Environment Agency and Anglian Water. Brackley WwTW discharges to the Great Ouse. The additional effluent forecast in 2026 equates to less 0.3% increase in river flow during the 1 in 2 year event, and the results of the Environmental capacity methodology are shown below. The risk value for this assessment is less than 2.5, and therefore falls within the low risk category If the low risk identified in this water cycle study has not fully resolved the matter to the satisfaction of the WCS steering group, a detailed risk assessment of the flood hazard and flood consequence of the additional effluent should be undertake using detailed river modelling. If this is required, we recommend that a working group be set up, comprising the lead local flood authority (Northamptonshire County Council), the planning authority SNDC, the EA and AWS to fully quantify the risk before mitigation measures are considered. With respect to Brackley WwTW, the option for additional surface water attenuation storage within development boundaries could potentially mitigate for any increase in flood risk to the Great Ouse. There are no Pre-Submission SUEs being assessed for Brackley that include or are adjacent to the River Great Ouse Floodplain, therefore there are limit opportunities through the development management process to provide flood reservoirs on the River Great Ouse. However, Brackley East does lie adjacent to a tributary of the River Great Ouse (upstream of the WwTW discharge point), and it may be possible to provide flood storage within this development area.
Wastewater network
It has been identified that the Pre-Submission SUEs would have a likely service impact on a number of AWS assets unless a strategic solution was identified. A potential strategic solution was identified in Phase 1 of the WCS whereby a new sewer would extend from the east of Brackley to the WwTW which could service both of these SUEs. Anglian Water Services have advised that further detailed planning of this infrastructure will not be commenced until either they are consulted on Detailed Site allocations under LDF or when a developer seeks to requisition. Delivery of infrastructure of this scale would typically take between 12 and 24 months.

Element	**Water supply**
Water supply infrastructure capacity	
A RAG assessment has been undertaken for the water supply asset capacity for each of the Brackley Pre-Submission sustainable urban extensions. The assessment has determined that additional infrastructure will be required to supply these growth areas. This will happen through the normal requisition process and delivery of the infrastructure would typically take in the order of 12-18 months following requisition by a developer.	

Location	Towcester
Element	**Flood risk management**
Site specific flood risk assessments	
A site specific flood risk assessment will be needed for the allocation considered in this study. Table 5.7 provides advice and recommendations for flood risk assessments. Site investigations should identify these potential areas that could be used for infiltration, both large scale and localised. Above ground attenuation features as promoted by the Flood and Water Management Act, and as will be required by the National SUDS standards, may include a significant requirement for land if the attenuation volumes are large. Therefore, developers should be required to prove that they have assessed the need for this land requirement at outline planning stage. In locations where infiltration potential is limited, there still remains the option to carry out smaller scale geological ground condition testing in the area, as the geological maps are very broad-scale. Where this is not possible, other types of SuDS, such as runoff attenuation, will be required. Should surface water runoff be required to be connected to a watercourse consideration needs to be given to the location of the allocation in relation to the nearest watercourse. There will be cases where surface water runoff will need to be routed through private land in order to connect to the watercourse. Under the Flood and Water Management Act, upper tier and unitary authorities will become the SAB, and would therefore be responsible for purchasing land or compensating land owners to allow surface water runoff to be routed through land, and connect to a watercourse. Given these considerations, development may be more suitable in locations which are closer to watercourses, and hence reduce the potential costs and difficulties of routing surface water through private land. There will be a removal of the automatic 'right to connect' surface water drainage to the public sewerage network. New surface water drainage systems will need to be approved in line with the National Standards before any connection to the public sewerage network is made. The study has provided guidance for developers and planners on the likely suitability of different SuDS methods within the Towcester area. This is strategic guidance and must be reviewed by developer as part of their site specific flood risk assessments and drainage strategies. The drainage strategies must also include an operation and maintenance strategy. Operating and maintaining SUDS will become the responsibility of upper tier authorities through the enactment of the Flood and Water Management Act. Table 5-8 and Table 6.4 summarises the recommendations for the Pre-Submission SUEs in Towcester.	
Land set aside for drainage and flood risk management	
Policy recommendation	We recommend that the Core Strategy include a policy or recommendation stating that the required level of protection for site specific Flood Risk Assessments and drainage strategies should be consistent with the Environment Agency's local standard of protection
Element	**Water quality and wastewater treatment**
WFD compliance	
At Towcester WwTW, the Pre-Submission Joint Core Strategy housing trajectory will lead to a deterioration of the current status of the waterbody for ammonia and phosphate by 2026 unless a tighter consent is applied to the WwTW. Additionally, it is not possible with current conventional technology to prevent a deterioration of	

status of phosphate, or to achieve good status for phosphate. However, development does not make it more difficult to achieve good status in the future if wastewater treatment technology changes. If the Core Strategy proceeds to submission and is adopted, the technical feasibility and disproportionate cost of achieving good status for phosphate will need to be examined as part of the National Environment Plan. If it is not technically feasible or economically viable to achieve good status, then the waterbody will fail to achieve its RBMP objective. The application of a tighter consent for ammonia will need to happen either when AWS next need to apply for a revised flow consent, or during the next National Environment Plan and periodic review of water company prices, due to publish in 2015.

Towcester WwTW capacity

In the short term the STW has capacity for the 5 year housing land supply. In the longer term a new consent will be required, and additional infrastructure will need to be funded and delivered through the AWS business planning process. The infrastructure feasibility assessment has not identified any constraints to providing this infrastructure, subject to a new consent being able to agreed within environmental capacity constraints, and Anglian Water Services being able to purchase the additional land identified for additional infrastructure.

Wastewater discharge and flood risk

The additional effluent in 2026 equates to less than a 0.03% increase in river flows during a 2 year flood event, and the results of the Environmental capacity methodology are shown below. The risk value for this assessment is less than 2.5, and therefore falls within the low risk category.

If the low risk identified in this water cycle study has not fully resolved the matter to the satisfaction of the WCS steering group, a detailed risk assessment of the flood hazard and flood consequence of the additional effluent should be undertake using a detailed river model. If this is required, we recommend that a working group be set up, comprising the lead local flood authority (Northamptonshire County Council), the planning authority (SNDC), the EA and AWS to fully quantify the risk before mitigation measures are considered.

We do not consider that the attenuation of treated wastewater effluent within the wastewater treatment works boundary is appropriate. If future assessment shows that the risk is greater than low, attenuation should be provided through the creation of additional flood plain within the same river reach as the wastewater treatment discharge, or through the additional attenuation of surface water runoff from developments beyond that required to mitigate for the risk of surface drainage increasing flood risk.

With respect to Towcester WwTW, the option for additional surface water attenuation storage within development boundaries could potentially mitigate for any increase in flood risk to the River Tove as they fall within the Tove and its upstream tributary's hydrological catchment. The Western section of the Towcester Pre-Submission SUE is adjacent to the Silverstone Brook upstream of its confluence with the River Tove. Therefore if future assessment identifies that additional floodplain or reservoir storage is required, it may be possible to provide this through development management policies with the boundaries of the Pre-Submission SUE.

Wastewater network

The phase 1 outline study identified the most likely strategy to serve this area was via connection to the trunk main flowing to Towcester WwTW. However, the drainage model is not of sufficient quality to model this solution in detail. Because of this constraint a proposed strategic solution was also put forward in phase 1, rather than using the existing network. This removes the need for a verified drainage model. The solution is to provide a new sewer to convey the new flows around the eastern side of the catchment to the WwTW.

Anglian Water Services have advised that further detailed planning of this infrastructure will not be commenced until either the sites are allocated by the adopted Core Strategy or they receive a direct approach from

developers seeking to request connection to the drainage network. The requisition and delivery of new sewerage infrastructure of this scale will take of the order of 18 months.	
Element	**Water supply**
Water supply infrastructure capacity	
A RAG assessment has been undertaken for the water supply asset capacity for Towcester South. The assessment has determined that additional infrastructure is required, and there are two feasible options to provide additional infrastructure depending upon which parts of the site are developed first. Infrastructure of the scale identified would typically take of the order of 18 months to deliver.	

9 Glossary of terms

416. **Annual Exceedance Probability** – Used in this report to refer to flood risk and flood defence standard of protection. A standard of protection to the 1 in 100 year event means that the location has a 1% chance (1 in 100) of flooding in any year, this is the 1% Annual Exceedance Probability (AEP). This does not mean that if the location floods in one year, it will definitely not flood again for the next 99 years, or that if it has not flooded for the previous 99 years, that it will definitely flood this year.

417. **Annual Monitoring Report (AMR)** - Assesses the implementation of the Local Development Scheme and the extent to which policies in Local Development Documents are being successfully implemented.

418. **Appropriate Assessment** – Required by the Habitats Directive (92/43/EEC) for all plans or projects which, either alone or in combination with other plans or projects, would be likely to have a significant effect on a European classified conservation site, and are not directly connected with the management of the site for nature conservation. Its purpose is to assess the implications of a proposal in respect to the site's conservation objectives. The assessment process is not specified by the regulations but is usually an iterative process at a level dependent on the location, size and significance of the proposed plan or project. English Nature can advise on whether a plan or project is likely to have a significant effect and thus require assessment.

419. **Area Action Plans** – Development Plan Documents that provide a planning framework for areas of change and areas of conservation.

420. **Areas of Outstanding Natural Beauty (AONB)** - Were brought into being by the same legislation as National Parks - the National Parks and Access to the Countryside Act of 1949. They are fine landscapes, of great variety in character and extent. The criteria for designation is their outstanding natural beauty. Many AONBs also fulfil a recreational role but, unlike national parks, this is not a designation criteria. The Countryside Agency and the Countryside Council for Wales are responsible for designating AONBs and advising Government on policies for their protection.

421. **Asset Management Plan (AMP)** - a plan for managing an water companies' infrastructure and other assets in order to deliver an agreed standard of service. The Asset Management Plans are submitted to Ofwat every 5 years and forms the basis by which water rates are set. These plans identify the timescales and levels of investment required to maintain and upgrade the serviceability of the assets.

422. **Biodiversity Action Plans (BAPs)** – The UK initiative, in response to the Rio Summit in 1992, to conserve and enhance biodiversity. The plan combines new and existing conservation initiatives with the emphasis on a partnership approach and seeks to promote public awareness.

423. **BREEAM - The Building Research Establishment Environmental Assessment Method.** A method for assessing the environmental sustainability of a new building. The BREEAM has been superseded by the Code for Sustainable homes for residential developments, but is still in common usage for non-residential developments.

424. **Catchment Abstraction Management Strategy (CAMS)** – a strategy to assess how much water can be abstracted to meet its many economic uses – agriculture, industry, and drinking water supply – while leaving sufficient water in the environment to meet ecological needs.

425. **Catchment Flood Management Plan (CFMP)** – A strategic planning tool through which the Environment Agency seeks to work with other key decision-makers within a river catchment, to identify and agree policies for sustainable flood risk management.

426. **Code for Sustainable Homes** – the Code for Sustainable Homes - a new national standard for sustainable design and construction of new homes—was launched in December 2006. The code measures the sustainability of a new home against a range of sustainability criteria. The code sets

minimum standards for energy and water use in new properties, and give homebuyers more information about the environmental impact of their new home.

427. **Combined Sewer Overflow (CSO)** - Combined sewer overflow is the discharge of untreated wastewater from a sewer system that carries both sewage and storm water (a combined sewerage system) during a rainfall event. The increased flow caused by the storm water runoff exceeds the sewerage system's capacity and the sewage is forced to overflow into streams and rivers through CSO outfalls.

428. **Communities and Local Government (CLG)** - Communities and Local Government is the government department responsible for policy on local government, housing, urban regeneration, planning and fire and rescue. They have responsibility for all race equality and community cohesion related issues in England and for building regulations, fire safety and some housing issues in England and Wales. The rest of their work applies only to England. (http://www.communities.gov.uk/corporate/about/)

429. **Core Strategy** - The Development Plan Document which sets the long-term spatial planning vision and objectives for the area. It contains a set of strategic policies that are required to deliver the vision including the broad approach to development.

430. **Critical Drainage Areas** - The Town and Country Planning (General Development Procedure) (Amendment) (No. 2) (England) Order 2006 introduces the concept of Critical Drainage areas as "an area within Flood Zone 1 which has critical drainage problems and which has been notified… [to]…the local planning authority by the Environment Agency".

431. **Development Plan** - As set out in Section 38(6) of the Planning and Compulsory Purchase Act (2004), an authority's development plan consists of the relevant Regional Spatial Strategy (or the Spatial Development Strategy in London) and the Development Plan Documents contained within its Local Development Framework.

432. **Development Plan Documents (DPDs)** - Spatial planning documents within the Council's Local Development Framework which set out policies for development and the use of land. Together with the Regional Spatial Strategy they form the development plan for the area. They are subject to independent examination. They are required to include a core strategy and a site allocations document, and may include area action plans if required; other DPDs may also be included, e.g. development control policies.

433. **Dry Weather Flow (DWF)** – The flow received or discharged by a wastewater treatment works in dry weather. Dry weather flow is regulated variable that is consented by the Environment Agency in a wastewater treatments works' consent to discharge under the Water Resource Act 1911.

434. **DEFRA** - Department of Environment, Food and Rural Affairs Development.

435. **Environment Agency** - The leading public body for protecting and improving the environment in England and Wales. Flood management and defence are a statutory responsibility of the Environment Agency; it is consulted by local planning authorities on applications for development in flood risk areas, and also provides advice and support to those proposing developments and undertaking Flood Risk Assessments. The Environment Agency reports to DEFRA.

436. **Environment Agency Flood Zones** - Nationally consistent delineation of 'high' and 'medium' flood risk, published on a quarterly basis by the Environment Agency.

437. **Flood Estimation Handbook** - The latest hydrological approach for the estimate of flood flows in the UK.

438. **Flood Risk Assessment** – A site specific investigation usually carried out by the site developers to be submitted as part of their planning applications. It assesses both current flood risk to the site and the impact of development of the site to flood risk in the area.

439. **Freshwater Fish Directive** - The EC Directive on Freshwater Fish is designed to protect and improve the quality of rivers and lakes to encourage healthy fish populations. In 2013, this directive will be repealed. Waters currently designated as Fish Directive waters will become protected areas under the Water Framework Directive.

440. **Future Water** - The Government's new water strategy for England, Future Water was published 7 February 2008. This strategy sets out the Government's long-term vision for water and the framework for water management in England. (http://www.defra.gov.uk/Environment/water/strategy/index.htm)

441. **Green infrastructure** – green infrastructure is the physical environment within and between our cities, towns and villages. It is a network of multi-functional open spaces, including formal parks, gardens, woodlands, green corridors, waterways, street trees, and open countryside.

442. **Good Ecological Status (GES)** – The Water Framework Directive (more formally the Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy) is a European Union directive which commits European Union member states to achieve good qualitative and quantitative status of all water bodies (including marine waters up to kilometer from shore) by 2015. It is a framework in the sense that it prescribes steps to reach the common goal rather than adopting the more traditional limit value approach. Good ecological status is defined by each member state, and is set at a level lower than a theoretical reference point of pristine conditions, i.e. in the absence of anthropogenic influence.

443. **Habitats Regulation Assessment** - An assessment of the potential effects of planning policies on European nature conservation sites, which lie within and outside the Borough

444. **Infrastructure** – The basic physical systems of a community's population, including roads, utilities, water, sewage, etc. These systems are considered essential for enabling productivity in the economy. Developing infrastructure often requires large initial investment, but the economies of scale tend to be significant. Water services infrastructure refers to infrastructure that provides clean water, urban drainage and wastewater services.

445. **Inset appointment** - An inset appointment is made when an existing water and/or sewerage undertaker is replaced by another as the supplier of water and/or sewerage services for one or more customers within a specified geographical area.

446. **Local Authority or Local Planning Authority (LA or LPA)** – the local authority or council that is empowered by law to exercise planning functions. Often the local borough or district council. National parks and the Broads authority are also considered to be local planning authorities. County councils are the authority for waste and minerals matters.

447. **Local Development Documents (LDDs)** – the collective term for Development Plan Documents and Supplementary Planning Documents.

448. **Local Development Framework (LDF)** - The name for the portfolio of Local Development Documents. It consists of the Local Development Scheme, a Statement of Community Involvement, Development Plan Documents, Supplementary Planning Documents, and the Annual Monitoring Report.

449. **Local Development Scheme (LDS)** - Sets out the programme for preparing Local Development Documents. All authorities must submit a Scheme to the Secretary of State for approval within six months of commencement of the 2004 Act (thus all authorities should now have submitted an LDS). LDSs are subject to review.

450. **'Making Space for Water' (DEFRA 2004)** - The Government's new evolving strategy to manage the risks from flooding and coastal erosion by employing an integrated portfolio of approaches, so as to: a) reduce the threat to people and their property; b) deliver the greatest environmental, social and economic benefit, consistent with the Government's sustainable development principles, and c) secure efficient and reliable funding mechanisms that deliver the levels of investment required.

451. **Mean Trophic Rank (MTR**) - The Mean Trophic Rank has been developed for England and Wales to implement the EC Urban Waste Water Directive: it is used to assess the impact of point sources on the river. It is based on the combination of species at a site and, for each species, its indicator value and its abundance.

452. **Minimum Residual Flow (MRF) -** The flow set at a river gauging station to protect downstream uses. When flow falls below this level controlled abstractions are required to cease.

453. **National Environment Programme (NEP)** - A key component of a periodic review is the National Environment Programme (NEP). The NEP is a list of environmental improvement schemes that ensure that water companies meet European and national targets related to water.

454. **Ofwat** – The Water Services Regulation Authority (Ofwat) is the body responsible for economic regulation of the privatised water and sewerage industry in England and Wales. Ofwat is primarily responsible for setting limits on the prices charged for water and sewerage services, taking into account proposed capital investment schemes (such as building new wastewater treatment works) and expected operational efficiency gains.

455. **Per capita consumption (PCC) –** The typical or average amount of a substance used by one person per day. Used in this study with reference to domestic water consumption.

456. **Periodic Review (PR)** – Every five years Ofwat sets the price limits that water companies can charge their customers for the supply of water and the treatment of waste water for the following five years. This Periodic Review determines how much water companies can spend on maintaining their services as well as improving them. The next periodic review is in 2014 and called PR14..

457. **Planning Policy Statements (PPS)** - The Government has updated its planning advice contained within Planning Policy Guidance Notes (PPGs) with the publication of new style Planning Policy Statements (PPSs), which set out its policy for a range of topics.

458. **Pollutants** – A substance or condition that contaminates air, water, or soil. Pollutants can be artificial substances, such as pesticides and PCBs, or naturally occurring substances, such as oil or carbon dioxide, that occur in harmful concentrations in a given environment

459. **Previously Developed (Brownfield) Land** - Land which is or was occupied by a building (excluding those used for agriculture and forestry). It also includes land within the curtilage of the building, for example a house and its garden would be considered to be previously developed land. Land used for mineral working and not subject to restoration proposals can also be regarded as Brownfield land.

460. **QMED** – The median annual maximum flood flow.

461. **Regional Spatial Strategy (RSS)** - Sets out the region's policies in relation to the development and use of land and forms part of the development plan for local planning authorities.

462. **River Basin Management Plan (RBMP)** – A strategic tool introduced by the Water Framework Directive (2000/60/EC) which integrates the management of land and water within a river basin (river catchment or group of catchments). The river basin may cover several political areas.

463. **River Quality Objective (RQO)** – agreed by Government as targets for all rivers in England and Wales when the water industry was privatised in 1989. The targets specify the water quality needed in rivers if we are to be able to rely on them for water supplies, recreation and conservation.

464. **Sensitive Areas (Eutrophic) (SA_e)** – Surface waters must be designated as Sensitive Areas under the Urban Waste water Treatment Directive (UWWTD) if they are eutrophic or if they may become eutrophic in the future if protective action is not taken (Annex II A(a)). Discharges to Sensitive Areas Eutrophic require more stringent treatment for nitrogen and/or phosphorus.

465. **Sites of Importance for Nature Conservation (SINCs)** - is a designation used in many parts of the United Kingdom to protect areas of importance for wildlife at a county.

466. **Site of Special Scientific Interest (SSSI)** – a site identified under the Wildlife and Countryside Act 1981 (as amended by the Countryside and Rights of Way Act 2000) as an area of special interest by reason of any of its flora, fauna, geological or physiographical features (basically, plants, animals, and natural features relating to the Earth's structure).

467. **Source Protection Zones (SPZs)** – The Environment Agency has defined Source Protection Zones (SPZs) for 2000 groundwater sources such as wells, boreholes and springs used for public drinking water supply. These zones show the risk of contamination from any activities that might cause pollution in the area. The maps show three main zones (inner, outer and total catchment) and a fourth zone of special interest, which is occasionally applied to a groundwater source. (http://www.environment-agency.gov.uk/maps/info/groundwater/?version=1&lang=_e)

468. **Special Protection Area (SPA)** - A Special Protection Area or SPA is a designation under the European Union Directive on the Conservation of Wild Birds. Under the Directive, Member States of the European Union (EU) have a duty to safeguard the habitats of migratory birds and certain particularly threatened birds. Together with Special Areas of Conservation (SACs), the SPAs form a network of protected sites across the EU, called Natura 2000.

469. **Statement of Community Involvement (SCI)** - Sets out the standards which authorities will achieve with regard to involving local communities in the preparation of local development documents and development control decisions. It is subject to independent examination.

470. **Strategic Direction Statement** – 25 year strategic plan prepared by a water company and regulated by Ofwat. The companies' strategic direction statements were first developed as part of the 2009 price review process to provide a 25 year context for the companies' five-year business plans.

471. **Strategic Environmental Assessment (SEA**) - A generic term used to describe environmental assessment as applied to policies, plans and programmes. The European 'SEA Directive' (2001/42/EC) requires a formal 'environmental assessment of certain plans and programmes, including those in the field of planning and land use'.

472. **Strategic Flood Risk Assessment (SFRA)** – a Level 1 SFRA is a district-wide assessment of flood risk, usually carried out by a local authority to inform the preparation of its Local Development Documents (LDDs) and to provide the information necessary for applying the Sequential Test in planning development. A Level 2 SFRA is a more detailed assessment produced where the Exception Test is required for a potential development site, or to assist in evaluating windfall planning applications.

473. **Strategic Housing Land Availability Assessment (SHLAA**) - A SHLAA is an assessment of the potential of a borough to accommodate housing development over a period of 15 years from the date of adoption of the LDF Core Strategy. The SHLAA forms part of the evidence base for the emerging Local Development Framework (LDF), and inform the identification of potential new housing sites to be allocated in the LDF.

474. **Super Output Areas (SOA)** – a new national geography created by the Office for National Statistics (ONS) for collecting, aggregating and reporting statistics.

475. **Supplementary Planning Documents (SPDs)** - Provide supplementary information in respect of the policies in Development Plan Documents. They do not form part of the Development Plan and are not subject to independent statutory examination, but are normally subject to public consultation.

476. **Surface water management plans (SWMP)** - Recent government policy development has promoted the production of surface water management plans (SWMPs). SWMPs will look at existing problems and inform planning decisions for new development. In the case of existing problems, SWMPs are particularly appropriate in situations where the causes of flooding are unclear or complex. In the case of new developments, SWMPs are a useful tool in areas of high growth where they can support a 'masterplan' approach to development to secure optimal outcomes

477. **Sustainability Appraisal (SA)** - Tool for appraising policies to ensure they reflect sustainable development objectives (i.e. social, environmental and economic factors) and required in the 2004 Act to be undertaken for all local development documents. It incorporates Strategic Environmental Assessment.

478. **Sustainable Development** – "Development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (The World Commission on Environment and Development, 1987).

479. **Sustainable Drainage Systems (SUDS)** – Surface water drainage systems which manage runoff in a more sustainable way than conventional drainage, through improved methods of managing flow rates, protecting or enhancing water quality and encouraging groundwater recharge. A variety of types are available and can be chosen as appropriate for the location and needs of the development, and many have added benefits such as enhancement of the environmental setting, provision of habitat for wildlife and amenity value for the community.

480. **The Sequential Test** - Informed by a Strategic Flood Risk Assessment, a planning authority applies the Sequential Test to demonstrate that there are no reasonably available sites in areas with less risk of flooding that would be appropriate to the type of development or land use proposed.

481. **UK Climate Impacts Programme (UKCIP)** -UKCIP02 is a government funded programme which helps organisations to adapt to inevitable climate change. UKCIP publishes climate change scenarios on behalf of the Government.

482. **Wastewater Treatment Works (WwTW) -** Sewage treatment, or domestic wastewater treatment, is the process of removing contaminants from wastewater and household sewage, both runoff (effluents) and domestic. It includes physical, chemical, and biological processes to remove physical, chemical and biological contaminants. Its objective is to produce an environmentally-safe fluid waste stream (or treated effluent) and a solid waste (or treated sludge) suitable for disposal or reuse (usually as farm fertilizer).

483. **Water Framework Directive (WFD**) – a European Union directive which commits member states to making all water bodies (surface, estuarine and groundwater) of good qualitative and quantitative status by 2015.

484. **Water neutrality** - If a development is to be 'water neutral' then the total demand for water should be the same after the new development is built, as it was before. That is, the new demand for water should be offset in the existing community by making existing homes and buildings in the area more water efficient. (http://www.environment-agency.gov.uk/research/library/publications/40737.aspx)

485. **Water resource zone** – a geographical area defined by the water supply/demand balance in the region such that all customers within it receive the same level of service in terms of reliability of water supply.

486. **Water Resource Management Plans (WRMP)** - Water companies in England and Wales have a statutory duty to prepare, consult, publish and maintain a water resources management plan under new sections of the Water Industry Act 1991, brought in by the Water Act of 2003. Water resource management plans show how the water companies intend to supply your water over the next 25 years. In doing so, they need to take into account population changes, climate change and protecting the environment from unnecessary damage caused by taking too much water for use.

487. **Water Resources Management Units (WRMU)** – hydrological unit used to manage and assess the environmental implications of abstraction in the Environment Agency's Catchment Abstraction Management Strategies

488. **Water resource zone** – a geographical area defined by the water supply/demand balance in the region such that all customers within it receive the same level of service in terms of reliability of water supply.

489. **Water stress** - Water stress occurs when the demand for water exceeds the available amount during a certain period or when poor quality restricts its use. Water stress causes deterioration of freshwater resources in terms of quantity (e.g. aquifer overexploitation or dry rivers) and quality (eutrophication, organic matter pollution, and saline intrusion).

490. **Water Treatment Works (WTW)** - Water treatment describes those processes used to make water more acceptable for a desired end-use. In this report WTW is used to describe water company owned assets that provide drinking water for everyday use through the water companies water supply network.

I APPENDICES

Appendix A - Planning applications status (April 2010)

A.1 Summary

		Commitments							
		Planning Applications		Existing Commitments		Sites Being Tested Through Core Strategy			
Location	Completions 2001 - 2009	2009-2014	2014 Onwards	2009-2014	2014 Onwards	2011-2016	2016-2021	2021-2026	2026 onwards
NIA	10101	3700	3769	5597	3676	6117	6600	6550	13473
Daventry Town	2522	0	0	433	125	1850	2150	2500	1700
Other DDC Areas		0	0	400	0	0	0	0	0
Towcester	2267	25	0	47	0	240	1500	1550	0
Brackley		0	0	294	0	850	720	0	0
Silverstone		95	0	29	0	0	0	0	0
Other SNC		122	0	415	0	0	0	0	0

A.2 Daventry

Schedule of All Sites on Daventry District Council 2008-2009 5 Year Housing Land Supply

					Commitments		
Building Name	Street	Village or Town	Parish/Ward	Status on 5YLS (used to inform commitments column)	Application Number(s)	Commitments (ie opp,u/c & LP Allocations)	Supply
Former Dowding Mills	Bridge Street	Weedon	Weedon	Full	2007/1141	Commitments	69
Rigiflex site	Northampton Road	Brixworth	Brixworth	Full	2005/0121	Commitments	34
Farm Buildings	White House Farm	Lilbourne	Lilbourne	Outline	2008/0145	Commitments	10
Clint Hill farm	Manor Road	Lamport	Lamport	Full	2007/0849	Commitments	8
Land adj to	66 Byfield Road	Woodford Halse	Woodford Halse	Full	2008/0017	Commitments	8
Land at Thistledome	Banbury Road	Charwelton	Charwelton	Full	2008/0281	Commitments	7
PHI Design Ltd		Long Buckby	Long Buckby	Full	2008/1070	Commitments	7
Barns at Manor Farm	High Street	Weedon	Weedon	Full	2008/0456	Commitments	7
Manor Farm	High Street	Weedon	Weedon	Full	2006/0410	Commitments	7
5 south street	South Street	Weedon	Weedon	Full	2006/1117	Commitments	5
77 Northampton Road	Northampton Road	Brixworth	Brixworth	Full	2007/1071	Commitments	4
Land at 24 Yelvertoft Road	Yelvertoft Road	Crick	Crick	Full	2005/0650	Commitments	4
Land to Rear of Pytchley House	14 Main Road	Kilsby	Kilsby	Full	2007/1263	Commitments	4
St Lawrence Court	The Banks	Long Buckby	Long Buckby	Full	2006/1243	Commitments	4
Grange Farm	West Haddon Road	Long Buckby	Long Buckby	Full	2007/0072	Commitments	4
Sun Inn	29 Main Street	Marston Trussell	Marston Trussell	Full	2007/0235	Commitments	4

Manor Farm Buildings	Welford Road	Naseby	Naseby	Full	2002/1275	Commitments	4
Newlands Lodge	Newland Road	Walgrave	Walgrave	Full	2005/0286	Commitments	4
38 West End	West End	Welford	Welford	Full	2007/1066	Commitments	4
9	High Street	Byfield	Byfield	Full	2008/1031	Commitments	3
8 Clipston lane	8 Clipston Lane	Great Oxendon	Great Oxendon	Full	2008/0228	Commitments	3
9 Clipston lane	Clipston Lane	Great Oxendon	Great Oxendon	Outline	2007/0340	Commitments	3
The Village Hall	Harrington Road	Old	Old	Full	2008/1230	Commitments	3
Land to the r/o 75 Northampton Road	Northampton Road	Brixworth	Brixworth	Outline	2004/0903	Commitments	2
35 Saxon House	Brampton Way	Brixworth	Brixworth	Full	2008/1204	Commitments	2
Greenlands	Boddington Road	Byfield	Byfield	Full	2008/1054	Commitments	2
Rosebank	Golf Lane	Church Brampton	Church Brampton	Outline	2008/0695	Commitments	2
The Old Rectory	Harlestone Road	Church Brampton	Church Brampton	Outline	2005/0918	Commitments	2
Jayswood	Walkers Lane	Church Brampton	Church Brampton	Full	2005/1045	Commitments	2
2 & 4 Sutton Street	Sutton Street	Flore	Flore	Full	2005/0439	Commitments	2
Land to r/o Manor House	37 Main Street	Great Oxendon	Great Oxendon	Full	2006/0950	Commitments	2
Stonecroft	4 Main Street	Great Oxendon	Great Oxendon	Full	2005/1007	Commitments	2
Plots 1, 2 & 3 Poplars Farm	Main Street	Hannington	Hannington	Full	2008/0495	Commitments	2
11 Market Place	Market Place	Long Buckby	Long Buckby	Full	2008/0557	Commitments	2
25 High Street	High Street	Long Buckby	Long Buckby	Full	2008/1110	Commitments	2
Barns adjoining Chard House	Brington Road	Long Buckby	Long Buckby	Full	2007/1371	Commitments	2
6 Cotton End	Cotton End	Long Buckby	Long Buckby	Full	2007/0756	Commitments	2

Land r/o High street	East of 8 Skin Yard	Long Buckby	Long Buckby	Full	2006/1240	Commitments	2
Land rear of 43-45,	Ashley lane	Moulton	Moulton	Outline	2006/1176	Commitments	2
Farm Buildings	Adj to Dial HouseFarm	Norton	Norton	Full	2008/0511	Commitments	2
Land adj to 22 Daventry Road	Daventry Road	Norton	Norton	Full	2008/0929	Commitments	2
Land adj to Beechwood	23 Sywell Road	Overstone	Overstone	Outline	2007/1300	Commitments	2
38 – 40 High Street	High Street	Weedon	Weedon	Full	2008/0291	Commitments	2
Stable Mews	Whilton Locks	Whilton	Whilton	Full	2007/0386	Commitments	2
Land Adj to Glebe Farm Cottage	Kelmarsh Road	Arthingworth	Arthingworth	Full	2006/0137	Commitments	1
Land adj 18	Main Street	Ashby St Ledgers	Ashby St Ledgers	Full	2005/0867	Commitments	1
Land Adj to 1	Stone Way	Badby	Badby	Full	2007/0069	Commitments	1
Land Adj Bridge House	Daventry Road	Badby	Badby	Full	2007/0214	Commitments	1
Village Farm	Rugby Road	Barby	Barby	Full	2003/1210	Commitments	1
Old Pinfold House	The Green	Barby	Barby	Full	2006/0045	Commitments	1
Land Adj to Arnold House	Daventry Road	Barby	Barby	Outline	2006/0150	Commitments	1
Fieldhead	Moulton Lane	Boughton	Boughton	Outline	2006/0200	Commitments	1
Land to the r/o High Street	Church Road	Braunston	Braunston	Full	2004/0632	Commitments	1
26 The Green	The Green	Braunston	Braunston	Full	2005/0771	Commitments	1
land at Church Road	Church Road	Braunston	Braunston	Full	2006/1411	Commitments	1
67	Church Road	Braunston	Braunston	Full	2007/1093	Commitments	1
Cedars Farm	Hall Lane	Little Brington	Brington	Full	2004/1330	Commitments	1
Brington Lodge	Hamilton lane	Great Brington	Brington	Full	2006/1434	Commitments	1
7 Foxhill walk	Foxhill Walk	Brixworth	Brixworth	Full	2007/1260	Commitments	1
Cedar House	Brixworth Hall Park	Brixworth	Brixworth	Outline	2007/0213	Commitments	1

Cedar	Brixworth Hall Park	Brixworth	Brixworth	ARM	2009/0044	Commitments	1
77 Northampton Road	Northampton Road	Brixworth	Brixworth	Outline	2007/0061	Commitments	1
36 The Knoll	36 The Knoll	Brixworth	Brixworth	Full	2008/1159	Commitments	1
Land at 42 Banbury Lane	Banbury Lane	Byfield	Byfield	Full	2006/0773	Commitments	1
25	Banbury Lane	Byfield	Byfield	Full	2008/0285	Commitments	1
18 Westhorpe Lane	Westhorp Lane	Byfield	Byfield	Outline	2008/0251	Commitments	1
Plot 1, 10 Westhorp Lane	Westhorp Lane	Byfield	Byfield	ARM	2008/0799	Commitments	1
Plot 2, 10 Westhorp Lane	Westhorp Lane	Byfield	Byfield	ARM	2008/0800	Commitments	1
Rear of 35 Bell Lane	Access from Westhorp Mews	Byfield	Byfield	Full	2008/0733	Commitments	1
Unit 3, Iron Hill Farm	Priors Marston Road	Byfield	Byfield	Full	2006/0909	Commitments	1
Land Adj to	4 Bell Lane	Byfield	Byfield	Full	2008/0590	Commitments	1
Corner Cottage	Boddington Road	Byfield	Byfield	Full	2007/0778	Commitments	1
Stonewalls	1 Banbury Lane	Byfield	Byfield	Full	2008/0270	Commitments	1
9 Fessey Road	9 Fessey Road	Byfield	Byfield	Full	2008/0412	Commitments	1
Land rear of 35 Bell Lane	Bell Lane	Byfield	Byfield	Full	2007/0406	Commitments	1
Parkgate Bungalow	Banbury Road	Charwelton	Charwelton	Full	2007/0448	Commitments	1
Wychmore	Sandy Lane	Church Brampton	Church Brampton	Full	2007/1148	Commitments	1
Land adj to woodlands	Sandy Lane	Church Brampton	Church Brampton	Outline	2007/1307	Commitments	1
Land adj to Almondbury	Sandy Lane	Church Brampton	Church Brampton	Full	2008/1086	Commitments	1
The Old Post Office	29 Main Street	Church Stowe	Church Stowe	Full	2008/0463	Commitments	1
48 Main Street	Main Street	Church Stowe	Church Stowe	Full	2008/1064	Commitments	1
Land to rear of high rising	Main Street	Church Stowe	Church Stowe	Full	2008/0276	Commitments	1

12 Pegs Lane	Pegs Lane	Clipston	Clipston	Full	2008/0916	Commitments	1
Land Adj to Mill House	15 Kelmarsh Road	Clipston	Clipston	Full	2007/0377	Commitments	1
Station Farm Road	Church Lane	Clipston	Clipston	Full	2008/0498	Commitments	1
The Stables	Cold Ashby Hall	Cold Ashby	Cold Ashby	Full	2008/0687	Commitments	1
Old Walled Garden adj to Cottesbrooke Cottage	Main Street	Cottesbrooke	Cottesbrooke	Full	2007/0456	Commitments	1
Garden House	14 The Green	Creaton	Creaton	Full	2007/1013	Commitments	1
Barn at Creaton Lodge Farm	Welford Road	Creaton	Creaton	Full	2008/0547	Commitments	1
land adj to	26 Boat House Lane	Crick	Crick	Full	2007/0330	Commitments	1
26a Boat Horse Lane	Boat Horse Lane	Crick	Crick	Full	2008/0897	Commitments	1
Land to rear of	20 Church Street	Crick	Crick	Full	2007/0338	Commitments	1
Summer Farm	West Haddon Road	Crick	Crick	Full	2008/0833	Commitments	1
8 The Marsh	The Marsh	Crick	Crick	Full	2007/1255	Commitments	1
5 The Green	The Green	Dodford	Dodford	Full	2008/0907	Commitments	1
3 The Bungalows	The Bungalows	Dodford	Dodford	Full	2008/0171	Commitments	1
Elkington Farm Cottage	Yelvertoft Road	Elkington	Elkington	Full	2007/0619	Commitments	1
Land At Manor House		Everdon	Everdon	Full	2008/0704	Commitments	1
Land At Orchard House Farm		Everdon	Everdon	Full	2009/0090	Commitments	1
2 Brockhall Road	Brockhall Road	Flore	Flore	Full	2008/0317	Commitments	1
Land to Rear of 14	Sutton Street	Flore	Flore	Full	2008/0158	Commitments	1
The Surgery	Bricketts Lane	Flore	Flore	Outline	2005/0401	Commitments	1
16 Flore Hill	Flore Hill	Flore	Flore	Full	2008/0071	Commitments	1
Land Adj to Lake House	Harborough Road	Great Oxendon	Great Oxendon	Full	2008/0803	Commitments	1

Land adjoining whitegates	Harborough Road	Great Oxendon	Great Oxendon	Outline	2006/1070	Commitments	1
Old Red Lion	Nortoft	Guilsborough	Guilsborough	ARM	2007/0878	Commitments	1
The Cattle Shed, Church Farm	Port Road	Upper Harlestone	Upper Harlestone		2008/0402	Commitments	1
24 Harrington Road	Harrington Road	Kelmarsh	Kelmarsh	Full	2008/0706	Commitments	1
Land to rear of Laurelcroft	North Street	Kilsby	Kilsby	Full	2008/0258	Commitments	1
10 The Banks	The Banks	Kilsby	Kilsby	Outline	2008/0591	Commitments	1
The Barn	Arnills Gate, The Ridgeway	Kilsby	Kilsby	Full	2004/1092	Commitments	1
Lnad between11&15	Malt Mill Close	Kilsby	Kilsby	Outline	2007/0113	Commitments	1
Land Adj to 6 Barby Road	Barby Road	Kilsby	Kilsby	Outline	2006/0228	Commitments	1
Land at Essen Lane, Rear of 16 Main Road	Main Road	Kilsby	Kilsby	Full	2007/1365	Commitments	1
Land to rear	15 Main Road	Kilsby	Kilsby	Full	2008/0895	Commitments	1
Land to rear of The Limes	Main Road	Kilsby	Kilsby	Full	2008/0368	Commitments	1
Isham Barn	Harrington Road	Lamport	Lamport	Full	2002/0357	Commitments	1
Land at 8 Manor Road	Manor Road	Lamport	Lamport	Full	2004/1036	Commitments	1
29 Yelvertoft Road	Yelvertoft Road	Lilbourne	Lilbourne	Full	2008/0337	Commitments	1
Lodge Farm	Brington Road	Long Buckby	Long Buckby	Full	2008/0967	Commitments	1
11a High Street	High Street	Long Buckby	Long Buckby	Full	2006/0740	Commitments	1
The Sycamores	Salem	Long Buckby	Long Buckby	Outline	2005/0696	Commitments	1
Land to rear of	33 Grasscroft	Long Buckby	Long Buckby	Full	2007/0844	Commitments	1
Land adj to	65 West Street	Long Buckby	Long Buckby	Full	2007/1059	Commitments	1
4 Syers Green lane		Long Buckby	Long Buckby	Full	2006/1442	Commitments	1
Land adj The Banks	Harborough Road	Maidwell	Maidwell	Outline	2006/0796	Commitments	1
The Old Bakehouse	Draughton Road	Maidwell	Maidwell	Full	2007/0447	Commitments	1

Land at rear of 29 Ashley Lane	Ashley Lane	Moulton	Moulton	Full	2008/0797	Commitments	1
18 A Thorpville	Thorpville	Moulton	Moulton	Full	2006/0600	Commitments	1
Plot to r/o 40 Boughton Road	Boughton Road	Moulton	Moulton	Outline	2005/1084	Commitments	1
30 Ashley Lane	Ashley Lane	Moulton	Moulton	Full	2008/1118	Commitments	1
Land Adj to 9a Park View	Park View	Moulton	Moulton	Full	2007/0445	Commitments	1
Land adj to 86 Church Street	Church Street	Naseby	Naseby	Full	2005/0119	Commitments	1
Land adj to Ivydene	High Street	Naseby	Naseby	Outline	2006/1307	Commitments	1
The Bungalow	Church Street	Naseby	Naseby	Outline	2005/1156	Commitments	1
Holm Oak	Carvells Lane	Naseby	Naseby	Full	2007/1266	Commitments	1
Land Adj to the Byre	High Street	Naseby	Naseby	Full	2007/0783	Commitments	1
Workshop adj to the Byre	High Street	Naseby	Naseby	Full	2008/0474	Commitments	1
Land adj to 15 Newlands	High Street	Naseby	Naseby	Outline	2008/1079	Commitments	1
20 Newlands	Newlands	Naseby	Naseby	Outline	2008/0441	Commitments	1
Newnham Hill Farm	Staverton Road	Newnham	Newnham	Full	2006/0750	Commitments	1
Land to rear of Dunster	Mounts Lane	Newnham	Newnham	Full	2008/1103	Commitments	1
Plot Between 114a and 116	Sywell Road	Overstone	Overstone	Full	2008/0415	Commitments	1
108 Sywell Road	Sywell Road	Overstone	Overstone	Full	2008/0721	Commitments	1
62 Sywell Road	Sywell Road	Overstone	Overstone	Full	2006/0851	Commitments	1
Collyweston House	High Street	Pitsford	Pitsford	Outline	2008/0953	Commitments	1
Garden of Rochberries	25 Manor Road	Pitsford	Pitsford	Full	2008/0497	Commitments	1
Kingsbrook Farm	Newnham Road	Preston Capes	Preston Capes	Full	2008/0275	Commitments	1
Barns at Manor Farm	High Street	Preston Capes	Preston Capes	Full	2008/0761	Commitments	1

Land adj to 24 Scott Close	Scott Close	Ravensthorpe	Ravensthorpe	Full	2006/0938	Commitments	1
Land adj to The Hollies	Church Hill	Ravensthorpe	Ravensthorpe	Full	2007/0936	Commitments	1
The Old Vicarage	Church Hill	Ravensthorpe	Ravensthorpe	Full	2007/0217	Commitments	1
The Barn	Naseby Road	Sibbertoft	Sibbertoft	Full	2005/0001	Commitments	1
Barn Adj Welland House	Westhorpe	Sibbertoft	Sibbertoft	Full	2006/0067	Commitments	1
Land adj 9 Welland Rise	Welland Rise	Sibbertoft	Sibbertoft	Outline	2005/0627	Commitments	1
1 Orchard Close	Orchard Close	Spratton	Spratton	Outline	2004/0561	Commitments	1
land adj to yew tree cottage	21 Yew Tree Lane	Spratton	Spratton	Outline	2007/0931	Commitments	1
Land adj 19 High Street	High Street	Spratton	Spratton	ARM	2005/0994	Commitments	1
25 Gorse Road	Gorse Road	Spratton	Spratton	Full	2007/1206	Commitments	1
Land to rear of	9 Welford Road	Spratton	Spratton	Outline	2007/1069	Commitments	1
Land to rear of levens	9 Welford Road	Spratton	Spratton	Outline	2008/1267	Commitments	1
11 Willow Close		Spratton	Spratton	Full	2007/0905	Commitments	1
Staverton Acres	Shuckburgh Road	Staverton	Staverton	Full	2005/1087	Commitments	1
Former CBL Metal Craft Premises	Daventry Road	Staverton	Staverton	Outline	2005/0542	Commitments	1
Staverton Hill Farm	Badby Lane	Staverton	Staverton	Full	2008/1057	Commitments	1
Newlands Lodge	Newland Road	Walgrave	Walgrave	Outline	2007/0952	Commitments	1
Manvell Farm	Kettering Road	Walgrave	Walgrave	Full	2006/0019	Commitments	1
Land at 75 West Street	West Street	Weedon	Weedon	Full	2008/1254	Commitments	1
Weedon Lodge Farm	Everdon Road	Weedon	Weedon	Full	2003/1231	Commitments	1
Land to rear of	1 Bridge Street	Weedon	Weedon	Full	2006/0275	Commitments	1
Former abattoir 1	Bridge Street	Weedon	Weedon	Full	2006/1019	Commitments	1
Former Chapel	Bridge Street	Weedon	Weedon	Full	2006/0665	Commitments	1
Land Adj to The Old Police House	High Street	Weedon	Weedon	Outline	2006/1183	Commitments	1

Land at Shrub End	Bridge Street	Weedon	Weedon	Outline	2007/0301	Commitments	1
23 Church Street	Church Street	Weedon	Weedon	Full	2006/0148	Commitments	1
Land adj to Queens Park	Queens Park	Weedon	Weedon	Full	2007/0282	Commitments	1
55/57 West Street	West Street	Weedon	Weedon	Full	2007/1437	Commitments	1
Land adj 19a High Street	High Street	Welford	Welford	Full	2008/0177	Commitments	1
The Wilderness	Churchill Road	Welton	Welton	Full	2004/1486	Commitments	1
Rear of Well Cottage	Well Lane	Welton	Welton	Full	2006/0784	Commitments	1
Adj 3 Haradays Lane	Haradays Lane	West Haddon	West Haddon	Outline	2006/0779	Commitments	1
Pasture Farm	Yelvertoft Road	West Haddon	West Haddon	Full	2008/1102	Commitments	1
Lodge Farm	Northampton Road	West Haddon	West Haddon	Full	2008/0977	Commitments	1
The Coach House	The Green	Whilton	Whilton	Full	2005/1033	Commitments	1
Roughmoor Grounds	Brington Lane	Whilton	Whilton	Full	2008/0870	Commitments	1
7 South View	South View	Whilton	Whilton	Outline	2008/0471	Commitments	1
R/o The Barn	Hinton Manor Court	Woodford	Woodford	Full	2001/1187	Commitments	1
Land Adj to Paddocks Farm	Parsons Street	Woodford	Woodford	Full	2006/1303	Commitments	1
Land Between 68 & 70	Byfield Road	Woodford	Woodford	Outline	2007/0073	Commitments	1
Site at 65 Byfield Road	65 Byfield Road	Woodford Halse	Woodford Halse	Outline	2007/1137	Commitments	1
Land adj to 16	School Close	Yelvertoft	Yelvertoft	Full	2008/0192	Commitments	1
Land to south of 7	Merrycot Lane	Yelvertoft	Yelvertoft	Full	2008/0418	Commitments	1
The Lannet	West Haddon Road	Guilsborough	Guilsborough	Full	2007/1444	Commitments	0

A.3 South Northamptonshire

		Commitments				
Settlement	**Status on 5YLS (used to inform commitments column)**	**Application Number(s)**	**Commitments (ie opp,u/c & LP Allocations)**	Total Site Capacity	Current Site Capacity	5 Year Housing Land Supply 2008-2013
Brackley	Allocation	Lapsed	Commitment	55	55	55
Brackley	Allocation		Commitment	47	47	47
Brackley	Allocation		Commitment	52	52	52
Brackley	Under Construction	S/2005/1412/P	Commitment	51	51	51
Brackley	Under Construction	S/2005/1404/P	Commitment	12	12	12
Brackley	Planning Permission	S/2004/1668/P	Commitment	13	13	13
Brackley	Under Construction	S/2006/1673/P	Commitment	22	14	14
Brackley	Planning Permission	S/2008/0869/P	Commitment	13	13	13
Deanshanger	Allocation		Commitment	30	30	30
Deanshanger	Planning Permission	S/2007/0955/P	Commitment	26	7	7
Hartwell	Under Construction	S/2006/1743/P	Commitment	40	11	11
Litchborough	Planning Permission	S/2003/1268/PO	Commitment	13	13	13
Paulespury	Planning Permission	S/2004/1168/PO	Commitment	15	15	15
Potterspury	Planning Permission	S/2008/0450/P	Commitment	26	26	26
Roade	Development Brief	S/2009/0068/P	Application	83	83	83
Roade	Approval in Principle	S/2008/0403/PO	Application	39	39	39

Silverstone	Application Pending	S/2009/0290/PO	Application	49	49	49
Silverstone	Application Pending	S/2009/0283/P	Application	46	46	46
Silverstone	Planning Permission	S/2008/0968/P	Commitment	10	10	10
Towcester	Allocation	Lapsed	Commitment	35	35	35
Towcester	Development Brief		Application	25	25	25
Abthorpe	Planning Permission	S/2007/1162/P	Commitment	1	1	1
Abthorpe	Under Construction	S/2007/1391/P	Commitment	1	1	1
Abthorpe	Under Construction	S/2007/1473/P	Commitment	4	4	4
Adstone	Under Construction	S/2006/0819/P	Commitment	1	1	1
Alderton	Planning Permission	S/2007/1359/P	Commitment	0	0	0
Alderton	Under Construction	S/2008/1426/P	Commitment	1	1	1
Ashton	Under Construction	S/2006/1237/P	Commitment	1	1	1
Ashton	Planning Permission	S/2005/0813/P	Commitment	1	1	1
Ashton	Planning Permission	S/2006/0520/PO	Commitment	1	1	1
Ashton	Planning Permission	S/2007/0212/P	Commitment	2	2	2
Ashton	Planning Permission	S/2007/0847/P	Commitment	2	2	2
Ashton	Planning Permission	S/2007/0848/P	Commitment	1	1	1
Ashton	Planning Permission	S/2008/0881/P	Commitment	2	2	2
Ashton	Planning Permission	S/2008/0106/P	Commitment	2	2	2
Aston Le Walls	Under	S/2006/0645/P	Commitment	1	1	1

Aston Le Walls	Construction Planning Permission	S/2008/0234/PO	Commitment	1	1	1
Aston Le Walls	Under Construction	S/2006/1185/LB	Commitment	-1	-1	-1
Aynho	Planning Permission	S/2004/1384/P	Commitment	4	4	4
Aynho	Planning Permission	S/2005/0920/P	Commitment	-4	-4	-4
Aynho	Planning Permission	S/2005/0655/LB	Commitment	-1	-1	-1
Blakesley	Under Construction	S/200/0258/P	Commitment	1	1	1
Blakesley	Under Construction	S/2002/0172/P	Commitment	1	1	1
Blakesley	Planning Permission	S/2004/1435/PO	Commitment	1	1	1
Blakesley	Planning Permission	S/20050194/P	Commitment	1	1	1
Blakesley	Planning Permission	S/2006/0312/P	Commitment	1	1	1
Blakesley	Planning Permission	S/2008/0206/P	Commitment	1	1	1
Blakesley	Planning Permission	S/2008/0586/P	Commitment	2	2	2
Blisworth	Planning Permission	S/2004/515/P	Commitment	1	1	1
Blisworth	Planning Permission	S/2005/0997/P	Commitment	2	2	2
Blisworth	Under Construction	S/2007/1547/P	Commitment	2	2	2
Blisworth	Planning Permission	S/2008/1351/PO	Commitment	2	2	2
Blisworth	Planning Permission	S/2006/1718/P	Commitment	1	1	1
Blisworth	Under Construction	S/2005/0062/P	Commitment	1	1	1

Blisworth	Under Construction	S/2007/0649/P	Commitment	4	4	4
Blisworth	Planning Permission	S/2008/1395/P	Commitment	1	1	1
Boddington (Upper)	Under Construction	S/2003/0658/P	Commitment	3	1	1
Boddington (Upper)	Under Construction	S/2006/0726/P	Commitment	1	1	1
Brackley	Planning Permission	S/2006/1605/P	Commitment	1	1	1
Brackley	Planning Permission	S/2007/0900/P	Commitment	2	2	2
Brackley	Planning Permission	S/2003/1709/PO	Commitment	2	2	2
Brackley	Planning Permission	S/2005/0425/PO	Commitment	1	1	1
Brackley	Planning Permission	S/2007/1437/P	Commitment	6	6	6
Brackley	Planning Permission	S/2006/1053/P	Commitment	2	2	2
Brackley	Planning Permission	S/2007/0696/P	Commitment	2	2	2
Brackley	Planning Permission	S/2007/0521/P	Commitment	1	1	1
Brackley	Planning Permission	S/2007/1130/P	Commitment	1	1	1
Brackley	Under Construction	S/2007/1414/P	Commitment	2	2	2
Brackley	Under Construction	S/2008/0008/P	Commitment	1	1	1
Brackley	Planning Permission	S/2008/0042/P	Commitment	4	4	4
Brackley	Under Construction	S/2008/0407/P	Commitment	3	3	3
Brackley	Under Construction	S/2008/0860/P	Commitment	2	2	2
Brackley	Planning	S/2008/1061/P	Commitment	1	1	1

	Permission Planning					
Brackley	Permission Planning	S/2008/1670/P	Commitment	1	1	1
Brackley	Permission Planning	S/2008/1670/P	Commitment	4	4	4
Brackley	Permission Under	S/200//1026/P	Commitment	1	1	1
Bradden	Construction Under	S/2006/1112/P	Commitment	3	2	2
Brafield on the Green	Construction Under	S/2007/1287/P	Commitment	1	1	1
Bugbrooke	Construction Planning	S/2002/0025/P	Commitment	1	1	1
Bugbrooke	Permission Planning	S/2007/0827/P	Commitment	1	1	1
Bugbrooke	Permission Planning	S/2007/0838/P	Commitment	1	1	1
Bugbrooke	Permission Planning	S/2007/0871/P	Commitment	1	1	1
Bugbrooke	Permission Under	S/2006/1662/P	Commitment	1	1	1
Bugbrooke	Construction Under	S/2006/1711/P	Commitment	0	1	1
Chacombe	Construction Planning	S/2004/0055/P	Commitment	2	2	2
Chacombe	Permission Under	S/2004/0686/P	Commitment	0	0	0
Chacombe	Construction Planning	S/2006/0955/P	Commitment	1	1	1
Chipping Warden	Permission Planning	S/2008/0722/P	Commitment	1	1	1
Chipping Warden	Permission Planning	S/2008/0081/P	Commitment	0	0	0
Cogenhoe	Permission Planning	S/1994/0821/R	Commitment	3	1	1
Cogenhoe	Permission	S/2006/0772/P	Commitment	1	1	1

Cogenhoe	Under Construction	S/2005/0914/P	Commitment	1	1	1
Cogenhoe	Under Construction	S/2007/0113/P	Commitment	1	1	1
Cogenhoe	Planning Permission	S/2007/0559/P	Commitment	1	1	1
Cogenhoe	Planning Permission	S/2008/1158/P	Commitment	1	1	1
Cogenhoe	Planning Permission	S/2008/1354/P	Commitment	1	1	1
Cold Higham	Planning Permission	S/2006/1436/PO	Commitment	5	5	5
Cold Higham	Planning Permission	S/2008/0463/P	Commitment	2	2	2
Cosgrove	Planning Permission	S/2006/0711/PO	Commitment	1	1	1
Cosgrove	Under Construction	S/2006/1195/P	Commitment	0	1	1
Cosgrove	Under Construction	S/2005/1181/P	Commitment	3	3	3
Cosgrove	Planning Permission	S/2006/1373/P	Commitment	3	3	3
Cosgrove	Under Construction	S/2008/0019/P	Commitment	1	1	1
Cosgrove	Planning Permission	S/2008/1102/P	Commitment	8	8	8
Cosgrove	Planning Permission	S/2008/1165/P	Commitment	7	7	7
Courteenhall	Planning Permission	S/2003/0861/P	Commitment	1	1	1
Courteenhall	Under Construction	S/2007/0087/P	Commitment	3	3	3
Croughton	Under Construction	S/1998/0808/P	Commitment	1	1	1
Croughton	Planning Permission	S/2008/0167/P	Commitment	1	1	1
Culworth	Under	S/2007/1339/P	Commitment	1	1	1

Culworth	Construction Planning Permission	S/2008/1173/P	Commitment	2	2	2
Deanshanger	Planning Permission	S/2006/0676/P	Commitment	1	1	1
Deanshanger	Planning Permission	S/2007/1419/P	Commitment	4	4	4
Deanshanger	Planning Permission	S/2007/1087/P	Commitment	0	0	0
Deanshanger	Planning Permission	S/2008/0274/P	Commitment	1	2	2
Deanshanger	Planning Permission	S/2008/0877/P	Commitment	1	1	1
Deanshanger	Planning Permission	S/2008/0784/P	Commitment	3	3	3
Deanshanger	Planning Permission	S/2008/0854/P	Commitment	4	4	4
Deanshanger	Under Construction	S/2007/1101/P	Commitment	1	1	1
Evenley	Under Construction	S/2002/0146/P	Commitment	1	1	1
Evenley	Planning Permission	S/2005/0807/P	Commitment	0	0	0
Evenley	Under Construction	S/2002/0146/P	Commitment	1	1	1
Eydon	Under Construction	S/2007/0633/PO	Commitment	2	2	2
Eydon	Under Construction	S/2009/0043/P	Commitment	2	2	2
Gayton	Planning Permission	S/2008/0581/PO	Commitment	1	1	1
Gayton	Under Construction	S/2007/0063/P	Commitment	1	1	1
Gayton	Planning Permission	S/2008/1337/P	Commitment	1	1	1
Grafton Regis	Planning Permission	S/2004/1513/P	Commitment	1	1	1

Grafton Regis	Under Construction	S/2007/1679/P	Commitment	1	1	1
Greatworth	Planning Permission	S/2007/0298/P	Commitment	1	1	1
Greatworth	Planning Permission	S/2006/0848/P	Commitment	5	5	5
Greatworth	Under Construction	S/2007/0321/P	Commitment	2	3	3
Greatworth	Planning Permission	S/2008/1199/P	Commitment	0	0	0
Greens Norton	Planning Permission	S/2007/1436/PO	Commitment	2	2	2
Greens Norton	Planning Permission	S/2008/0821/P	Commitment	3	3	3
Greens Norton	Planning Permission	S/2007/0704/P	Commitment	1	1	1
Greens Norton	Planning Permission	S/2008/1303/P	Commitment	5	5	5
Greens Norton	Planning Permission	S/2008/1403/P	Commitment	1	1	1
Hackleton	Planning Permission	S/20071260/P	Commitment	1	1	1
Hackleton	Under Construction	S/2007/0720/P	Commitment	5	5	5
Hackleton	Planning Permission	S/2006/1110/P	Commitment	1	1	1
Hackleton	Planning Permission	S/2008/1090/P	Commitment	1	1	1
Hackleton	Planning Permission	S/2007/0141/PO	Commitment	1	1	1
Hackleton	Planning Permission	S/2007/0391/P	Commitment	1	1	1
Hackleton	Planning Permission	S/2007/1344/PO	Commitment	1	1	1
Hackleton	Planning Permission	S/2006/1040/PO	Commitment	1	1	1
Hackleton	Planning	S/2005/1187/P	Commitment	1	1	1

	Permission Planning					
Hackleton	Permission	S/2008/1525/P	Commitment	1	1	1
Harpole	Permission Planning	S/2006/0198/P	Commitment	1	1	1
Harpole	Under Construction	S/2007/1384/P	Commitment	1	1	1
Harpole	Permission Planning	S/2008/1642/P	Commitment	0	0	0
Hartwell	Permission	S/2006/0911/P	Commitment	5	5	5
Hartwell	Under Construction	S/2007/0627/P	Commitment	1	1	1
Helmdon	Under Construction	S/2004/0033/P	Commitment	0	1	1
Helmdon	Permission Planning	S/2003/0176/P	Commitment	2	2	2
Hinton In The Hedges	Under Construction	S/2002/0963/P	Commitment	3	2	2
Hinton In The Hedges	Permission Planning	S/2007/1429/PO	Commitment	1	1	1
Kings Sutton	Under Construction	S/1999/0216/P	Commitment	3	3	3
Kings Sutton	Permission Planning	S/2005/1766/P	Commitment	5	5	5
Kings Sutton	Permission	S/2005/1579/P	Commitment	1	1	1
Kings Sutton	Under Construction	S/2007/1464/P	Commitment	1	1	1
Kings Sutton	Permission Planning	S/2006/1723/P	Commitment	1	1	1
Kislingbury	Under Construction	S/2007/1063/P	Commitment	2	2	2
Kislingbury	Permission Planning	S/2007/1309/P	Commitment	1	1	1
Litchborough	Under Construction	S/1993/0046/P	Commitment	1	1	1

Litchborough	Planning Permission	S/2003/1265/PO	Commitment	2	2	2
Litchborough	Under Construction	S/2007/1036/P	Commitment	1	1	1
Litchborough	Planning Permission	S/2008/0152/PO	Commitment	1	1	1
Little Houghton	Planning Permission	S/2008/1046/P	Commitment	2	2	2
Maidford	Under Construction	S/2006/1210/P	Commitment	3	3	3
Marston St Lawrence	Under Construction	S/2002/1266/P	Commitment	1	1	1
Middleton Cheney	Planning Permission	S/2003/1669/P	Commitment	1	1	1
Middleton Cheney	Planning Permission	S/2006/1323/P	Commitment	1	1	1
Middleton Cheney	Under Construction	S/2008/1298/P	Commitment	2	2	2
Middleton Cheney	Planning Permission	S/2008/1562/P	Commitment	1	1	1
Middleton Cheney	Planning Permission	S/2008/1618/P	Commitment	1	1	1
Middleton Cheney	Under Construction	S/2008/1640/P	Commitment	3	3	3
Middleton Cheney	Planning Permission	S/2008/0294/P	Commitment	1	1	1
Milton Malsor	Planning Permission	S/2005/0962/P	Commitment	1	1	1
Milton Malsor	Planning Permission	S/2008/0318/P	Commitment	1	1	1
Milton Malsor	Planning Permission	S/2008/0809/P	Commitment	4	4	4
Moreton Pinkney	Under Construction	S/2007/1208/P	Commitment	6	7	7
Moreton Pinkney	Under Construction	S/2007/1542/P	Commitment	1	1	1
Moreton	Under	S/2007/1503/P	Commitment	1	1	1

Pinkney	Construction					
Nether Heyford	Planning permission	S/2004/0195/P	Commitment	2	2	2
Nether Heyford	Under Construction	S/2008/1199/P	Commitment	2	2	2
Nether Heyford	Planning Permission	S/2008/0321/P	Commitment	1	1	1
Newbottle	Under Construction	S/2003/0657/P	Commitment	1	1	1
Old Stratford	Under Construction	S/2002/0809/P	Commitment	-1	-1	-1
Old Stratford	Under Construction	S/2004/1562/P	Commitment	1	1	1
Old Stratford	Under Construction	S/2007/0821/P	Commitment	1	1	1
Old Stratford	Under Construction	S/2007/0218/P	Commitment	3	4	4
Old Stratford	Planning Permission	S/2006/0682/P	Commitment	3	3	3
Old Stratford	Under Construction	S/2007/1478/P	Commitment	3	3	3
Old Stratford	Planning Permission	S/2008/0583/PO	Commitment	3	3	3
Overthorpe	Planning Permission	S/2004/0299/P	Commitment	1	1	1
Pattishall	Planning Permission	S/2008/1050/P	Commitment	2	2	2
Pattishall	Planning Permission	S/2007/0458/P	Commitment	1	1	1
Pattishall	Planning Permission	S/2000/1372/P	Commitment	1	1	1
Pattishall	Under Construction	S/2007/0600/P	Commitment	1	1	1
Paulespury	Planning Permission	S/2007/0059/PO	Commitment	1	1	1
Paulespury	Under Construction	S/2006/1707/P	Commitment	1	2	2

Paulespury	Planning Permission	S/2006/0314/PO	Commitment	2	2	2
Paulespury	Planning Permission	S/2007/0828/P	Commitment	1	1	1
Paulespury	Planning Permission	S/2008/0226/P	Commitment	1	1	1
Paulespury	Planning Permission	S/1998/0695P	Commitment	3	2	2
Paulespury	Planning Permission	S/2005/0110/P	Commitment	1	1	1
Paulespury	Planning Permission	S/2007/0887/PO	Commitment	1	1	1
Potterspury	Under Construction	S/2005/1492/P	Commitment	1	1	1
Potterspury	Planning Permission	S/2006/1706/P	Commitment	1	1	1
Potterspury	Under Construction	S/2008/1693/P	Commitment	1	1	1
Quinton	Planning Permission	S/2008/007/P	Commitment	1	1	1
Radstone	Planning Permission	S/2004/1480/P	Commitment	1	1	1
Moreton Pinkney	Planning Permission	S/2008/1635/P	Commitment	1	1	1
Roade	Planning Permission	S/2006/0577/P	Commitment	2	2	2
Roade	Under Construction	S/2007/0852/P	Commitment	1	1	1
Roade	Planning Permission	S/2007/0950/P	Commitment	0	0	0
Roade	Planning Permission	S/2008/0105/P	Commitment	1	1	1
Roade	Planning Permission	S/2008/0244/PO	Commitment	1	1	1
Roade	Planning Permission	S/2008/1533/PO	Commitment	1	1	1
Shutlanger	Planning	S/2008/1433/P	Commitment	3	3	3

	Permission Planning					
Silverstone	Permission	S/2007/0185/P	Commitment	3	3	3
Silverstone	Under Construction	S/2006/0384/P	Commitment	3	3	3
Silverstone	Under Construction	S/2005/0582/P	Commitment	1	1	1
Silverstone	Under Construction	S/2006/0317/P	Commitment	1	1	1
Silverstone	Under Construction	S/2007/0982/P	Commitment	1	4	4
Silverstone	Planning Permission	S/2007/0479/P	Commitment	0	0	0
Silverstone	Planning Permission	S/2007/1274/PO	Commitment	2	2	2
Silverstone	Planning Permission	S/2007/1624/P	Commitment	1	1	1
Silverstone	Planning Permission	S/2008/1020/P	Commitment	2	2	2
Silverstone	Planning Permission	S/2008/1023/PO	Commitment	1	1	1
Silverstone	Under Construction	S2008/1216/P	Commitment	1	1	1
Slapton	Planning Permission	S/2005/1548/P	Commitment	2	2	2
Stoke Bruerne	Under Construction	S/2006/1676/P	Commitment	1	1	1
Sulgrave	Under Construction	S/2001/0910/P	Commitment	2	2	2
Syresham	Under Construction	S/1999/0946/P	Commitment	3	2	2
Syresham	Under Construction	S/2000/0033//P	Commitment	3	2	2
Syresham	Under Construction	S/2007/0651/P	Commitment	0	0	0
Thorpe Mandeville	Planning Permission	S/2007/0172/P	Commitment	1	1	1

Tiffield	Planning Permission	S/2007/0454/P	Commitment	0	0	0
Tiffield	Planning Permission	S/2007/0659/P	Commitment	0	0	0
Towcester	Planning Permission	S/2007/0776/PO	Commitment	3	3	3
Towcester	Planning Permission	S/2004/1308/P	Commitment	-1	-1	-1
Towcester	Under Construction	S/2006/0325/P	Commitment	1	1	1
Towcester	Under Construction	S/2005/1112/P	Commitment	1	1	1
Towcester	Planning Permission	S/2007/0294/P	Commitment	1	1	1
Towcester	Planning Permission	S/2007/0004/P	Commitment	1	1	1
Towcester	Planning Permission	S/2007/1607/P	Commitment	4	4	4
Towcester	Planning Permission	S/2008/1048/P	Commitment	1	1	1
Towcester	Planning Permission	S/2008/1626/P	Commitment	1	1	1
Upper Heyford	Under Construction	S/2003/1505/P	Commitment	1	1	1
Weston and Weedon Lois	Under Construction	S/2008/0793/P	Commitment	4	4	4
Weston and Weedon Lois	Planning Permission	S/2006/1092/P	Commitment	1	1	1
Whitfield	Under Construction	S/2007/0857/P	Commitment	1	1	1
Wicken	Planning Permission	S/2006/1560/P	Commitment	0	0	0
Wicken	Planning Permission	S/2005/0760/P	Commitment	1	1	1
Wicken	Planning Permission	S/2008/0931/P	Commitment	1	1	1
Woodend	Planning	S/2007/1474/P	Commitment	0	0	0

Yardley Gobion	Permission Under Construction	S/2007/0103/P	Commitment	2	2	2
Yardley Gobion	Under Construction	S/2007/1674/PR	Commitment	1	1	1
Yardley Gobion	Planning Permission	S/2008/1118/P	Commitment	1	1	1
Yardley Gobion	Planning Permission	S/2008/0609/P	Commitment	1	1	1
Yardley Hastings	Under Construction	S/2006/0910/PR	Commitment	1	1	1
Yardley Hastings	Under Construction	S/2004/1501/P	Commitment	5	5	5
Yardley Hastings	Under Construction	S/2008/0830/P	Commitment	1	1	1

A.4 Northampton related development area

Address/Location	Ward	Commitments			Current Site Capacity	5 year supply Apr 2009-Mar 2014	Completions 09/10	Completions 10/11	Completions 11/12	Completions 12/13	Completions 13/14	Sum Beyond 2014/2015 Onwards
		Status on 5YLS (used to inform commitments column)	Application Number(s)	Commitments (ie opp,u/c & LP Allocations)								
Dallington Grange (Policies H1, H5)	Spencer	Decision Pending	07/0008/OUTWNN	Commitment	3500	550			150	200	200	2950
Upton Lodge (excluding Norwood Farm) (Policy H4)	West Hunsbury	Decision Pending	N/2007/0307, N/2007/0308	Application	1588	600			200	200	200	988
Nunn Mills (Policy D17)	Delapre	Approval in Principle (Pending Decision)	WN/2006/0014	Application	1250	450			50	200	200	800
Whitehills (Policy HS2)	Outside Borough Boundary	Allocated	No Application Submitted	Commitment	1000	300			50	125	125	700
Upton Park	West Hunsbury		Application Due 2009	Application	979	480			160	160	160	499
Ransome Road (D17)	Delapre	Approval in Principle (Pending Decision)	WN/2006/0016	Application	800	350		50	100	100	100	450

Upton Lodge (Norwood Farm)	Outside Borough Boundary	Decision Pending	SO/2006/1655/PO	Application	781	400				200	200	381
Pineham (Policy D13,14)	West Hunsbury	Pending Decision	No Application Submitted	Application	646	325			75	100	150	321
Former British Timken, Main Road	Old Duston	Under Construction	06/0013/OUTWNN (WN/2006/0013) 07/0272/REMWNN (N/2007/1241) 08/0112/REMWNN, 08/0065/Remwnn	Commitment	597	597	194	125	150	128		0
Upton Phase 1 (Policies H1,H4)	West Hunsbury	Under Construction	Various including WN/2006/0204	Commitment	581	581	123	33	225	200		0
Princess Marina Hospital	West Hunsbury	Outline Permission	07/0004/OUTWNN	Commitment	550	550		50	175	175	150	0
Grange Park RBS/ Saxon Avenue Site	Grange Park	Decision Pending	08/0208/DCNWNS	Application	450	200					200	250
St Crispins (Policy H4)	West Hunsbury	Under Construction	Various including N/2005/0930	Commitment	307	281	36		150	95		26
Land Adjacent to Wootton Fields (Policy WFH1)	Outside Borough Boundary	Outline Permission	S/2007/0813/PO	Commitment	300	300		100	100	100		0
Kingsthorpe Middle School, Northfield Way	Boughton Green	Pending Decision	WN/2006/0156	Application	240	160				80	80	80

Land off Lancaster Way (formerly known as Tunnel Hill Cottages)	Delapre	Allocation, Pending Decision	07/0348/FULWNN (N/2008/0033)	Commitment	230	230		30	75	75	50	0
Former Parklands Middle School, Devon Way	Parklands	Pending Decision	WN/2006/154	Application	184	184				92	92	0
Former Cherry Orchard Middle School, Birchfield Road East	Headlands	Outline Permission	WN/2006/0132	Commitment	170	170			85	85		0
Bective Road - Unit 5/5a	St David	Full Permission	WN/2006/0028	Commitment	155	155			100	55		0
Wellingborough Road - Rear of Wildacres,	Billing	Full Permission	N/2002/1094	Commitment	151	151	41	55	55			0
Freeschool Street (Policy D26)	Castle	SPD Decision Pending	WN/2006/0033 and 0034	Application	150	150			50	100		0
Former Blackthorn Middle School, Blackthorn Road	Ecton Brook	Outline Permission	WN/2006/0030	Commitment	128	128			64	64		0
Former Green Oaks Lower School, Bective Road	St David	Pending Decision	WN/2006/0031	Application	126	126				63	63	0
Emmanuel School, Bird Hill Walk	Lumbertubs	Outline Permission	WN/2006/0029	Commitment	115	115		50	65			0
Harvey Reeves Road	St James	Decision Pending	WN/2006/0015	Application	100	100				50	50	0

Former Abington Vale Middle School, Bridgewater Drive	Weston	Outline Permission	WN/2006/0022	Commitment	100	100			50	50		0
East of Upton Way/Sixfields	St James	Pending Decision	WN/2006/0020	Application	90	90		90				0
Former St Marys RC Middle School, Grange Road	Eastfield	Outline Permission	WN/2006/0130	Commitment	86	86			86			0
St Edmunds Hospital (Policy D16)	St Crispin	Approval in Principle	N/2002/1414	Application	85	85		60	25			0
Former Millway Primary School, Millway	Old Duston	Outline Permission	WN/2006/0153	Commitment	80	80			80			0
Hardingstone Allotments (Policy L24)	Nene Valley	Allocation, Pending Decision	07/0357/FULWNN (N/2007/1540)	Commitment	71	71	25	46				0
Former Ryelands Middle School, Prestbury Road	New Duston	Outline Permission	WN/2006/0032	Commitment	68	68			68			0
Former St Gregory's Lower School, Grange Road	Eastfield	Full Permission	06/0195/REMWNN	Commitment	66	66		20	46			0
Former Ecton Brook Middle School, Ecton Brook Road	Billing	Outline Permission	WN/2006/0074	Commitment	54	54			54			0
Hawkins Shoe Factory - Overstone	St Crispins	Full Permission	N/2002/0083	Commitment	52	52		52				0

Road												
Former Goldings Middle School, Crestwood Road	Thorplands	Outline Permission	WN/2006/0131	Commitment	50	50			50			0
Southbridge East (East) (Policy D17)	Delapre	Under Construction	N/1999/1166	Commitment	44	44				44		0
Ridings Arcade, St Giles Street	St Crispin	Full Permission	N/2002/1540	Commitment	39	39			39			0
Grange Park (Policy GPH1)	Grange Park	Under Construction	S/2002/1667/PR	Commitment	37	37	37					0
Wootton Trading Estate (Policy H3)	Nene Valley	Allocation, Full Permission	N/2006/0870	Commitment	30	30	30					0
2-10 Thenford Street	St Crispin	Full Permission	N/2005/0995	Commitment	25	25		25				0
4-5 Cheyne Walk	St Crispin	Under Construction	N/2003/0730	Commitment	24	24	24					0
173 Bridge Street	St Crispin	Full Permission	N/2008/0063	Commitment	24	24		24				0
44-50 St Andrews Road	Castle	Full Permission	N/2005/0797	Commitment	24	24	24					0
Land at Former Spencer Middle School, Lewis Road	Spencer	Outline Permission	N/2005/1639	Commitment	23	23		23				0
Duston Garage, Peveril Road	Old Duston	Full Permission	N/2007/1145	Commitment	21	21	21					0
Adj 2 Balmoral Road	Kingsthorpe	Full Permission	N/2004/1112	Commitment	20	20	20					0

18-20 St Michaels Road	St Crispin	Full Permission	N/2004/0683	Commitment	20	20		20				0
Trefoil House, St Katherine's Terrace	Castle	Full Permission	WN/2006/0066	Commitment	19	19		19				0
Talavera Way	Thorplands	Under Construction	N/2004/0814	Commitment	18	18	18					0
5 Duke Street	Castle	Full Permission	08/0223/FULWNN, N/2005/0566	Commitment	18	18	18					0
82 High Street, Kingsthorpe	Boughton Green	Full Permission	N/2004/1057	Commitment	16	16	16					0
Land adjacent to Scout Hut, Billing Lane	Thorplands	Under Construction	06/0161/FULWNN (WN/2006/0161)	Commitment	15	15	15					0
26 Regent Street	Castle	Full Permission	N/2005/0774	Commitment	15	15	15					0
23/23A Gold Street	Castle	Full Permission	WN/2006/0158	Commitment	14	14	14					0
73 Great Russell Street	St Crispin	Full Permission	N/2008/0060	Commitment	14	14			14			0
Lanercost, Cliftonville Road	St Crispin	Full Permission	07/0140/FULWNN (N/2007/0694)	Commitment	14	14		14				0
52-56 Hazelwood Road	St Crispin	Full Permission	N/2004/1234	Commitment	14	14	14					0
Tonmead Road	Lumbertubs	Full Permission	N/2008/0141	Commitment	14	14		14				0
Manda Site, Woolmonger Street	Castle	Full Permission	N/2005/0698	Commitment	14	14	14					0
Wallbeck Close	Boughton Green	Under Construction	N/2002/1666	Commitment	13	13	13					0

Land for development, Tonmead Road	Lumbertubs	Full Permission	N/2007/1038	Commitment	13	13		13				0
Burns Street	St Crispin	Full Permission	06/0209/FULWNN	Commitment	12	12	12					0
Sharman RD/Spencer Street	St James	Full Permission	N/2008/0178	Commitment	12	12		12				0
71 Booth Rise	Parklands	Under Construction	N/2007/0310	Commitment	12	12	12					0
Homelands, 174 Harborough Road	Boughton Green	Full Permission	N/2004/0544	Commitment	10	10		10				0
Deenside, 57 Artizan Road	St Crispin	Full Permission	N/2004/1605	Commitment	10	10	10					0
56 Lorne Road	Castle	Full Permission	N/2005/1197	Commitment	10	10	10					0
Kingsthorpe Hall, Mill Lane	Kingsthorpe	Under Construction	N/2002/1476	Commitment	9	9	9					0
Great Billing C of E School, Station Road	Billing	Outline Permission	N/2006/0841	Commitment	9	9		9				0
Land at Shelfleys Site, Ladybridge Drive	West Hunsbury	Under Construction	06/0151/FULWNN	Commitment	8	8	8					0
42 Kingsthorpe Grove	Kingsthorpe	Full Permission	N/2008/0811	Commitment	8	8		8				0
2 Meeting Lane	Old Duston	Full Permission	N/2003/1039	Commitment	8	8	8					0
87 Station Road	Billing	Full Permission	N/2008/0763	Commitment	7	7		7				0

42-46 Kingsthorpe Grove	St David	Full Permission	N/2005/0607	Commitment	6	6	6					0
207-209 St Andrews Road	Castle	Full Permission	N/2005/1232	Commitment	6	6		6				0
4-8 Talbot Road	St Crispin	Under Construction	N/2005/0382	Commitment	6	6	6					0
14 The Green	Nene Valley	Full Permission	N/2003/0653	Commitment	6	6	6					0
Land to rear of 81 Station Road	Billing	Full Permission	N/2006/0804	Commitment	5	5	5					0
68-76 Orchard Hill	Billing	Under Construction	N/2008/0042	Commitment	5	5		5				0
2 Gray Street/30 Hunter Street	St Crispin	Full Permission	08/0074/FULWNN	Commitment	5	5		5				0
52 (land adjacent to Lowood House) The Avenue	St Crispin	Full Permission	N/2005/1678	Commitment	5	5		5				0
22 Stockley Street/41 Alfred Street	St Crispin	Full Permission	N/2004/0052	Commitment	5	5	5					0
202 & 204 Kettering Road	St Crispin	Full Permission	N/2003/0800	Commitment	5	5	5					0
188 Kettering Road	St Crispin	Full Permission	N/2004/0032	Commitment	5	5	5					0
126 Lower Thrift Street	St Crispin	Full Permission	N/2007/1240	Commitment	4	4		4				0
38 Ambush Street	Castle	Full Permission	N/2008/0180	Commitment	4	4		4				0
6 to 8 St Michaels Avenue	St Crispin	Full Permission	N/2005/0165	Commitment	4	4	4					0
81 St Giles Street	St Crispin	Full Permission	N/2005/1584	Commitment	4	4	4					0

2 Gray Street	St Crispin	Full Permission	N/2001/1516	Commitment	4	4	4					0
110 King Edward Road	Abington	Full Permission	N/2008/0742, N/2008/0784	Commitment	4	4		4				0
Woodstock Flat 25, Cliftonville Road	St Crispin	Full Permission	N/2003/0324	Commitment	4	4	4					0
Land to South West of Sunningdale Close	Kingsley	Full Permission	N/2005/1432	Commitment	3	3		3				0
Land at Ash Lane	Nene Valley	Full Permission	N/2003/0508	Commitment	3	3	3					0
93 St Michaels Road	St Crispin	Full Permission	08/0239/FULWNN	Commitment	3	3	3					0
57 St Michaels Road	St Crispin	Full Permission	08/0240/FULWNN	Commitment	3	3	3					0
3 Fish Street	St Crispin	Full Permission	08/0274/FULWNN	Commitment	3	3		3				0
Land to rear of 110-114 King Edward Road	Abington	Full Permission	N/2005/1009	Commitment	3	3	3					0
123 Abington Avenue	Abington	Full Permission	N/2005/1428	Commitment	3	3	3					0
76 Church Way	Weston	Full Permission	N/2004/1140	Commitment	3	3	3					0
61 Church Way	Weston	Full Permission	N/2008/0714	Commitment	3	3		3				0
Sunningdale Close	Kingsley	Full Permission	N/2008/0754, N/2008/1203	Commitment	3	3	3					0
6 & 8 High Street	Kingsthorpe	Under Construction	N/2006/0310	Commitment	3	3	3					0
17 Castilian Street	St Crispin	Full Permission	N/2008/1020	Commitment	3	3		3				0
41 Weedon	St James	Full	N/2005/0070	Commitment	3	3	3					0

Road		Permission										
30 London Road	Delapre	Full Permission	N/2006/0419	Commitment	2	2	2					0
32 London Road	Delapre	Full Permission	N/2006/0418	Commitment	2	2	2					0
8 Junction Road	Kingsley	Full Permission	N/2003/1193	Commitment	2	2	2					0
134 Spencer Bridge Road	Spencer	Full Permission	N/2008/0443	Commitment	2	2		2				0
142 Chiltern Way	Old Duston	Full Permission	N/2003/0986	Commitment	2	2	2					0
49A Kettering Road	St Crispin	Full Permission	N/2003/1598	Commitment	2	2	2					0
44 Purser Road	Abington	Full Permission	N/2005/1545	Commitment	2	2	2					0
Palmerston Road	St Crispin	Full Permission	08/0113/FULWNN	Commitment	2	2	2					0
2 Hardingstone House, The Green	Nene Valley	Under Construction	N/2001/0582	Commitment	2	2	2					0
150 Hazeldene Road	Kingsley	Full Permission	N/2008/1251	Commitment	2	2		2				0
204 Kingsley Road	Kingsley	Full Permission	N/2009/0032	Commitment	2	2		2				0
71 Church Way	Weston	Full Permission	N/2008/0653	Commitment	2	2	2					0
Plot 3, Wootton Hill Farm	West Hunsbury	Full Permission	N/2006/0097	Commitment	1	1	1					0
Plot 1, Wootton Hill Farm	West Hunsbury	Full Permission	N/2007/0853	Commitment	1	1	1					0
Plot 2, Wootton Hill Farm	West Hunsbury	Full Permission	N/2006/0037	Commitment	1	1	1					0

Land Adjacent to 31 Church Lane	Billing	Full Permission	N/2005/1335	Commitment	1	1	1					0
24 East Park Parade	Kingsley	Full Permission	N/2004/1203	Commitment	1	1	1					0
46 East Park Parade	Kingsley	Full Permission	N/2004/1493	Commitment	1	1	1					0
15 Park Avenue North	Kingsley	Full Permission	N/2005/1177	Commitment	1	1	1					0
5 The Crescent	Kingsley	Full Permission	N/2006/0866	Commitment	1	1	1					0
56 Murray Avenue	Kingsley	Full Permission	N/2003/1480	Commitment	1	1	1					0
3 Kingsthorpe Grove	Kingsthorpe	Full Permission	N/2005/0891	Commitment	1	1	1					0
42-46 Kingsthrope Grove	Kingsthorpe	Full Permission	N/2005/1123	Commitment	1	1	1					0
Land At 164 Kingsthorpe Grove	Kingsthorpe	Full Permission	N/2005/1332	Commitment	1	1	1					0
Land to rear of 166 Balfour Road	Kingsthorpe	Full Permission	N/2003/0363	Commitment	1	1	1					0
21B Manor Road	Kingsthorpe	Full Permission	N/2008/0702	Commitment	1	1		1				0
Land to rear of 63 Thornton Road	Kingsthorpe	Outline Permission	N/2006/0486	Commitment	1	1		1				0
44A Chalcombe Avenue	Kingsthorpe	Full Permission	N/2006/0610	Commitment	1	1	1					0
64/66 High Street	Kingsthorpe	Full Permission	N/2003/0028	Commitment	1	1	1					0
8 Foxgrove Avenue	Kingsthorpe	Full Permission	N/2004/0047	Commitment	1	1	1					0

44 Harborough Road North	Boughton Green	Full Permission	N/2005/0409	Commitment	1	1	1					0
110 Harlestone Road	Spencer	Outline Permission	N/2006/0959	Commitment	1	1		1				0
Duston Nursery Millway	Old Duston	Full Permission	N/2004/0798	Commitment	1	1	1					0
Land adjoining 25 Holyrood Road	St James	Outline Permission	N/2006/0483	Commitment	1	1	1					0
14 Shakespeare Road	St Crispin	Full Permission	N/2004/0453	Commitment	1	1	1					0
1 Beech Grove	Headlands	Full Permission	N/2006/0916	Commitment	1	1	1					0
60 Ridgeway	Weston	Full Permission	N/2005/0525	Commitment	1	1	1					0
53 Derngate	St Crispin	Full Permission	N/2008/0717	Commitment	1	1		1				0
2 Stanfield Road	Old Duston	Full Permission	N/2008/0737	Commitment	1	1		1				0
St Christophers Home Abington Park Crescent	Weston	Full Permission	N/2006/0508	Commitment	1	1	1					0
3 Cheyne Walk	St Crispin	Full Permission	N/2005/0410	Commitment	1	1	1					0
8 Albion Place	St Crispin	Full Permission	N/2003/0688	Commitment	1	1	1					0
79 Upper Thrift Street	St Crispin	Full Permission	N/2004/1695	Commitment	1	1	1					0
69 Billing Road	St Crispin	Full Permission	N/2003/0977	Commitment	1	1	1					0
5 Southcrest	West Hunsbury	Full Permission	N/2008/0188	Commitment	1	1	1					0

65 Booth Rise	Parklands	Full Permission	N/2008/0189	Commitment	1	1	1					0
90 Balmoral Road	Kingsthorpe	Full Permission	N/2008/0212	Commitment	1	1	1					0
49 Kerrfield Estate	Old Duston	Full Permission	N/2008/0352	Commitment	1	1	1					0
6 Woodside Crescent	Headlands	Full Permission	N/2009/0055	Commitment	1	1		1				0
21 The Drive	Kingsley	Full Permission	N/2009/0062	Commitment	1	1		1				0
117 Acre Lane	Boughton Green	Full Permission	N/2009/0068	Commitment	1	1		1				0
54 Malcolm Road	Kingsley	Full Permission	N/2008/1180	Commitment	1	1		1				0
31 Church Lane	Billing	Full Permission	N/2008/1191	Commitment	1	1		1				0
1 Thorpeville	Parklands	Outline	N/2008/1236	Commitment	1	1		1				0
20 Abington Avenue	Abington	Full Permission	N/2009/0076	Commitment	1	1		1				0
2 Cherry Tree Lane	Nene Valley	Full Permission	N/2008/1269	Commitment	1	1		1				0
147 Welford Road	Kingsthorpe	Full Permission	N/2008/1285	Commitment	1	1		1				0
9 Stratford Drive	Nene Valley	Full Permission	N/2008/1310	Commitment	1	1		1				0
1 Brookfield Road	Kingsley	Full Permission	n/2009/0002	Commitment	1	1		1				0
79 Earl Street	Castle	Full Permission	08/0277/fulwnn	Commitment	1	1	1					0
1 Standing Stones	Billing	Full Permission	N/2009/0031	Commitment	1	1		1				0
33/33a Billing Road	St Crispin	Full Permission	08/0114/COUWNN	Commitment	1	1	1					0
202 St James Park Road	Castle	Full Permission	N/2008/0685	Commitment	1	1		1				0
75 Kingsley Road	Kingsley	Full Permission	N/2008/0846	Commitment	1	1		1				0

16 Springbanks Way	East Hunsbury	Full Permission	N/2008/0788	Commitment	1	1		1				0
56 Quintonside	Outside Borough Boundary	Full Permission	S/2008/1056P	Commitment	1	1		1				0
9 Ardington Road	Abington	Full Permission	N/2005/1069	Commitment	1	1	1					0
							914	1031	2591	2741	2020	7445

Appendix B -

Appendix C Flood risk management additional information

C.1 Catchment Description

1. The River Nene, River Great Ouse (including River Tove), River Cherwell and their tributaries all originate within the administrative areas of the West Northamptonshire local planning authorities (LPAs) as shown in Figure 5-1. The principal rivers in the study area drain from west to east with the exception of the River Cherwell, which flows from north to south. The upper reaches of these catchments are classed as being 'flashy' due to the underlying hard rock geology, leading to relatively short catchment response times. The main source of flooding within West Northamptonshire is from rivers and watercourses overtopping their banks.

C.1.1 River Nene and Tributaries

2. The catchment of the River Nene covers the majority of the Daventry District Council and Northampton Borough Council administrative areas. The River Nene rises on the mainly clay soils of the Northampton Uplands at sources near Badby, Naseby and Yelvertoft and then crosses the gently undulating rural country to the flat plains of Peterborough. The catchment is largely rural and the major land use is agriculture. The main urban areas include:

- Daventry (covered by this Water Cycle Strategy)
- Northampton (covered by this Water Cycle Strategy)
- Wellingborough (covered by the North Northamptonshire Water Cycle Strategy)
- Kettering (covered by the North Northamptonshire Water Cycle Strategy)
- Corby (covered by the North Northamptonshire Water Cycle Strategy)
- Peterborough (covered by the Peterborough Water Cycle Strategy).

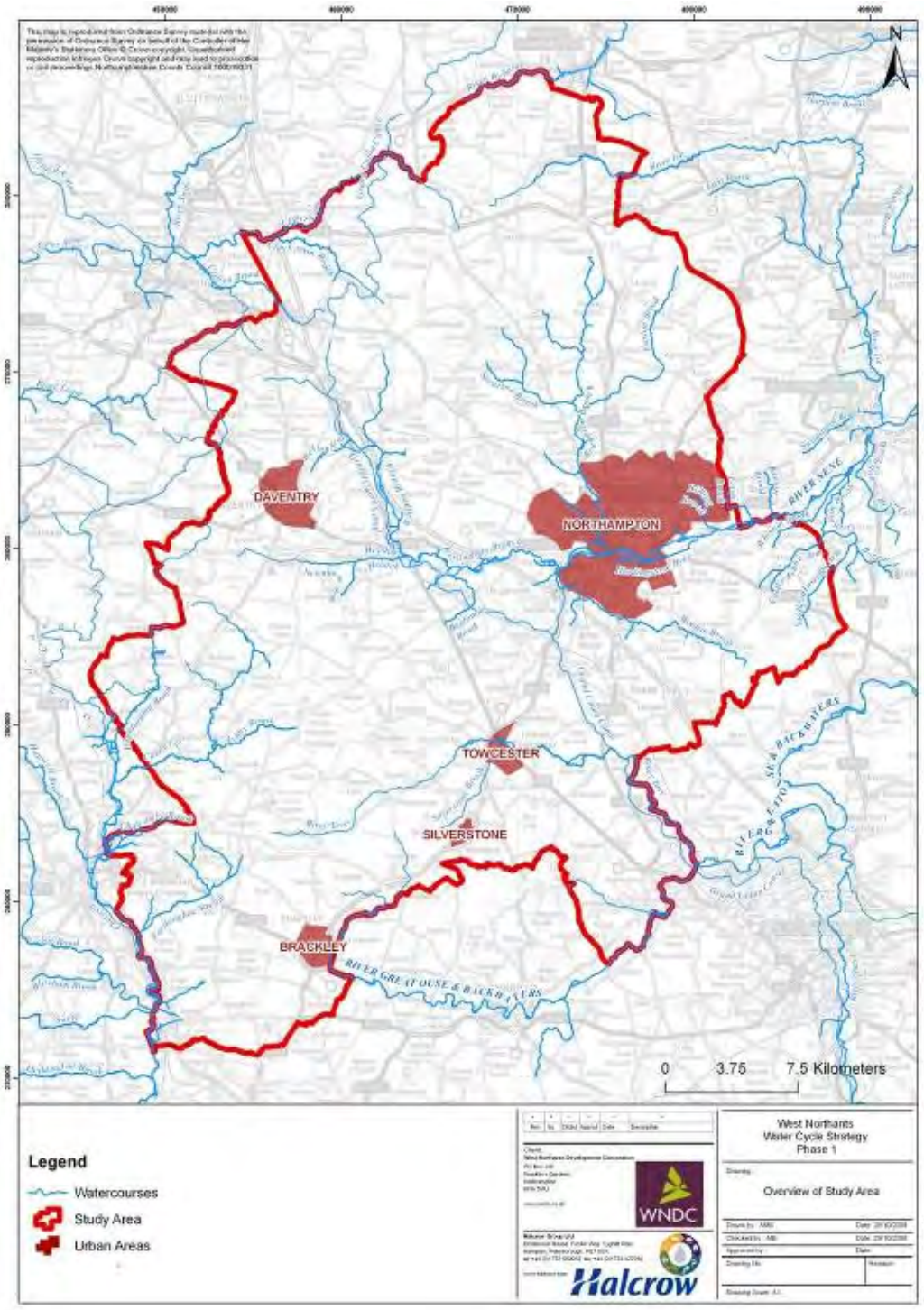

Figure 0.1: Study area overview showing principal watercourses.

3. Northampton lies at the confluence of the River Nene's principal upper tributaries – the Kislingbury Branch, the Brampton Branch and Wootton Brook (as shown in Figure 5-1). The upper catchment is crossed by the Grand Union Canal and its Northampton Arm. The canal is supplied with water from the Daventry and Drayton reservoirs in the upper catchment of the Kislingbury Branch. The Kislingbury Branch is joined by the Weedon Branch. Downstream of the confluence with the Weedon Branch, the Kislingbury Branch has an extensive floodplain and is joined by the Wootton Brook before entering Northampton where it is joined by the Grand Union Canal, immediately upstream of South Bridge, and by the Brampton Branch.

4. The three main tributaries of the Upper Nene, namely Wootton Brook, the Kislingbury Branch and Brampton Branch, are classified as Main Rivers and respond to storm rainfall at approximately the same rate. For example the flood of April 1998 passed through Northampton in a single peak which arrived about 22 hours after the start of the storm.

5. In the upper catchment of the Brampton Branch, there are three public water supply reservoirs – Ravensthorpe, Hollowell and Pitsford – owned and operated by Anglian Water Services (AWS). The Nene Catchment Flood Management Plan (CFMP) states that it is to be expected that the AWS reservoirs in the catchment of the Brampton Branch will spill during major flood event such as the one in April 1998. It is probable that these reservoirs would moderate less intense floods if the reservoirs were not full when the flood event started. Using the reservoirs for flood water storage would require the co-operation of Anglian Water Services.

6. The catchment is crossed by the Grand Union Canal, the Northampton Arm of which may have some effect on how the catchment responds. The canal does not, however, introduce floodwater from other catchments. According to the Nene CFMP, the relatively small British Waterways reservoirs (Daventry and Drayton reservoirs) in the upper reaches of the Kislingbury Branch are unlikely to have a significant influence on how the overall catchment responds. The wide floodplain in the lower reaches of the Kislingbury Branch tends to moderate flood flow.

7. Through Northampton, the River Nene is separated from its floodplain by flood defences. The Northampton Washlands compensate for the effect of upstream development on flow downstream. The Washlands consists of an area of former gravel workings into which flood waters are diverted and stored for controlled release as the flood subsides. This scheme is intended to reduce flood peaks in the Nene downstream of Northampton, not to benefit the town itself.

8. The flood storage reservoir recently constructed on the Weedon Branch is designed to protect Weedon, but also has some influence in reducing flood risk in the Kislingbury Branch through to Northampton.

9. The River Nene catchment is underlain by rock formations of mainly Jurassic age with older limestones and mudstones outcropping in the hills to the north and west. These are overlain in the middle of the catchment by sandstones which are exposed along the valley of the River Nene. Younger limestone rocks cap hills in the centre of the catchment and to the east and west the youngest rocks – mudstones – occur.

10. The rocks are overlain by the more recent drift deposits, much of which are the result of glaciations which have led to the deposition of till, sands and gravels mostly in the middle of the catchment. On top of the drift deposits are deposits derived from the shifting meanders of the River Nene, comprising river terrace gravels and alluvium. These deposits lie along the river course. In the upper reaches of the catchment, the drift deposits give way to expose the underlying rock.

11. Much of the underlying rock across West Northamptonshire gives rise to impermeable clay-based soils with a relatively quick response to rainfall and a high proportion of run-off followed by high river flow.

12. Groundwater flooding was not identified as a significant factor in the Northampton Borough Council Strategic Flood Risk Assessment (SFRA) or the West Northamptonshire SFRA. The River Nene CFMP notes that the

Nene catchment does not have any of the groundwater emergence zones, identified by Defra (2004), in which there is a greater risk of groundwater flooding.

C.1.2 River Great Ouse

13. The River Great Ouse starts in Northamptonshire near Brackley and then passes through Buckingham, Newport Pagnell, Bedford, St Neots, St Ives and Earith before it crosses the Fens and flows into The Wash. The principal tributaries include the rivers: Tove, Ouzel, Ivel, Cam, Lark, Wissey and the Little Ouse. Of these watercourses only the River Tove, which flows through the centre of Towcester, is situated within the study area. The River Tove is classified as a Main River. Silverstone Brook is also classified as a Main River and has its confluence with the Tove in the centre of Towcester.

14. The Great Ouse catchment is largely rural and it supports traditional industries such as manufacturing, tourism, and agriculture. However, research and technology, finance and service sectors are becoming more important.

15. The main urban areas downstream of the study areas include:

- Milton Keynes, (covered by the Milton Keynes Water Cycle Strategy)
- Bedford, (covered by the Bedford Growth Area Water Cycle Strategy)
- Cambridge (covered by the Cambridge Water Cycle Strategy).

16. The upper part of the Great Ouse catchment is at a level of typically 70m AOD and spans the southern part of the South Northamptonshire administrative area. At this location soils consist mainly of clays with limestone being the dominant under-lying strata. Impermeable clay-based soils provide a relatively quick response to rainfall and a high proportion of run-off followed by high river flow.

C.1.3 River Cherwell and Tributaries

17. The River Cherwell rises at Hellidon to the south east of Daventry, flowing in a southerly direction through parts of Daventry District and South Northamptonshire. Downstream of the administrative area for South Northamptonshire near to Cropredy, the Oxford Canal also follows the Cherwell Valley. Further downstream the River Cherwell then flows through Banbury and parts of industrial Oxfordshire before flowing through Oxford and ultimately flowing into the River Thames to the west of central Oxford. Only a small portion of this catchment falls within the study area.

C.2 Actions from the Great Ouse CFMP (April 2010 - still in draft and subject to review) relating to development.

18. **Catchment wide actions from the Draft Great Ouse CFMP Summary Report – April 2010 Consultation Draft include:**

19. Actions specific to development within the Bedford Ouse Rural and Eastern Rivers sub area are outlined below:

- Investigate options to reduce current flood risk management activities. However, where flood risk is more concentrated (for example in towns and villages) existing actions to manage flooding may be continued.
- Ensure that opportunities are taken within minerals and waste development/action plans to use mineral extraction sites to store floodwater.
- Develop environmental enhancement projects to improve the natural state of the rivers and their habitats.

20. Actions specific to development within the Towcester part of the Towcester Shefford/the Flit Corridor, Alconbury/ Alconbury Weston and Huntingdon/ Brampton sub area include:

- Develop a flood risk study for Wood Burcote Brook to confirm the level of flood risk along this watercourse particularly from low magnitude flood events.
- Continue with improvements to the flood warning service by extending the current Floodline Warnings Direct Service
- Ensure any policies within the Local Development Framework or any revisions are in line with the CFMP policy.

C.3 Actions from the Nene CFMP Summary Report (December 2009) relating to development.

21. Actions specific to development within the Upper and Middle Nene sub area are outlined below:

- Investigate options to cease or reduce current bank and channel maintenance and flood defence maintenance. In addition, changes in land use, development of sustainable farming practices and environmental enhancement should be investigated to mitigate an increase in flooding in the future.
- Encourage planners to develop policies to prevent inappropriate development in the floodplain using measures set out in Planning Policy Statement 25 (PPS25). Any new development should be targeted to areas with lowest flood risk.
- Encourage planners to develop policies for regeneration and redevelopment of commercial sites to incorporate resilience measures so that the location, layout and design of development can help mitigate residual flood risk. Regeneration and redevelopment should also provide opportunities to improve the environment and make space for water.
- Continue maintenance and inspection of Grendon Brook Villages, Great Oakley and Clipston flood storage reservoirs and Geddington flood relief channel.

22. Actions specific to development within the River Nene (Weedon to Kislingbury) and River Nene Corridor sub area (specifically Weedon to Kislingbury) are outlined below:

- Produce flood storage studies for this sub-area to investigate the most appropriate storage options and locations for floodplain storage. The studies should also consider opportunities to enhance the environment by improving the natural state of the river and its habitat - This will mitigate future flood risk to the Northamptonshire Central sub area and commercial areas of the Northampton Outer sub area. The study should consider the flood defence measures constructed at Upton. The study should determine the possible location of storage and combination of river restoration and engineered flood storage.
- Encourage planners to develop policies to prevent inappropriate development in the floodplain using measures set out in Planning Policy Statement 25 (PPS25). Any new development should be targeted to areas with lowest flood risk.

23. Actions specific to development within the Wootton part of the Wootton, Thrapston, Barnwell River Nene (Oundle to Water Newton) sub area are outlined below:

- Work with planners to influence the location, layout and design of new and redeveloped property. Ensure that only appropriate development is allowed on the floodplain through the application of Planning Policy Statement 25 (PPS25).
- Work with partners to develop a Surface Water Management Plan for Wootton.

24. Actions specific to development within the Northampton Central and Northampton Outer sub area are outlined below:

- Develop a flood storage study to investigate the feasibility of creating storage areas, natural or engineered, along the river corridor upstream of the town to manage future flood risk within Northampton - This will mitigate future flood risk to the Northamptonshire Central sub area and commercial areas of the Northampton Outer sub area. The study should consider the flood defence measures constructed at Upton and the protection of the Upper Nene Valley Gravel Pits SSSI/pSPA/Ramsar site. The study should determine the possible location of storage and combination of river restoration and engineered flood storage. Where possible the study should enhance the environment by improving the natural state of the river and its habitat.
- Encourage planners to develop policies for new development and regeneration (including commercial sites) to incorporate resilience measures so that the location, layout and design of development can help to reduce flood risk. Planners should prevent inappropriate development in the floodplain using measures set out in Planning Policy Statement 25 (PPS25), and ensure that any new development does not increase the risk to existing development. Any new development or regeneration should provide opportunities to improve the river environment and make space for water.
- Work with partners to investigate the options for managing urban drainage issues and surface water flooding. Where strategies, including water cycle strategies, have been developed organisations need to work together to implement the recommendations made.

Table B1: Sub areas from the River Nene CFMP lying within West Northamptonshire. Source: River Nene Catchment Flood Management Plan, Summary Report December 2009.

Sub area	Area (km^2)	Characteristics	Location	Sources	Mechanism	Receptors
Upper and middle Nene catchment	1331	Rural with scattered small settlements, but including the medium sized towns of Daventry, Rothwell and Desborough. Low population density.	Headwaters of the River Nene and tributaries, including the major tributaries of: Harpers Brook, Willow Brook, upper River Ise, Brampton Branch, and Dodford Branch.	River flooding from the River Nene tributaries. Considered to be potential for groundwater flooding in some areas, including the Harpers Brook and Willow Brook catchments.	Overtopping of the watercourses onto their functional floodplains, with only isolated flood defences across this sub area. Exceedance of the capacity of flood storage areas leading to increased flooding.	Isolated people and properties, historic environment sites, BAP habitats, SSSIs, agricultural land, critical infrastructure, and transport infrastructure.
River Nene (Weedon to Kislingbury)	15	Rural with scattered small settlements. Low population density.	Floodplain of the Kislingbury branch of the River Nene, including parts of the lower Bugbrooke Brook and lower Weedon branch. Includes the settlements of Weedon, Kislingbury and Bugbrooke.	River flooding from the Kislingbury branch, Weedon branch and Bugbrooke Brook. Flooding as a result of defence failure in Kislingbury.	Overtopping of the watercourses onto their functional floodplains, with only isolated flood defences across this sub area. Exceedance of the capacity of flood storage areas leading to increased flooding. Overtopping or breach of flood defences in Kislingbury. This would lead to rapid and potentially life threatening, inundation of the areas protected by these	People and properties (predominantly in the settlements of Weedon, Kislingbury and Bugbrooke), SSSIs, historic environment sites, BAP habitats, critical infrastructure, and transport infrastructure.

Sub area	Area (km^2)	Characteristics	Location	Sources	Mechanism	Receptors
					defences.	
Wootton	11	Suburban areas of south Northampton. High population density.	Southern areas of Northampton focussed on the suburbs of Wootton and Collingtree Park that are at risk of flooding from the Wootton Brook.	River flooding from the Wootton Brook. Considered to be some potential for groundwater flooding in some areas of the sub area.	Overtopping of the watercourse onto the functional floodplain.	People and properties, critical infrastructure, transport infrastructure.
Northampton Central	15	Central area of Northampton including central business district and residential areas. High social vulnerability to flooding and high population density.	Central area of Northampton that is protected at present to a 0.5% AEP standard. This includes the St. James End, Cotton, Far Cotton and Brackmills areas of the town.	River flooding from the River Nene, Brampton Branch and Kislingbury Branch. Flooding as a result of defence failure. Surcharge of surface and subsurface drainage systems.	Overtopping or breach of flood defences. This would lead to rapid, potentially life threatening, inundation of the areas protected by these defences. Heavy rainfall leading to local drainage network being unable to cope with runoff.	People and properties (significant risk to people in this sub area for higher magnitude floods), SSSIs, historic environment sites, BAP habitats, community facilities, critical infrastructure, and transport infrastructure.
Northampton Outer	43	Urban and suburban areas of Northampton. High population density.	Areas of Northampton excluding those which are part of the Northampton Central sub area. This includes the Dallington Brook, Billing Brook, lower reaches of the Brampton Branch and River Nene in the Billing area of Northampton.	River flooding from the River Nene, Brampton Branch, Dallington Brook and Billing Brook. Surcharge of surface and subsurface drainage systems.	Overtopping of the watercourses onto the functional floodplain. Exceedance of the capacity of flood storage areas leading to increased flooding. Heavy rainfall leading to local drainage network being unable to	People and properties, historic environment sites, BAP habitats, critical infrastructure, and transport infrastructure.

Sub area	Area (km^2)	Characteristics	Location	Sources	Mechanism	Receptors
					cope with runoff.	

C.4 Planning Policy Statement 25: Development and flood risk

25. Planning Policy Statement 25 (PPS25) details national planning policy in relation to flood risk. It considers both flood risk to new developments and the potential impact of new development on flood risk. Its aims are to ensure that flood risk is taken into account at all stages in the planning process to avoid inappropriate development in areas at risk of flooding, and to direct development away from areas at highest risk.

26. PPS25 advocates a risk based approach using the "Sequential" and "Exception" tests and considering the vulnerability of different types of development to flooding. The Sequential Test requires that for a development to be appropriate there should be no reasonably available sites in areas of lower flood risk. If there are no reasonably available sites in lower risk areas, then in certain circumstances, development may be appropriate in higher risk areas following application of the sequential test and exception test where necessary. This requires that the development provides wider sustainability benefits outweighing flood risk, that developments are on brownfield sites if possible and that the development is safe and does not increase flood risk elsewhere. PPS25 states that it is not acceptable for new development to increase flood flows downstream.

C.5 Groundwater Flooding

C.5.1 Causes and Impacts of Groundwater Flooding

27. PPS25 states that "groundwater flooding occurs when water levels in the ground rise above surface elevations," however groundwater may also cause harm in other ways, for example when it enters sub-surface structures (such as basements etc). Recent research being carried out for Defra identifies seven types of groundwater flooding event, as follows:

i. rise of typically high groundwater levels to extreme levels in response to prolonged extreme rainfall;

ii. rising groundwater levels in response to reduced groundwater abstraction in an urban area (termed groundwater rebound) or a mining area (termed minewater rebound);

iii. subsidence of the ground surface below the current groundwater level;

iv. rise of groundwater level in aquifers in hydraulic continuity with high in-bank river levels or extreme tidal conditions;

v. rise of groundwater levels due to leaking sewers, drains and water supply mains;

vi. faulty borehole headworks or casings causing upward leakage of groundwater through confining layers driven by artesian heads;

vii. increases in groundwater levels and changed flow paths due to artificial obstructions or pathways, and loss of natural storage and drainage paths.

28. Of these, only (i), (iv) (v) and (vii) are likely to apply in the West Northamptonshire study area, and even these are expected to be limited in extent.

29. The Defra research also identifies the following impacts observed as a direct result of excess groundwater at or close to surface:

- flooding of basements of buildings below ground level;
- flooding of buried services or other assets below ground level;
- inundation of farmland, roads, commercial, residential and amenity areas;
- flooding of ground floors of buildings above ground level;
- overflowing (surcharging) of sewers and drains.

30. Often, effects of groundwater flooding are indistinguishable from effects of fluvial flooding, or are not obviously attributable to groundwater (e.g. surcharge of sewers). As a result the recording of groundwater flooding is often inconsistent. A Defra Study, carried out in 2004, maps groundwater flooding recorded during the most severe recent groundwater flooding episodes (winter 2000/2001 and winter 2003). This study shows no groundwater flooding incidents in the West Northamptonshire study area.

Appendix D – PPS25

D.1 Introduction

31. PPS25 – Development and Flood Risk replaced PPG25 (published in 2001) upon its publication in December 2006. This was revised in March 2010. PPS25 sets out the Government's national policy on flood risk and reflects the general direction set out in the report *Making Space for Water* (Defra 2004) and provides a first response to the longer term risks set out in the 2004 *Foresight Future Flooding* report.

32. The policies within PPS25 complement other national planning policies and should be read in conjunction with *Making Space for Water* and the Water Framework Directive.

33. PPS25 states that: "The aims of planning policy on development and flood risk are to ensure that flood risk is taken into account at all stages in the planning process to avoid inappropriate development in areas at risk of flooding, and to direct development away from areas at highest risk. Where new development is, exceptionally, necessary in such areas, policy aims to make it safe without increasing flood risk elsewhere and where possible, reducing flood risk overall." Planning authorities should ensure that the Local Development Documents set out policies for the allocation of sites which avoid flood risk to people and property. A sequential approach should be taken at the site level to match the vulnerability of flood risk and land use and ensure that all new development in flood risk areas is appropriately flood resilient.

D.2 Risk Based Approach

34. A risk based approach to flooding should be applied at all levels of planning and should avoid adding to the cause of flooding, manage the pathways to reduce likelihood and reduce the consequences should they occur. Appropriate Flood Risk Assessments should be used and the sequential test applied with the exception test only being implemented when departures from the sequential test are justified.

D.3 Responsibilities

35. Landowners have the primary responsibility for safeguarding their land and other property against natural hazards such as flooding. Individual property owners and users are also responsible for managing the drainage of their land in such a way as to prevent, as far as is reasonably practicable adverse impacts on neighbouring land.

36. Regional Planning Bodies have a responsibility to take flood risk into account when determining strategic planning considerations.

37. Local Planning Authority should consult the Environment Agency and other relevant bodies when developing their Local Development Documents.

38. The Environment Agency has a statutory responsibility for flood management and defence in England and provides advice to planning authorities on planning applications. They have permissive powers to maintain flood defence in the public interest. There is however no statutory duty for the Environment Agency to protect land against flooding as the primary responsibility falls upon the landowner to safeguard their land.

D.4 The Sequential Test

39. The sequential test aims to steer development into flood Zone 1. The Environment Agency's flood zone maps should be used as a starting point for the sequential test. SFRAs should be used to inform the sequential test/exception test process where available. Table D.1 of PPS25 gives detail of flood risk zones as follows:

40. Zone 1 (Low Probability) – land with less than a 1 in 1000 chance of flooding from rivers in any one year and suitable for all of the land uses identified in Table D.2. Such development should have regard for flooding from other sources and the potential to make things worse elsewhere and still require a flood risk assessment if the development site is greater than 1 ha.

41. Zone 2 (Medium Probability) – land that has between a 1 in 1000 and 1 in 100 chance of river flooding which is suitable for water compatible, less vulnerable and more vulnerable uses of land and essential infrastructure as identified in Table D.2. High vulnerable uses are only appropriate if the exception test is passed. Any development proposal should come with a flood risk assessment.

42. Zone 3a (High Probability) – land that has a 1 in 100 or greater chance of river flooding and is suitable for water compatible and less vulnerable land uses as set out in Table D.2. More vulnerable development and essential infrastructure is required to pass the sequential test and all development proposals should be supported by an appropriate flood risk assessment. Highly vulnerable development should not be permitted.

43. Zone 3b (The Functional Flood Plain) – land where water has to flow or be stored in times of flood where only water compatible uses are permitted and where essential infrastructure passes the exception test. All development proposals in this zone should be accompanied by a flood risk assessment.

D.5 The Exception Test

44. Paragraph D9 of PPS25 details of how the exception test is to be passed. The paragraph is reproduced below:

45. D9: For the Exception Test to be passed:

46. a) it must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk, informed by a SFRA where one has been prepared. If the DPD has reached the 'submission' stage – see Figure 4 of PPS12: Local Development Frameworks – the benefits of the development should contribute to the Core Strategy's Sustainability Appraisal;

47. b) the development should be on developable[1] previously-developed land or, if it is not on previously developed land[2], that there are no reasonable alternative sites on developable previously-developed land; and

48. c) a FRA must demonstrate that the development will be safe, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.

D.6 Flood Risk Assessment (FRA)

49. Annex E of PPS25 outlines what is required in a FRA and includes a listing similar to that in PPG25. FRAs are required at regional, local and at site specific planning level. An FRA is now required to consider all sources of flood risk. Any FRA should form part of an Environmental Statement under the Planning Regulations.

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[1] Developable sites are defined in Planning Policy Statement 3 (PPS3) *Housing* as those sites which should be in a suitable location for housing development and there should be a reasonable prospect that the site is available for, and could be developed at the point envisaged.

[2] Previously-developed land definition (commonly known as Brownfield Land). See Annex B of Planning Policy Statement 3 *Housing*

D.7 Managing Surface Water

50. Annex F of PPS25 outlines that the management of surface water is a material planning consideration and should as far as possible mimic the pre-development state. Surface water drainage should be considered at the earliest possible stage in the planning and design process. FRAs should demonstrate the method of management to be used. The methods should use SuDS where appropriate and should ensure that both volume and peak is managed to the pre-development state. Ownership and responsibility for the sustainable drainage must be clear and the Environment Agency and the IDBs should be engaged to enable runoff to be managed as close to source as possible.

D.8 Residual Flood Risk

51. Managing residual flood risk must be considered by those planning development. Development should not normally be permitted where flood defences, properly maintained, would not provide an acceptable standard of flood protection for the lifetime of the development. Flood resistance and resilience measures should not be used to justify development and where flood defences are considered necessary as part of a development then the developer is normally expected to fund them. Flood warning is an essential part of managing residual risk. The PPS25 Practice Guidance contains for more information regarding residual risk.

Appendix E – Flood Zone Maps

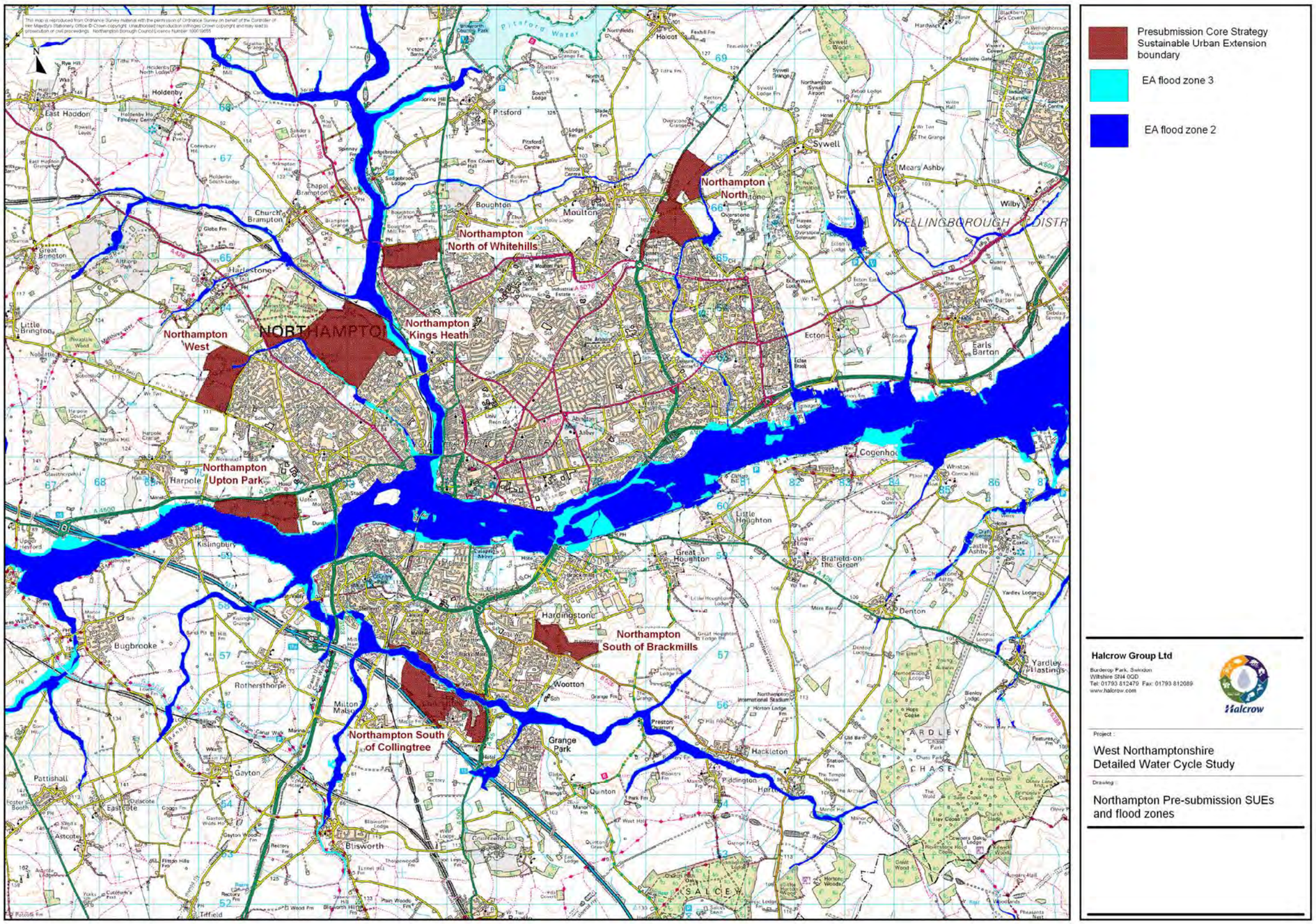


Figure D.1 Northampton flood zones

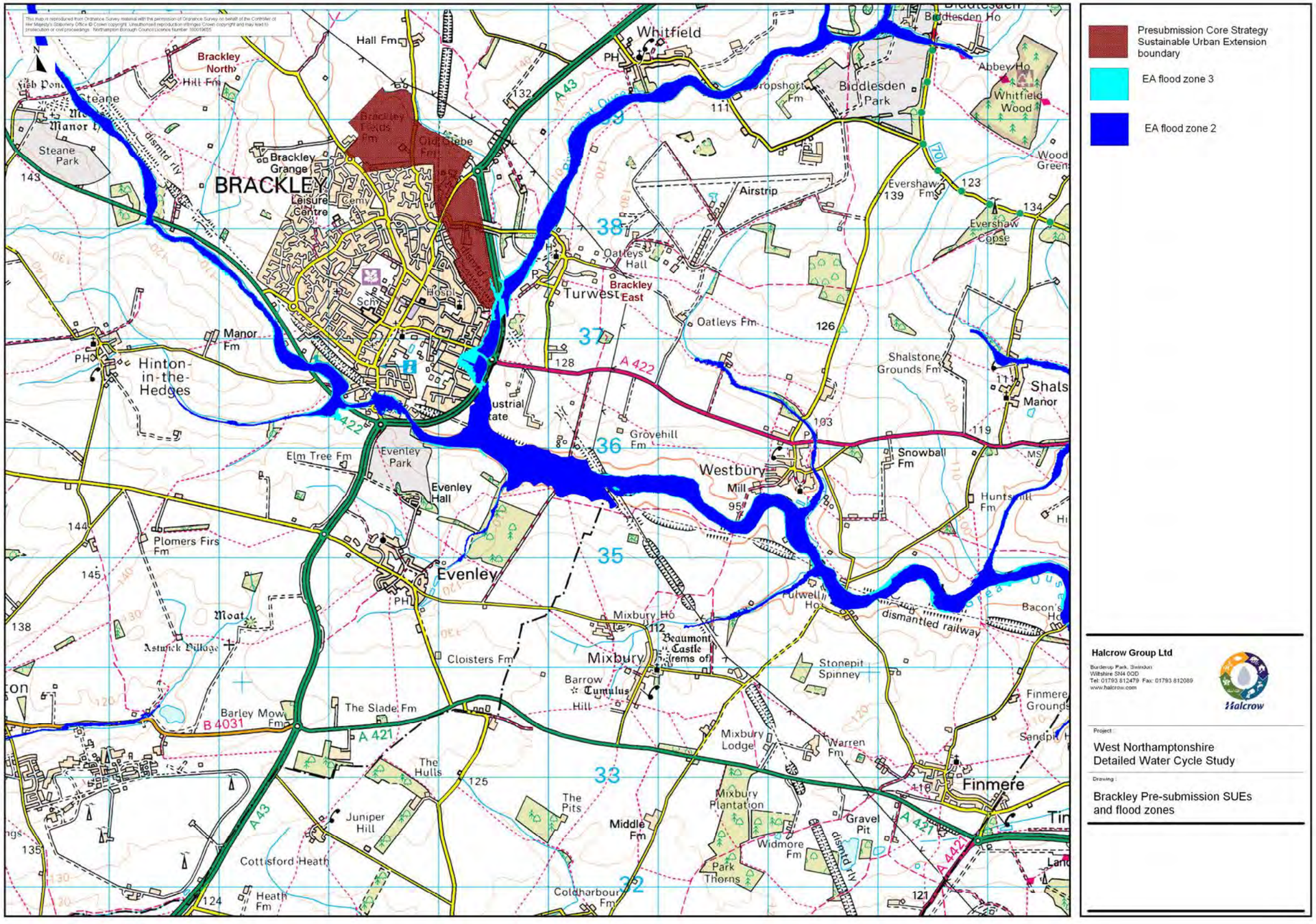


Figure D.2 Brackley flood zones

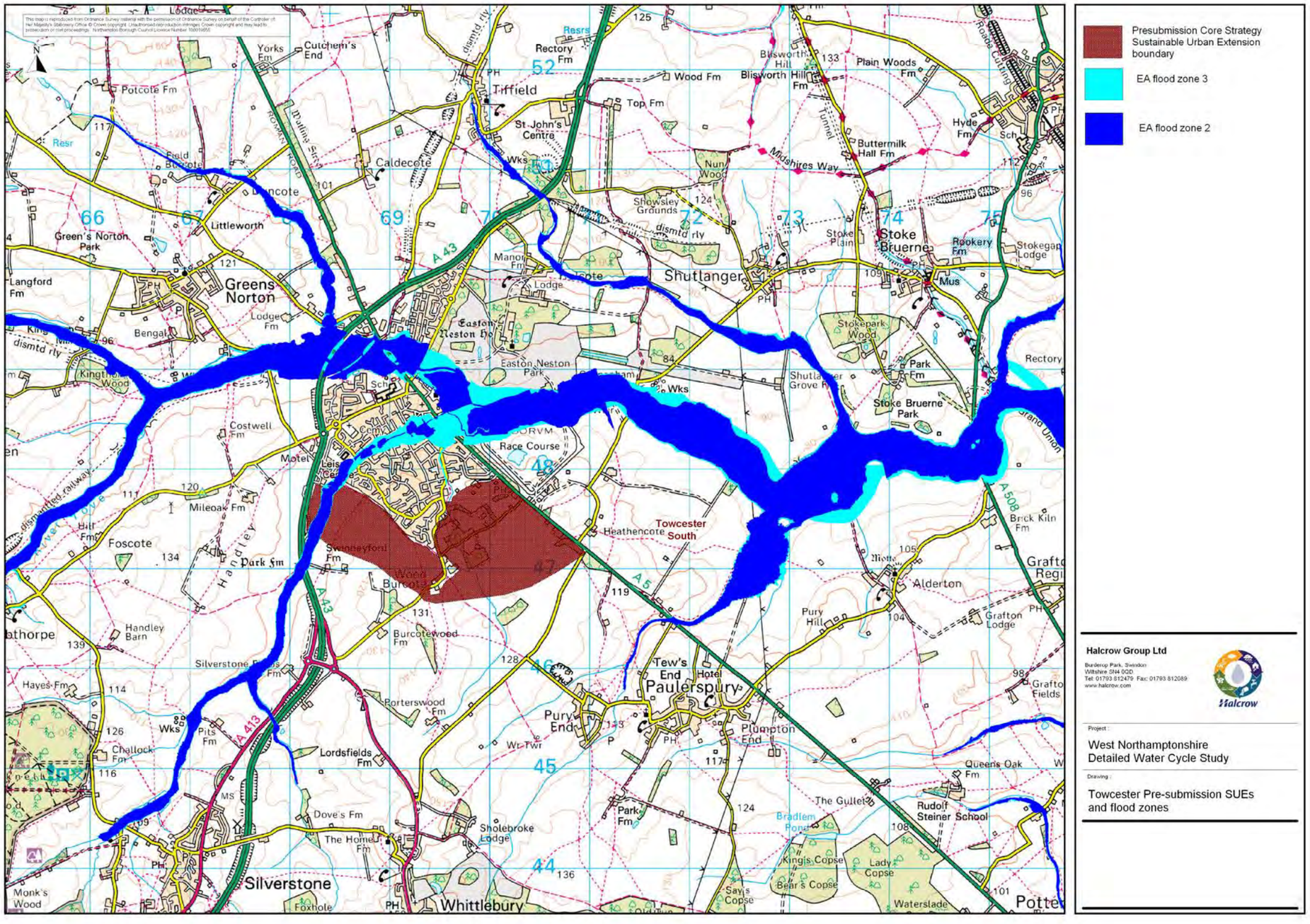


Figure D.3 Towcester flood zones

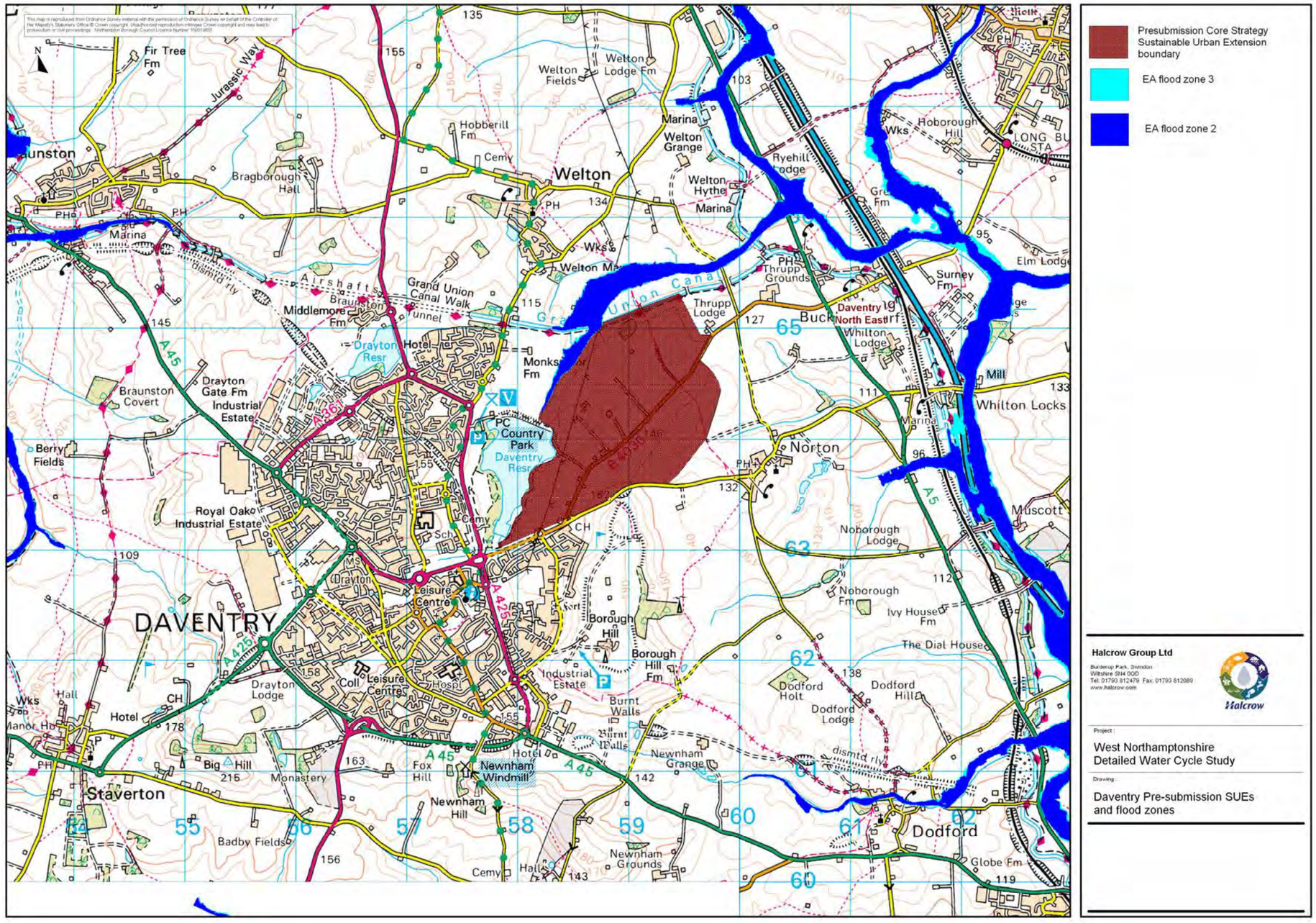


Figure D.4 Daventry flood zones

Appendix F – History of Flooding

Table E1: History of flooding on the River Nene. Adapted from the River Nene CFMP and the West Northamptonshire SFRA:

Date	Source	Scale	River affected	Locations	Consequences
Autumn/Winter 1847	Fluvial	Major	River Nene	Northampton to Peterborough	Flooded 10,000 acres of land. Stopped all trains between Northampton and Peterborough for three days.
18 Oct 1939	Fluvial	Moderate	River Nene	Northampton	Extensive flooding of property in Northampton (St James' End and Far Cotton).
February 1940	Fluvial	Moderate	River Nene	Northampton	
November 1946	Fluvial	Moderate	River Nene	Weedon Northampton	Flooding of property in Weedon.
March 1947	Fluvial. A combination of heavy rain on a frozen catchment caused high run-off rates which, followed by a rapid snowmelt resulted in flooding in the River Nene catchment from Northampton to Peterborough.	Major	River Nene	Sites along the River Nene: Northampton to Peterborough	Properties flooded in Weedon. Riverside properties were flooded in Northampton, but few if any were dwellings. Three bridges downstream of Northampton were damaged. The railway station, Victoria Mills, the tannery and a few houses were flooded.
Winter 1950/51	Fluvial	Minor	River Nene (seven flood peaks with sustained high discharge)		
June and July 1958	Fluvial	Moderate	River Nene		
November 1974	Fluvial	Minor	River Nene		Shallow inundation of the floodplain. No major flooding reported
March 1975	Fluvial	Minor	River Nene		
December	Fluvial	Minor	River Nene		Agricultural land flooded, but few roads

Date	Source	Scale	River affected	Locations	Consequences
1981/January 1982					and no properties were flooded
April/ May 1983	Fluvial	Minor	River Nene		Navigation on River Nene closed. Flood storage areas put to effective use to keep flows within bank other than at isolated low spots
September 1992	Fluvial	Moderate	River Nene and tributaries	Weedon Kislingbury Clipston Geddington Nether Heyford	Severe flooding of property was experienced in several villages, the worst of which was: Weedon (12), Kislingbury (1), Clipston (3), Geddington (1), Nether Heyford (1).
April 1998	Fluvial. Large areas along the River Nene and River Ise were flooded due to heavy rainfall. Flooding affected similar areas to the 1947 flood, but also further upstream of Peterborough and downstream of Northampton. This incident had severe consequences with fatalities in Northampton and extensive damage to property in several towns along the River Nene. The severity of the flood was of the order of 1% AEP.	Major	River Nene River Ise	Sites along the River Nene from Newnham to near Cogenhoe, from near Earls Barton to Guyhirn, and in Wisbech and Sutton Bridge. Pitsford Water to River Nene	Fatalities in Northampton and extensive damage to property in Northampton and damage to several other towns along the River Nene. Total of approximately 2800 properties affected, nearly 90% residential and about 90% in Northampton. About 340 caravans flooded, mostly in Billing Aquadrome.
October 2002	Surface water; drainage	Minor	-	Long Buckby	Two properties flooded
January 2003	Fluvial	Minor/ Moderate	River Nene	Cogenhoe Earls Barton Northampton	Properties flooded: Cogenhoe (1); Earls Barton (2); Northampton (1).
June 2007	Fluvial. Intense rainfall (over 65mm in three hours at one gauge) amounting to a 1 in 15 year rainfall, fell on the already saturated Wootton Brook catchment in June 2007 leading to rapid run-off. Eight properties along the Wootton Brook were flooded.	Minor	Wootton Brook	Collingtree Park	8 domestic properties in Collingtree Park flooded from Wootton Brook.

Table E2: History of flooding from the River Nene. From the BHS Chronology of Hydrological Events.

Ref http://www.dundee.ac.uk/geography/cbhe/

Year	Month	Quotation	River basin	Entry date
1663	05	1663 May 8 About May 8th there was a violent thunderstorm at Northampton " which caused extraordinary floods in a few hours, bearing away bridges, drowning horses, men and cattle....." [River Nene]	032 - Nene	9/16/98
1260		1260 "Prodigious rainfall .... fresh water from the uplands, combining with high tides, overtopped embankments and inundated some 35,000 acres, causing great losses".	032 - Nene	10/12/98
1335		1335 " major flooding"	032 - Nene	10/12/98
1570	12	1570 December "After Christmas .... massive floods, both tidal and freshwater " .... "caused by melting of great quantities of snow in the uplands" ... after Candlemas [Feb 2, 1571] ... and some 38,000 acres were under water.	032 - Nene	10/12/98
1875		1875 The major flow in the Nene, resulting from the extremely wet year of 1875, produced further erosion in the tidal cut.....	032 - Nene	10/12/98
1919		1919 severe inundation	032 - Nene	10/12/98
1926		1926 severe inundation	032 - Nene	10/12/98
1927		1927 Floods....when many acres were inundated	032 - Nene	10/12/98
1929		1929 Thorney Drainage Board [TDB] minute records great shortage of water; too low in Thorney River for syphon to work.	032 - Nene	10/12/98
1903	01	1903 January 6 Rainfall observer at Blisworth (Grafton House) south of Northampton noted "5th and 6th Large floods" [River Nene]	032 - Nene	10/13/98
1887		1887 Rainfall observer at Thrapstone (Hargrave) noted "Cracks in the soil due to the drought could be traced to depths of 4 and 5 feet...."	032 - Nene	10/19/98
1912	01	1912 January 15-24 (p[3]) Nene Valley 7,000 acres flooded between Northampton and "Peterborough."	032 - Nene	11/18/98

	1910	12	1910 December Rainfall observer, Leon G.H. Lee, at Raunds noted (p[35]) "Tremendous floods occurred in the Nene valley during the first half of December. The Midland Railway suffered serious damage owing to embankment slips."	032 - Nene	11/20/98
	1911		1911 Observer, W.B.Jacques, at Orlingbury (Hall) noted (p[52]) "Wells here failed on August 15th for the first time since 1868. Springs only began to move on December 24th." [Upper Nene]	032 - Nene	12/3/98
	1868		1868 (p[52]) Wells at Orlingbury failed, and did not do so again until 1911. [Upper Nene]	032 - Nene	12/3/98
	1883	11	1883 November 6 Observer at Northampton (Sedgebrook) noted (p[28]) "Great flood in the Nene valley."	032 - Nene	12/22/98
	1882	11	1882 November 7 Rainfall observer at Northampton noted (p[23]) "Heavy floods" [Nene]	032 - Nene	12/23/98
	1870	11	1870 November Rainfall observer at Northampton (Thorpelands) noted (p77) "in November the rain had only penetrated a few inches into the soil, and the springs had not increased in volume at the end of the year."	032 - Nene	1/4/99
	1877	01	1877 January Observer at Castle Ashby, below Northampton, noted (p[38]) "Excessive rainfall, which, following the very heavy fall in December, 1876, of 5.42 in., produced almost continuous floods in the Nene Valley."	032 - Nene	1/5/99
	1907	05	1907 May 13/14 Rainfall observer at Blisworth noted, p[11], "In the 24 hours ending 8.30 p.m. 14th, 2.09 in. of rain fell, causing large floods."[Nene]	032 - Nene	4/7/99
	1907	12	1907 December 16 Observer at Raunds noted, p[25], "High floods in the Nene valley."	032 - Nene	4/7/99
	1907	05	1907 May Rainfall observer at Huntingdon noted, p[37] "Both here and in the village of Brampton floods spoiled much of the hay crop."	032 - Nene	4/7/99
	1907		1907 autumn Rainfall observer, R.Soames, at Scaldwell, Northants, [noted, p[66], "The last three months were very wet, resulting in heavy floods."	032 - Nene	4/7/99
	1896	06	1896 June 2 [p7] "... Heavy thunderstorm in Northamptonshire, the main street of Wansford flooded..."	032 - Nene	4/12/99
	1869		1869 [p69] Rainfall observer at Northampton (Thorpelands) noted "Drought felt severely in July and August, and also in October and November. No extraordinary falls of rain in the year, and springs quite as low in November as in the previous year..."	032 - Nene	6/8/99

	1852	11	1852 November 25 [page 199] "Northamptonshire and Cambridgeshire suffered severely. Both the Midland and North-Western Railway traffic was interrupted. Whittlesea Mere, which had recently been drained at a vast expense, and had been brought into rich cultivation, was again an expanse of water, with no present hope of drainage, the whole country around being in a similar state. At Cambridge the students were rowing over the country, the fens and Isle of Ely being one sheet of water... Many individual cases of drowning occurred; large numbers of sheep were drowned; hares, rabbits, wild animals, and birds perished in vast numbers; all farm industry was interrupted, and low fevers became prevalent." [ha032, 033]	032 - Nene	8/12/99
	1870	12	1870 December [p78] Northampton "Thorpelands: In November the rain had only penetrated a few inches into the soil, and the springs had not increased in volume at the end of the year"	032 - Nene	8/19/99
	1890	12	1890 December Observer at Thrapstone (Hargrave) noted, p[75], "... ponds were still empty at the close of the year."	032 - Nene	8/24/99
	1898		1898 autumn "The drought of the past year (1898) in Northamptonshire and other Midland and Southern Counties, has been such a serious inconvenience to localities supplied by superficial or shallow-seated water ... I was recently informed by Mr Wallis, of Burton Latimer, that having occasion during the latter part of 1898 to dig into the ground a considerable depth, he found it to be thoroughly hard and quite dry to a depth of 45 in. to 50 in. Capillarity had certainly acted through 4 feet or more..."	032 - Nene	9/13/99
	1878	10	1878 October 30 Rainfall observer at Northampton noted, p[51], "... heavy snowstorm on 30th"	032 - Nene	9/22/99
	1879	07	1879 July Observer at Northampton noted, p[41], "...Floods in the Nene Valley"	032 - Nene	9/24/99
	1905		1905 Observer, R. Soames, at Scaldwell, Northants, [now just above Pitsford Reservoir] noted, p[68], "springs and ponds lower than ever".	032 - Nene	10/13/99
	1847	09	1847 September [p128] "For weeks that autumn and winter the floods had been out along the whole distance from Northampton to Peterborough, forming an enormous inland lake two miles wide in places, and covering 10,000 acres of land that could not recover from the soaking for months. Mr Hartshorne [Rev Charles Hartshorne, Rector of Cogenhoe] ... prepared a complete report on the problem ..." To a December meeting of gentry he is reported as saying '...Few seasons pass without a summer flood ... Sometimes the waters reach their height as quickly as a day and a half after rain.' [p132], Northampton: "...the flood of September 1847 put Northampton Bridge Street station under water and left gaps in embankments which stopped all trains between Northampton and Peterborough for three days,..." [Nene]	032 - Nene	11/9/99
	1852	11	1852 November [p132] Northampton: "... During a November storm five years later [there having been a flood in 1847] floods did great damage to the [railway] track and washed out bridges at Hignham Ferrers and Fotheringay. This time no trains could use	032 - Nene	11/9/99

			the line for a week." [Nene]		
	1633		1633 [p130] "Another Commission [on Sewers] which sat at Kettering in 1633 and laboriously surveyed the Nene from Wansford to Kislingbury had 'all obstructions cleared and the river widened to its ancient breadth' ... or so it is claimed." [Nene]	032 - Nene	11/9/99
	1713		1713 [p131] "... an Act of Parliament was passed for making the river navigable from Peterborough to Northampton ... " [Nene]	032 - Nene	11/9/99
	1884		1884 autumn Observer at Northampton (The Holly's) noted p[90]: "The town was on short supply of water during a great part of the year - from 7 to 10 in the summer months, and 6 to 12 at the end of the year."	032 - Nene	1/5/2000
	1880	07	1880 July 14 Rainfall observer at Northampton noted, p[14]: "Heavy rain all day; total fall , 1.74 in., causing a flood on the outskirts of the town, with destruction of property and loss of life." [ha 032]	032 - Nene	5/16/2000
	1622	07	1622 July 2 Northampton, p102, identifying the floods of July 1622, May 1633, Christmas 1821 and July 1875 as the worst in 250 years: "On the 2nd July 1622, when the flood was so high that people in the south and west parts of the town had to be carried about in boats ..."	032 - Nene	5/16/2000
	1663	05	1663 May 6 Northampton, p102, identifying the floods of July 1622, May 1663, Christmas 1821 and July 1875 as the worst in 250 years: "... on the 6th May, 1663, when the water came as high as St. John's Hospital, forcing away two of the arches of the South Bridge..."	032 - Nene	5/16/2000
	1821	12	1821 December Northampton, p102, identifying the floods of July 1622, May 1633, Christmas 1821 and July 1875 as the worst in 250 years: "... at Christmas, 1821, when the water washed away the foundations, &c., of several houses and buildings at the lower end of town.	032 - Nene	5/16/2000
	1875	07	1875 July Northampton, p102, identifying the floods of July 1622, May 1663, Christmas 1821 and July 1875 as the worst in 250 years: "Fields adjoining rivers canals, and brooks, were entirely submerged, while in many instances the water ran over the roads; hay and grain crops considerably damaged; much injury done to a tan yard by the pits being filled with rain water, and the liquor spoilt, an engine was set to pump out the water, but its furnace was gradually put out and rendered useless. Most mills breweries, foundries &c., had to stop work on account of the floods, the engines fires being in many cases extinguished ... Many of the inhabitants, remembering the floods in 1849 and 1872, had prepared forth the recent one by stopping up likely places for its entrance, or removing their property either to buildings standing higher, or to upper parts of their houses."	032 - Nene	5/16/2000
	1849		1849 p102: Northampton flood still remembered in the higher one(s) of July 1875.	032 - Nene	5/16/2000

	1872		1872 p102: Northampton flood still remembered in the higher one(s) of July 1875.	032 - Nene	5/16/2000
	1875	07	1875 July 14/22 "In the fens of Cambridgeshire and Northamptonshire the water is said to cover the country for miles; the valley of the Nene, near Peterborough, is flooded..."	032 - Nene	5/19/2000
	1875	07	NOTES ON THE FLOOD OF- JULY 15TH ... Northampton - The Nene over its banks; great quantities of hay spoilt ...	032 - Nene	5/19/2000
	1897	08	1897 August Rainfall observer at Daventry (Fawsley) noted p[62]: "Following a very dry July, 6.10 in. of rainfell, the greatest in any month since observations began in 1879." [ha 032, Nene headwater]	032 - Nene	8/4/2000
	1951	04	"On April 10 the flow of the River Nene at Northampton was nine times the average winter flow..."	032 - Nene	10/1/2004
	1663	05	Kislingbury, west of Northampton: " 1663:May Flood. Probably half to two thirds of the houses were flooded to a depth of over 4ft."	032 - Nene	12/8/2004
	1998	04	Kislingbury, west of Northampton: "Very serious flooding again experienced in the village. The worst in living memory"	032 - Nene	12/8/2004
	2003		Kislingbury, west of Northampton: 2003 Flood defences built by the Environment Agency along the river bank from The Whirly up to and including The Bridge and on to the playing fields. Cost £1.4 million"	032 - Nene	12/8/2004

Table E3: History of flooding in the Great Ouse catchment.

Ref http://www.dundee.ac.uk/geography/cbhe/

Year	Month	Quotation	River basin	Entry date
1852	11	1852 November 25 [page 199] "Northamptonshire and Cambridgeshire suffered severely. Both the Midland and North-Western Railway traffic was interrupted. Whittlesea Mere, which had recently been drained at a vast expense, and had been brought into rich cultivation, was again an expanse of water, with no present hope of drainage, the whole country around being in a similar state. At Cambridge the students were rowing over the country, the fens and Isle of Ely being one sheet of water... Many individual cases of drowning occurred; large numbers of sheep were drowned; hares, rabbits, wild animals, and birds perished in vast numbers; all farm industry was interrupted, and low fevers became prevalent." [ha032, 033]	033 - Great Ouse	8/12/99
1914	12	1914 December 30 Observer at Blisworth noted p[26] "Large floods out" [R. Tove]	033 - Great Ouse	10/27/99
1875	07	1875 July "Brackley - The lower part of Syresham is so flooded that communication between one part of the village and another is stopped." [ha 033, Great Ouse headwater]	033 - Great Ouse	6/14/2000

Appendix G – Geology Maps

G.1 Geological and Hydrogeological Setting in Northampton

G.1.1 Introduction

52. The geology of the Northampton area is shown on BGS 1:63,360 Scale Geological Map Sheet No. 185 as shown in Figure F-1.

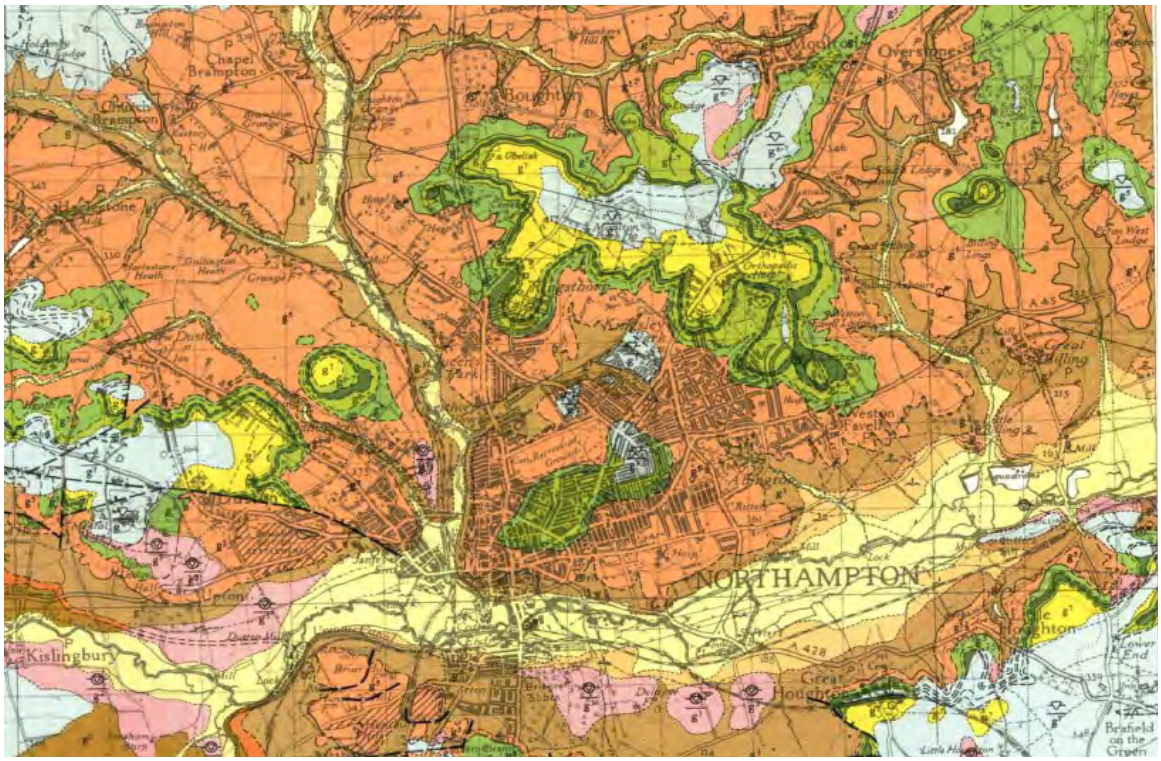


Figure F-1: Northampton Geological Map Sheet No. 185

53. The geological strata present around the Northampton area, and a summary of both their hydrogeological properties and their potential for infiltration drainage are described briefly on Table F-1.

G.1.2 Solid Strata

54. Clay strata (Upper Lias Clay) underlie much of the areas along the lower lying valleys associated with the River Nene and Grand Union Canal. The Environment Agency (EA) classifies these deposits as non-aquifer because they do not readily store or transmit groundwater.

55. Northampton Sand deposits (Inferior Oolite Series) underlie the majority of the study area. The Northampton Sands comprise sandy ironstone and sandstone and is classified by the EA as a minor aquifer.

56. Sequence of Lower Estuarine and Upper Estuarine Limestone deposits are present across areas of higher ground, around Maulton Park in the north, Kings Heath and in a line extending from Duston north-westwards along the line of Berrywood Road. The Great Oolite limestone caps the higher ground to the east of the study area and in areas around Kings Heath and Duston. The Lower and Upper Estuarine Series comprise mudstones, siltstones, sandstone and limestone respectively and are classified as a minor aquifer. The Great Oolite Limestone is classified as a major aquifer.

G.1.3 Drift Deposits

57. Drift deposits primarily comprise alluvium associated with the River Nene and Grand Union Canal. These deposits tend to be relatively thin and limited in extent. Further to the south, there are more significant sand and gravel drift deposits associated with the River Nene and isolated pockets around Dallington. Significant deposits of Glacial Till are present extending from Duston north-westwards along the line of Berrywood Road.

58. Drift deposits tend to have a shallow water table and are in hydraulic continuity with, and drained by adjacent rivers and streams. When levels in these watercourses are high less groundwater will be able to drain away.

Table F-1: Geological strata outcropping beneath Northampton and their hydrogeological properties

Geology			Geological and Hydrogeological Properties[1]	Infiltration Drainage Potential[2]	Distribution and comment[3]
Age	Formation	Unit			
Quaternary (Pleistocene and Recent)	Alluvium		Primarily silt and clay, occasional sand and gravel. Low intergranular permeability.	Poor	Localised - river flood plains. Minor occurrence.
	Glacial Sand & Gravel		Sand and Gravel. Moderately permeable.	Good	Localised. Minor occurrence.
	Glacial Till		Likely to be primarily clays with occasional sands and gravels. Mostly impermeable.	Poor	Localised – across south east. Moderate occurrence.
Upper Jurassic	Great Oolite Limestone		Limestones	Moderate	Localised in areas of higher ground - Kings Heath and Duston. Minor occurrence.

Geology			Geological and Hydrogeological Properties[1]	Infiltration Drainage Potential[2]	Distribution and comment[3]
Age	Formation	Unit			
	Upper Estuarine Series		Limestones	Moderate	Localised in areas of higher ground - Kings Heath and Duston. Minor occurrence.
	Lower Estuarine Series		Mudstones, sandy mudstones, siltstone and sandstone. Typically 2m to 5m thick.	Moderate	Localised in areas of higher ground - Kings Heath and Duston
	Northampton Sands		Sandy ironstone and sandstone	Moderate	Centre of study area. Moderate occurrence
	Upper Lias Clays		Mudstones and siltstones	Poor	Associated with lower lying valleys associated with River Nene and Grand Union Cana. Moderate occurrence.

Notes to Table F-1:

1.Generalised descriptions only. Strata thickness and depth not always available. Major impermeable units may have very localised more permeable units but these are unlikely to be significant in extent.

2.The infiltration drainage potential is based primarily on geological/lithological properties only – groundwater levels or topographic setting may further limit potential.

3.Refer geological map for distribution, some deposits described here may occur outside the study area.

G.1.4 Soils

59. Soil type provides a generic description of the drainage characteristics of soils. This will dictate, for example, the susceptibility of soils to water logging or the capacity of a soil to freely drain to allow infiltration to groundwater. Soil type may only be fully determined after suitable ground investigations, although the mapped soil types found beneath the study area are briefly described in Table F-2 below, which gives an indication of their permeability and infiltration potential.

Table F-2: Soil associations in the Northampton area and their characteristics1

Symbol and sub group2	Soil Association	Geology (see below)	Soil characteristics
544	Banbury	Jurassic and Cretaceous Ironstone	Well drained brashy fine and coarse loamy ferruginous soils over ironstone. Some deep fine loamy over clayey soils with slowly permeable subsoils and slight seasonal waterlogging.
712b	Denchworth	Jurassic and Cretaceous Clay	Slowly permeable seasonally waterlogged clayey soils with similar fine loamy over clayey soils. Some fine loamy over clayey soils with only slight seasonal waterlogging and some slowly permeable calcareous clayey soils. Landslips and associated irregular terrain locally.
813b	Fladbury 1	River alluvium	Stoneless clayey soils, in places calcareous, variably affected by groundwater. Flat land. Risk of flooding.
411d	Hanslope	Chalky Till	Slowly permeable calcareous clayey soils. Some slowly permeable non-calcareous clayey soils. Slight risk of water erosion.
541r	Wick 1	Galciofluvial or river terrace drift	Deep well drained coarse loamy and sandy soils, locally over gravel. Some similar soils affected by groundwater. Slight risk of water erosion.

Notes to Table F-2:

i. Based on "Soils of South West England. 1:250,000 Sheet 3. Soil Survey of England and Wales. 1983 and accompanying legend (which provides descriptions above). Note that UK soils mapping is being revised and some soils types and associations may change.

ii. The soils are listed approximately in order of extent/occurrence in the study area and include significant groups only.

G.2 Geological and Hydrogeological Setting in Daventry

G.2.1 Introduction

60. The geology of the Daventry area is shown on BGS 1:63,360 Scale Geological Map Sheet No. 185 as shown in Figure F-2.

61. The geological strata present around the Daventry area, and a summary of both their hydrogeological properties and their potential for infiltration drainage are described briefly on Table F-3.

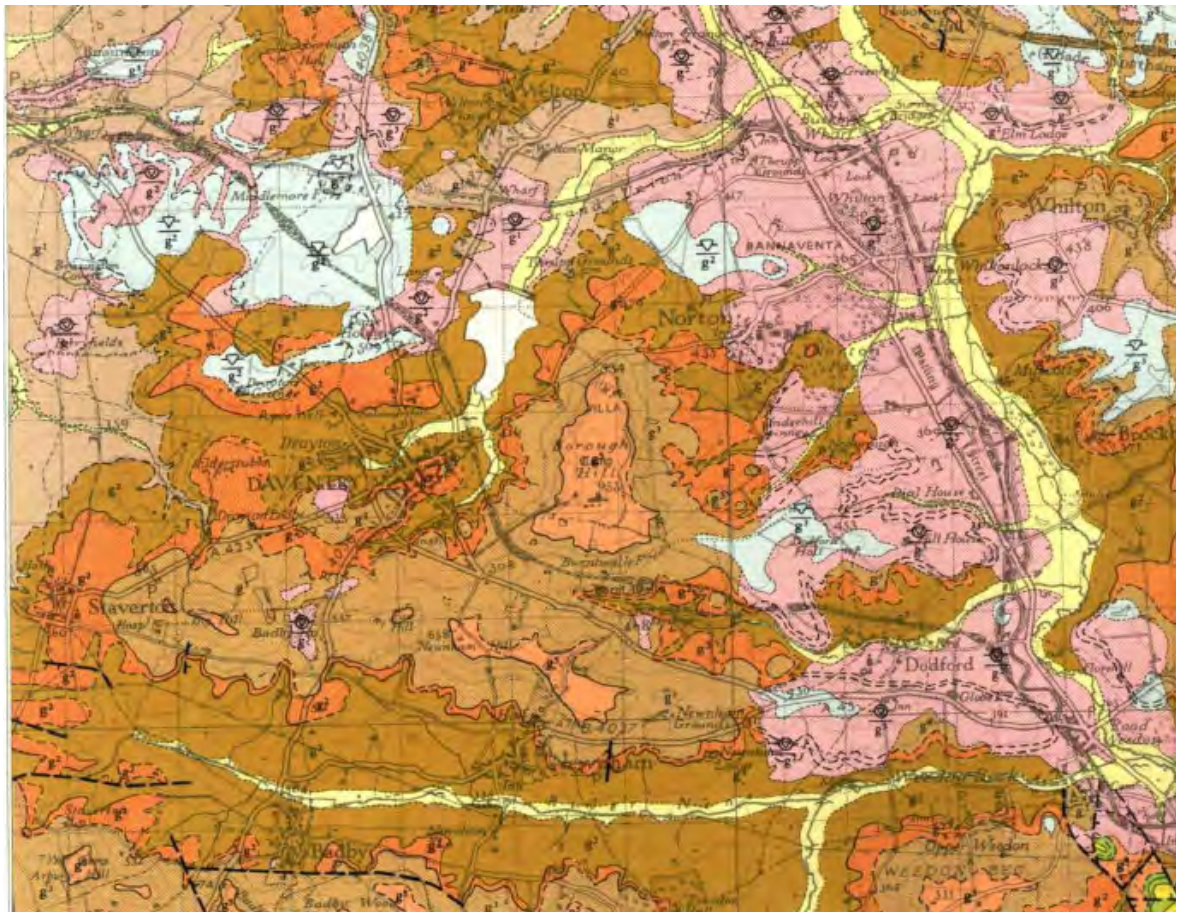


Figure F-2: Daventry (Geological Map Sheet No. 185)

G.2.2 Solid Strata

62. Silt and clay strata (Middle Lias Silt & Silty Clay and Lower Lias Clay) and Marlstone Rock Bed underlie much of the study area extending from Newham Grange in the south, northwards through Norton to Thrupp Lodge and Daventry Reservoir. The Marlstone Rock bed is a mix of interbedded limestone, sandstone, and mudstone

beds. The Environment Agency (EA) classifies these deposits as a non-aquifer because they do not readily store or transmit groundwater. Groundwater occurs both in fissures in the limestones and from within the intergranular permeability developed in the sandstones.

63. Upper Lias Clays are present along the western edge of the study area on the flanks of Borough Hill. The Upper Lias Clays comprise mudstone and siltstone and is classified by the EA as a non-aquifer.

64. Northampton Sands (Inferior Oolite Series) occur on the crest and upper flanks of Borough Hill to the west of the study area. The Northampton Sands comprise sandy ironstone and sandstone and is classified by the EA as a minor aquifer.

G.2.3 Drift Deposits

65. Drift deposits primarily comprise glacial sand and gravel present in the north of the study area around Monksmoor and to the east of the study area. Isolated pockets of glacial sand and gravel occur in the south around Newnham Grange.

66. Glacial Till is present to the north of Norton and in the valley around Dodford Hall.

67. Alluvium is present in the north of the area associated with an un-named watercourse. Alluvial deposits tend to be relatively thin and limited in extent. Alluvial deposits tend to have a shallow water table, in hydraulic continuity with, and drained by adjacent rivers and streams. When levels in the watercourses are high, less groundwater will be able to drain away.

Table F-3: Geological strata outcropping beneath Daventry and their hydrogeological properties

Geology			Geological and Hydrogeological Properties[1]	Infiltration Drainage Potential[2]	Distribution and comment[3]
Age	Formation	Unit			
Quaternary (Pleistocene and Recent)	Alluvium		Primarily silt and clay, occasional sand and gravel. Low intergranular permeability.	Poor	Localised - river flood plains. Negligible occurrence.
	Glacial Sand & Gravel		Sand and Gravel. Moderately permeable.	Good	Across north and east of study area. Moderate occurrence.
	Glacial Till		Likely to be primarily clays with occasional sands and gravels. Mostly impermeable.	Poor	Localised – across north and isolated pocket sin south. Moderate occurrence.
Upper Jurassic	Northampton Sands		Sandy ironstone and sandstone	Moderate	Localised on crest of Borough Hill to the wets of the study area. Minor occurrence
	Upper Lias Clays		Mudstones with siltstones	Poor	Across western edge of study area on flank of Borough Hill. Minor occurrence.
	Marlstone Rock Bed		Interbedded limestone, sandstone, and mudstone beds	Moderate	Occurs as thin band running along eastern edge of study area. Minor occurrence.
	Middle Lias Silt & Clay		Silts and Clays	Poor	Occur across the study area from north to south. Moderate occurrence

Notes to Table F-3

i. Generalised descriptions only. Strata thickness and depth not always available. Major impermeable units may have very localised more permeable units but these are unlikely to be significant in extent.

ii. The infiltration drainage potential is based primarily on geological/lithological properties only – groundwater levels or topographic setting may further limit potential.

iii. Refer to geological map for distribution, some deposits described here may occur outside the study area.

G.2.4 Soils

68. Soil type provides a generic description of the drainage characteristics of soils. This will dictate, for example, the susceptibility of soils to water logging or the capacity of a soil to freely drain to allow infiltration to groundwater. Soil type may only be fully determined after suitable ground investigations, although the mapped soil types (soil association) found beneath the study area are briefly described in Table H-4 below, which gives an indication of their permeability and infiltration potential.

Table F-4: Soil associations in the Daventry area and their characteristics[1]

Symbol and sub group2	Soil Association	Geology (see below)	Soil characteristics
712b	Denchworth	Jurassic and Cretaceous Clay	Slowly permeable seasonally waterlogged clayey soils with similar fine loamy over clayey soils. Some fine loamy over clayey soils with only slight seasonal waterlogging and some slowly permeable calcareous clayey soils. Landslips and associated irregular terrain locally.
544	Banbury	Jurassic and Cretaceous Ironstone	Well drained brashy fine and coarse loamy ferruginous soils over ironstone. Some deep fine loamy over clayey soils with slowly permeable subsoils and slight seasonal waterlogging.
572h	Oxpasture	Drift over Jurassic and Cretaceous clay shale	Fine loamy over clayey and clayey soils with slowly permeable subsoils and slight seasonal waterlogging. Some slowly permeable seasonally waterlogged clayey soils.
411d	Hanslope	Chalky Till	Slowly permeable calcareous clayey soils. Some slowly permeable non-calcareous clayey soils. Slight risk of water erosion.
541r	Wick 1	Galciofluvial or river terrace drift	Deep well drained coarse loamy and sandy soils, locally over gravel. Some similar soils affected by groundwater. Slight risk of water erosion.

711f	Wickham 2	Drift over Jurassic and Cretaceous clay or mudstone	Slowly permeable seasonally waterlogged fine loamy over clayey, fine silty over clayey and clayey soils. Small areas of slowly permeable calcareous soils on steeper slopes.

Notes to Table F.4:

i. Based on "Soils of South West England. 1:250,000 Sheet 3. Soil Survey of England and Wales. 1983 and accompanying legend (which provides descriptions above). Note that UK soils mapping is being revised and some soils types and associations may change.

ii. The soils are listed approximately in order of extent/occurrence in the study area and include significant groups only.

G.3 Geological and Hydrogeological Setting in South Northamptonshire

G.3.1 Introduction

69. The geology of the South Northants area is shown on BGS 1:63,660 Scale Geological Map Sheet No. 202 Towcester as shown in Figure F-3.

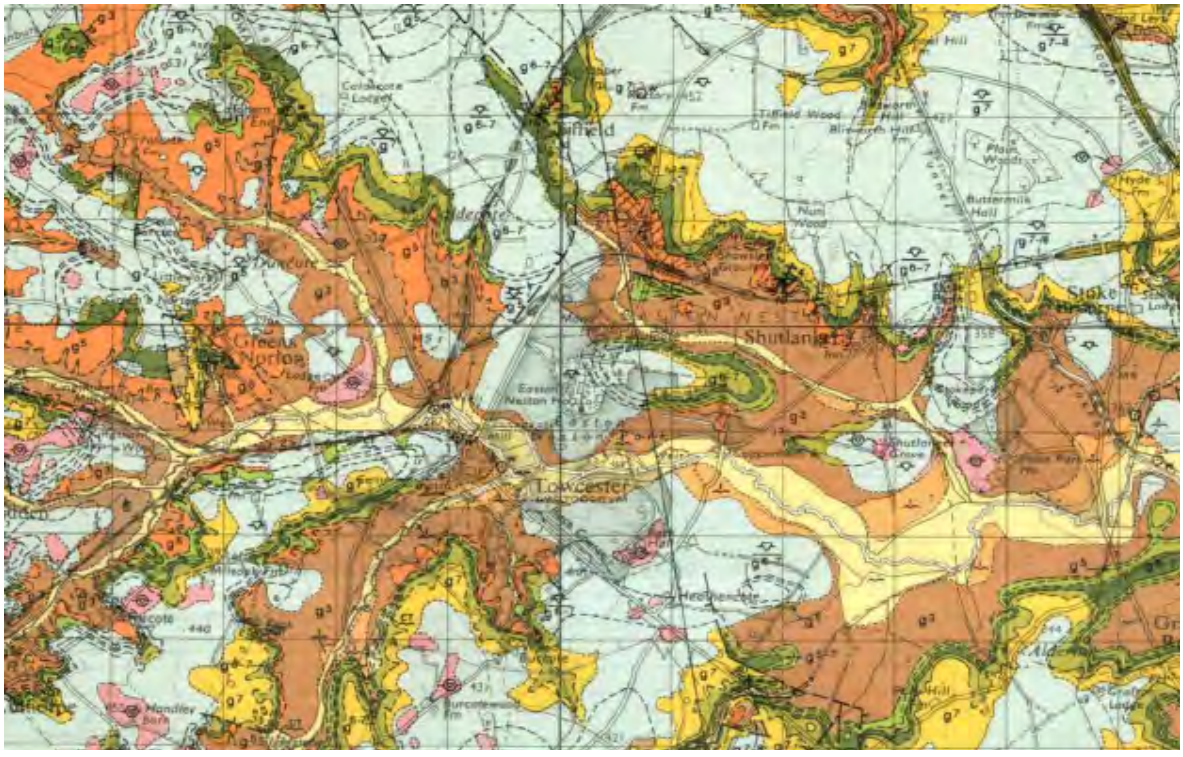


Figure F-3: South Northamptonshire Geological Map Sheet No. 202

70. The geological strata present around the South Northants area, and a summary of both their hydrogeological properties and their potential for infiltration drainage (see Section H3.3 below) are described briefly on Table H-5.

G.3.2 Solid Strata

71. Mainly Clay (Lower Jurassic) deposits underlie the north western and central areas. The Mainly Clay comprises mainly mudstones with some siltstones and is classified by the Environment Agency as a non aquifer as the strata does not readily store or transmit groundwater.

72. Northampton Sands (Inferior Oolite Series) and Lower Estuarine Series are present in a band running north to south through the centre of the study area. The Northampton Sands comprise sandy ironstone and sandstone and is classified by the EA as a minor aquifer.

73. Limestones of the Upper Estuarine Series are present across much of the central and western parts of the study area and are classified by the EA as a minor aquifer. Groundwater occurs in fissures in the limestones.

74. Limestones (Blisworth) underlie much of the southern area around Wood Burcote. Blisworth Limestones are a mixture of limestones, thin marls, mudstone, packstone and wackestones. The Blisworth Limestone is classified by the EA as a major aquifer and is the most significant aquifer in the study area.

G.3.3 Drift Deposits

75. Drift deposits primarily comprise the alluvium and river terrace deposits associated with the tributary of the River Tove running through the study area. These deposits tend to be relatively thin and limited in extent. Drift deposits tend to have a shallow water table, in hydraulic continuity with, and drained by adjacent rivers and streams. When levels in these watercourses are high less groundwater will be able to drain away.

76. Further to the south, between Wood Burcote and Swinneyford Farm, there are isolated pockets of glacial sand and gravel. Across the southeast of the site extending from Wood Burcote to the A5 more significant deposits of boulder clay are present.

Table F-5: Geological strata outcropping beneath South Northants and their hydrogeological properties

Geology			Geological and Hydrogeological Properties1	Infiltration Drainage Potential2	Distribution and comment3
Age	Formation	Unit			
Quaternary (Pleistocene and Recent)	Alluvium		Primarily silt and clay, occasional sand and gravel. Low intergranular permeability.	Poor	Localised - river flood plains. Minor occurrence.
	River Terrace Deposits		Sand and Gravel. Moderately permeable.	Good	Localised - river flood plains. Minor occurrence.
	Glacial Sand & Gravel		Sand and Gravel. Moderately permeable.	Good	Localised. Minor occurrence.

Geology			Geological and Hydrogeological Properties1	Infiltration Drainage Potential2	Distribution and comment3
Age	Formation	Unit			
	Glacial Till		Likely to be primarily clays with occasional sands and gravels. Mostly impermeable.	Poor	Localised – across south east. Moderate occurrence.
Upper Jurassic	Blisworth Limestone		Limestones with thin marls and mudstones, packstones and wackestones. Typically from 6 m to 7m thick, up to about 12m.	Moderate.	Across north of study area.
	Upper Estuarine Series		Limestones	Moderate.	Centre of study area. Minor occurrence
	Lower Estuarine Series		Mudstones, sandy mudstones, siltstone and sandstone. Typically 2m to 5m.	Moderate	Centre of study area. Minor occurrence
	Northampton Sands		Sandy ironstone and sandstone	Moderate.	Centre of study area. Minor occurrence
Lower Jurassic	Mainly clay		Mainly clays	Poor	Across north of study area. Moderate occurrence.

Notes to Table F-5:

i. Generalised descriptions only. Strata thickness and depth not always available. Major impermeable units (e.g. Mainly clay) may have very localised more permeable units but these are unlikely to be significant in extent.

ii. The infiltration drainage potential is based primarily on geological/lithological properties only – groundwater levels or topographic setting may further limit potential.

G.3.4 Soils

77. Soil type provides a generic description of the drainage characteristics of soils. This will dictate, for example, the susceptibility of soils to water logging or the capacity of a soil to freely drain to allow infiltration to groundwater. Soil type may only be fully determined after suitable ground investigations, although the mapped soil types found beneath the study area are briefly described in Table F-6 below, which gives an indication of their permeability and infiltration potential.

Table F-6: Soil associations in the South Northants area and their characteristics[1]

Symbol and sub group[2]	Soil Association	Geology (see below)	Soil characteristics
711f	Whickham2	Drift over Jurassic and Cretaceous clay or mudstone	Slowly permeable, seasonally waterlogged fine loamy over clayey, fine silty over clayey and clayey soils. Small areas of slowly permeable calcareous soils on steeper slopes.
511b	Moreton	Jurassic clay and limestone	Well drained calcareous clayey and fine loamy soils over limestone. In places shallow and brashy. Some deeper slowly permeable calcareous clayey soils.
411d	Hanslope	Chalky Till	Slowly permeable calcareous clayey soils. Some slowly permeable non-calcareous clayey soils. Slight risk of water erosion.
813b	Fladbury 1	River Alluvium	Stoneless clayey soils, in places calcareous, variably affected by groundwater. Flat land. Risk of flooding

Notes to Table F.6:

i. Based on "Soils of South East England. 1:250,000 Sheet 6. Soil Survey of England and Wales. 1983 and accompanying legend (which provides descriptions above). Note that UK soils mapping is being revised and some soils types and associations may change.

ii. The soils are listed approximately in order of extent/occurrence in the study area and include significant groups only.

Appendix H – SuDS Guidance

H.1 Introduction

78. The aim of this section is to provide guidance on the design, maintenance and adoption of SUDS measures recommended for the development sites. Developers should refer to 'The SUDS Manual' (CIRIA C697, 2007) or updated versions for the latest best practice on the planning, design, construction, operation and maintenance of SUDS. Key elements from that manual have been highlighted in this appendix, which is not intended to form a comprehensive guide for developers but instead to emphasise the most important elements relevant for the West Northamptonshire area.

H.2 Design of SUDS

79. Overall, a precautionary approach should be adopted to minimise risks to people and property, and standards should be agreed with the Environment Agency and Local Authority and any other body responsible for adoption and maintenance prior to detailed design.

- The minimum requirements for the site drainage should be for the system to cater for the 30 year critical rainfall event without causing any surface water flooding. The system performance should also be tested for a short duration (1 hour) and critical duration 100 year and 100 year plus climate change rainfall event to ensure properties are not affected by temporary ponding and that there are safe overland flow paths. The runoff from the 100 year critical storm including climate change must be retained on site before safe discharge at pre-development rates to prevent any detrimental impact on third parties.
- The drainage system should be designed to empty from full within 24 to 48 hours so that it can receive runoff from subsequent storms. If this is not feasible, the drainage system should be tested for long duration events to ensure it is not overwhelmed.
- To prevent the risk of SUDS operation failure in high groundwater levels, all infiltration and storage areas must be designed to operate during the 1% annual exceedance probability groundwater level.
- To cater for loss of infiltration capacity over time, a factor of safety must be included in all infiltration units, determined by the consequences of failure and size of area being drained.
- Climate change must be accounted for in all drainage calculations.

H.2.1 Prevention and Source Control SUDS

80. Prevention measures include limiting the impermeable surface source area of the development, including reduced road lengths and widths, minimising building footprints, and using porous materials for driveways, car parks and pavements. Source control measures manage the quantity and quality of runoff at its source, and include green roofs, soakaways and rainwater harvesting. Where source control SUDS are used to prevent surface water runoff from individual properties from entering the public sewer network, sewerage undertakers will allow customers to claim a reduction in their water charges (AWS customers should see, http://www.anglianwater.co.uk/_assets/media/Surface-water-drainage-application.pdf).

81. Prevention and source control SUDS should be used in particular to prevent runoff from small rainfall events and the initial stages of large events, in order to mimic natural drainage systems in which runoff does not occur at these times. These events also tend to have the lowest water quality, due to the 'first flush' effect. Interception storage should be provided to prevent any runoff from rainfall of at least 5 mm depth, but

preferably 10 mm. Further key design criteria for a selection of source control SUDS are given in Error! Reference source not found.. The potential poor water quality of this runoff should be taken into account when considering suitable SUDS.

82. Whilst source control measures play a valuable role in run-off management, their contributions are comparatively minor especially for large design return periods. Their success also relies heavily upon appropriate maintenance and management, typically by the private property owner at the domestic dwelling scale, who may be unfamiliar with the location, design and performance of such measures.

SUDS Feature	Key Design Criteria
Green Roofs	• Minimum roof pitch of 1 in 80, maximum of 1 in 3. • Structural roof strength must provide for full additional load of saturated green roof elements. • Hydraulic design should follow guidance in BSEN12056-3 (BSI, 2000) • Multiple outlets should be used to reduce risks from blockages. • A lightweight soil medium and appropriate vegetation consisting of native plant species should be used. • The Environment Agency's green roof toolkit should be referred to: http://www.environment-agency.gov.uk/business/sectors/91967.aspx
Soakaways	• Normally designed to 1 in 10 year event but should preferentially be designed for 1 in 30 year event. • Site investigations are required by Building Regulations to determine infiltration rates and an appropriate factor of safety should be used. • Appropriate pre-treatment such as an oil and sediment collector is required for water quality purposes. • Soakways must not discharge into contaminated ground. • Fill material should provide >30% void space. • There should be a minimum distance of 1 m from the base to the seasonally high groundwater table. • The maximum acceptable depth for soakaways is 2 m below existing ground levels unless otherwise agreed in writing with the Environment Agency. • Soakaways must be sited at least 5 m from building foundations. • Communal soakaways should be avoided to prevent confusion over ownership and maintenance responsibilities.
Water butts	• Must be designed with a throttled overflow to drain excess flows away, leaving a storage volume available for attenuation of future storm events.
Rainwater harvesting	• Design is dependent on demand requirements, contributing surface area, stormwater management requirements and seasonal rainfall characteristics. • An overflow should be included to cater for excess inflows and ensure storage is available to maximise capture of rainwater in extreme events. • Water should generally be stored underground to minimise the growth of hazardous bacteria. • The first flush may need to be diverted away from the main storage tank to prevent most of the pollution from entering. This may limit the system's capacity to intercept water in small events.
Pervious pavements	• Must be structurally designed for site purpose and vehicular loading. • Surface infiltration rate should be order of magnitude greater than the design rainfall intensity. • A temporary subsurface storage volume should be provided to meet the requirements for infiltration and/or controlled discharge. • A geotextile filtration layer can be incorporated to improve water quality. • Soil and other material must be prevented from contaminating the surface and sub-structure. • Pervious Pavements shall not discharge into contaminated ground.

Table H-1: Key design criteria for a range of source control SUDS. Based on 'The SUDS Manual' (CIRIA C697, 2007).

H.2.2 Pathway Control SUDS

83. Pathway control SUDS should be used to manage the flow of surface water between storage SUDS elements. The natural drainage paths of the site should be followed and original ditches and streams retained and integrated into the design. Open systems should be used in preference to piped systems. There should be a

presumption against culverting of existing watercourses and a buffer strip should be left along each side of the watercourses for maintenance and emergency access, as follows:

- For 'Main Rivers', the EA should be consulted regarding the proposed works. An undeveloped buffer strip of 9 m must be left adjacent to each bank of watercourses in the Anglian region.
- For 'Ordinary Watercourses', the relevant IDB should be consulted if the development site lies within their drainage district boundaries.
- For all other watercourses, the Local Authority should be consulted. At present there are no byelaws regarding buffer strips. However it is recommended that a minimum of 7 m buffer strip is provided to allow maintenance and emergency access. It is recommended that the Local Authority consider the preparation of local byelaws for drainage that reflect their new responsibilities under the forthcoming Floods and Water Management Bill.
- It is recommended that this buffer strip is increased where possible to retain existing habitats or used as an opportunity to create new habitats. Habitats could include marshy grassland, wet woodland, reedbeds, ponds and scrapes and this would increase the ecological value of the buffer strip as well as providing important links between habitats across the development area. All planting should consist of native species.

84. Pathway control SUDS could be provided purely to control conveyance, e.g. through flow control structures, but can also be used in combination to improve water quality and to store water for infiltration. For example, filter strips are vegetated strips of land designed to accept and treat overland runoff before it enters the next SUDS element. These could therefore be used in the buffer zone adjacent to watercourses to improve water quality and encourage infiltration. Similarly, infiltration / filter trenches can be used to filter and convey surface water to downstream SUDS components while encouraging infiltration to groundwater. The key design criteria for a selection of pathway control SUDS are given below.

SUDS Feature	Key Design Criteria
Filter strips	• Minimum width of 6 m, with minimum slopes of 1 in 50 and maximum slopes of 1 in 20. • Runoff from adjacent impervious areas should be evenly distributed across the strip to prevent erosion. The water depth should be less than 50 mm for the design water quality treatment event. • Planted with grass or other dense vegetation that is able to prevent erosion and capable of growing through silt deposits.
Infiltration / filter trenches	• Excavated trench of 1 – 2 m depth filled with stone aggregate or other void-forming media. • Infiltration trenches allow infiltration to groundwater in permeable areas. Filter trenches do not allow infiltration to groundwater, but can be used to control conveyance and improve water quality of surface water to downstream elements. • Not intended to act as a sediment trap and therefore require effective upstream pre-treatment to remove sediment and fine silts which would block the filtration pores. • Infiltration trenches should not be used where groundwater is vulnerable to pollution or to drain developments which are pollution hotspots. • Infiltration Trenches shall not discharge into contaminated ground. • Observation wells and/or access points for maintenance should be included for perforated pipe components.
Swales	• Linear vegetated strips for storage or conveyance of water, designed to allow infiltration where appropriate. • Velocities during extreme events must be limited to 1 – 2 m/s, depending on soil type, to prevent erosion. • The flow height of water during frequent events should be maintained below the top of the vegetation (typically 100 mm). • The maximum side slopes should be 1 in 3, where soil conditions allow. • The minimum base width should be 0.5 m.

SUDS Feature	Key Design Criteria
	• Will require lining to prevent infiltration into contaminated ground . • Check dams should be used to reduce velocities and increase storage times.
Open channels	• Uncontrolled conveyance via open channels to a point of discharge from the site is not acceptable. • The relevant drainage authority (EA / IDB / local authority) must be consulted for any works to existing watercourses. • If additional flows are to be conveyed via existing watercourses to new storage facilities, a site-specific flood risk assessment should be used to ensure there is no additional flood risk from the watercourse due to the increased flows. Channel enhancements should be used to improve capacity, through soft engineering techniques with channel profile graded to suit a range of aquatic ecology. Runoff must be pre-treated to ensure no detriment to water quality. Culverting of watercourses should be avoided. • Deep and steep-sided ditches should be avoided.
Pipes	• Piped systems should be avoided where possible. • Sewers for Adoption 6th Edition (2006) require a minimum pipe size of 150 mm for public sewer systems with minimum gradient of 1 in 150, although control orifices may be as small as 80 mm if agreed with the adopting authority. All flow control structures such as hydrobrakes must be designed to prevent blockage and for easy maintenance. • Synthetic pipework should be from recycled sources. • Any SUDS pipework that is to be adopted must be designed assuming that all hard surfaces contribute runoff at a normal rate even if it is attenuated or reduced in volume by upstream SUDS components. This precaution is currently being taken to ensure that long-term failure or change of drainage practice in the future will not result in flooding due to pipe capacities being overloaded. Exceptions to this rule must be agreed with the adopting authority.

Table H-2: Key design criteria for a range of pathway control SUDS. Based on 'The SUDS Manual' (CIRIA C697, 2007).

H.2.3 Site Control SUDS

85. Site control SUDS should be provided to limit runoff from the site to greenfield conditions. Brownfield sites must also aim to achieve greenfield conditions in order to improve flood risk downstream. Three conditions must be met:

- The maximum rate of surface water runoff discharge from a site must be no greater than the equivalent greenfield runoff rate. The system should be tested over a range of storm events (e.g. 1 in 1 year, 1 in 30 year and 1 in 100 year) to ensure compliance for both frequent and rare events. This should be achieved using attenuation storage with outlet flow controls.

- The total volume of runoff during the design storm event should be restricted to the greenfield equivalent during the flood event and infiltrated to groundwater or released at a low rate (e.g. 2 l/s/ha) afterwards. This should be achieved using long term storage with outlet flow controls.

- Storage should be included to allow sedimentation and improvements in water quality. Depending on the upstream treatment components, the water quality treatment volume should be sized to accommodate 10 mm of runoff from impermeable surfaces. 'Online' storage is preferred to 'offline' storage in order to give maximum treatment benefits to all runoff. Improvements in water quality should where possible be provided through ecological features such as reed beds and wet woodlands, profiled to give maximum benefit to ecology. All planting should consist of native species.

86. The general principle should be to reproduce the natural drainage conditions of the site. For permeable sites, infiltration techniques should be used to ensure that the annual rate of recharge to groundwater is the same or greater than greenfield conditions (provided there is no detrimental impact on groundwater flood risk downstream). For impermeable sites, large volumes of storage may need to be provided to restrict runoff in

flood events to greenfield conditions, with release at a low rate afterwards. The key design criteria for a selection of site control SUDS are given below.

87. The location of large site control SUDS features should be carefully considered. On steep sites, large site control SUDS should be located at the base of slopes to prevent increased slope instability or re-emergence of groundwater downslope. SUDS should be linked to existing ecological water and wetland features to allow the creation of habitat corridors that may also give other recreation and amenity benefits to the community. Where there are existing wetland habitats within the site boundaries, these should be enhanced and included in the development plans to create a network of green infrastructure. Conflicts between public access and conservation should be managed by ensuring public access is strategically planned to retain some water and wetland features as undisturbed habitats for wildlife.

88. Health and safety should be evaluated for all SUDS components, but is particularly relevant for larger features. Ponds should have shallow slopes, shelving edges, and life saving equipment to allow easy rescue, with strategically placed vegetation, information boards and fencing to discourage bathers. There should be safe vehicle access for maintenance and in emergencies. The design should not allow stagnant water to form. Underground storage should be avoided to reduce the hazards of maintenance in confined spaces. The residual risks of flooding due to embankment failure or blockage should be assessed to ensure the risks are managed appropriately.

SUDS Feature	Key Design Criteria
Underground storage / infiltration	• Should be avoided due to health and safety considerations of maintenance and access in confined spaces. • Standard storage design using greenfield limiting discharges to determine storage volumes. • Structural design must meet the relevant standards for appropriate surface loadings. • Modular geocellular systems should be used, wrapped either in a permeable geotextile for infiltration, or an impermeable membrane to provide storage. • Should not discharge into contaminated ground.
Infiltration basins	• Vegetated depressions designed to store runoff and infiltrate gradually into the ground. • Effective pre-treatment is required to remove sediments and fine silts prior to infiltration. • Should be designed to infiltrate the water quality treatment volume (10 mm runoff from impermeable surfaces) as a minimum. • Should not be used where groundwater is vulnerable to pollution or to drain pollution hotspots. • Should not discharge into contaminated ground.
Detention basins	• Detention volume should be sized to manage the design storm event via a constrained outflow mechanism. • The basin should have a minimum length : width ratio of 2:1, and maximum side slopes of 1:4 in most cases. • The basin should normally be dry, allowing the potential for dual land use for recreation. • Enhanced pollution control should be included through ecological elements at the outlet, such as reedbeds or wet woodland habitats.
Ponds	• Permanently wet detention basins with permanent pool volume sized for water quality treatment (10 mm runoff from impermeable surfaces) and temporary storage volume for flow attenuation. • Sedimentation should be managed in a forebay area or upstream pre-treatment. • The length : width ratio should be between 3:1 and 5:1, with a minimum depth of 1.2 m and maximum depth of 2 m for the permanent pool area. Side slopes should be less than 3:1. • The ponds should be an irregular shape with irregular profiling to improve habitat diversity. Reeds should be planted for pollution control and a wildlife shelf provided.
Wetlands	• Shallow ponds, wet woodlands and marshy areas that may detain water for extended periods of time. The permanent water body should include volume required for water quality treatment, with additional shallow temporary storage volume available for attenuation. • Sedimentation should be managed in a forebay area or upstream pre-treatment. • There should be a continuous baseflow to prevent stagnation of water and a combination of deep and shallow areas (maximum depth 2 m). The length : width ratio should be greater than 3:1. Side slopes should be shallow.

Table H-3: Key design criteria for a range of site control SUDS. Based on 'The SUDS Manual' (CIRIA C697, 2007).

Appendix I - Options for Demand Management

89. Key measures that in combination help achieve water neutrality, or limit the impact of development on the environment can include:

- Expanded metering;
- Enhanced regulation for water efficiency;
- Water efficient devices and retrofitting;
- Greywater recycling;
- Rain water and stormwater recycling;
- Education and community wide public awareness
- Economic measures and tariff structures.

90. The overall objective is that new development should have a benign effect upon the water environment. Where water neutrality cannot be achieved options for augmenting water resources can be considered, i.e. rain water harvesting.

Metering

91. The measures included in the scenarios above, in some cases, will not be practical to implement. Environment Agency preferred metering of 95% of existing properties by 2016 is an ambitious target and requires around 6,900 properties a year from 2010 to 2016 to be connected to a meter in the WCS area, at a cost of up to £500 each.

92. In 2008 60% of AWS customers were connected to a meter, which is about twice the national average and AWS forecast a continued annual 2% growth in meter uptake to 90% by 2035. Some areas such as the WCS area are considered water stressed and as such will be targeted for the AWS Enhanced Metering Project, accelerating penetration to 90% by 2023/2024. This targets customers, providing a comparison between unmeasured and measured bills, and a trial offering free household water efficiency assessments with installation of water efficiency devices.

93. Since October 2007, water companies within seriously water stressed areas have been given extended powers to increase compulsory metering. AWS have no current or developing policy for compulsory metering, though this is to be reviewed for AMP 6. AWS have not implemented enforced meter installation upon change of occupancy, which they have reviewed and consider uneconomic.

94. It is recommended that current metering uptake levels are continued as a minimum and further consideration taken to accelerate meter uptake, including meter installation upon change of occupancy.

Water Consumption in New Properties

95. A range of water consumption targets have been identified for new properties. The governments strategy has a requirement for a standard of 120 litres per day (l/p/d) for new properties which it anticipates will be achieved by ensuring that all new homes have fittings with a good standard of water efficiency. New requirements on water efficiency will be introduced into Building Regulations.

96. It is recommended that the Code for Sustainable Homes is supported as much as practicably possible depending upon each individual development. The code should be specifically targeted through local planning regime at the largest developments where the benefits from development wide collection systems would be greatest. Staggering development should also be considered so the largest developments are built later within the planning period, in the hope that by which time the code may be statutory and technology will be in place to make the more stringent levels of the code more cost-efficient and feasible.

97. Predictions for possible reductions in water consumption through the utilisation of water efficient fixtures and fittings for new homes are shown in Table I-1.

Fitting/appliance	Owner-ship	Volume (litre per use)	With power shower & low flush toilet		With power shower & dual flush toilet		With standard shower & low flush toilet		With standard shower & dual flush toilet	
			Use no/day	Use l/h/d	Use no/day	Use l/h/d	Use no/day	Use l/h/d	Use no/day	Use l/h/d
4,5 l flush toilet	1	4.5	3.1	14.0	0	0	3.1	14.0	0	0
4l/2l flush toilet	1	4	0	0	1	4	0	0	1	4
	1	2	0	0	2.1	4.2	0	0	2.1	4.2
Bath	0.15	70.0	1	10.5	1	10.5	1	10.5	1	10.5
Power shower	0.7	63.0	1	44.1	1	44.1	0	0	0	0
Standard shower	0.7	40.0	0	0	0	0	1	28.0	1	28.0
Hand basin	3.1	4.8	1	14.9	1	14.9	1	14.9	1	14.9
Kitchen tap	2.0	7.2	1	14.4	1	14.4	1	14.4	1	14.4
Washing machine	0.3	36.0	1	10.8	1	10.8	1	10.8	1	10.8
Hand clothes washing	0.0	32.0	1	1.0	1	1.0	1	1.0	1	1.0
Dishwasher	0.3	12.0	1	3.4	1	3.4	1	3.4	1	3.4
Dishwashing by hand	0.15	16.0	1	2.4	1	2.4	1	2.4	1	2.4
Outdoor use	1.0	0.8	1	0.8	1	0.8	1	0.8	1	0.8
Miscellaneous	0.9	4.8	0.9	3.8	0.9	3.8	0.9	3.8	0.9	3.8

Total				**120.0**		**114.2**		**103.9**		**98.1**
	Reduction (litre)			**Revised total (l/h/d)**						
Water recirculation	-4.6			**115.4**		**109.6**		**101.6**		**95.8**
Water butt plus pump	-0.8			**114.6**		**108.8**		**100.8**		**95.0**
Grey water direct recirculation	-7.0			**107.6**		**104.7**		**93.8**		**90.9**
Rainwater harvesting	-21.3			**94.1**		**89.8**		**80.3**		**75.9**

Table 1-1: Water Use in New Housing by Component.

Water Efficient Devices

98. The government expects the demand for water efficient products from new housing to help drive the market and improve the efficiency of everyday water using products over time. To further facilitate these improved levels of efficiency, the Water Supply (Water Fittings) Regulations 1999 will be reviewed. These cover for example the maximum water use of toilets, urinals, washing machines etc. The review will also consider enforcement issues, advances in technical standards and water conservation, and the case for setting new performance standards for key water fittings. This will also support the CSH.

99. Most water companies offer water efficient devices either free of charge or at a reduced price. These can include:

- Cistern displacement device, low flush toilet, dual flush toilet, retrofit dual flush valve;
- Push-on taps, aerated tap (bathroom), flow restrictors, aerated shower head;
- Contoured low volume bath;
- Shower timer;
- Flow recirculation;
- Low water use washing machine;
- Water butts.

Greywater Recycling

100. Greywater is wastewater from showers, baths, washbasins, washing machines and kitchen sinks, which can be reused to reduce water demands.

101. The physical and microbiological characteristics of greywater vary significantly depending on its origin. Water from baths, showers and wash basins is generally less heavily contaminated than that originating from the kitchen or laundry, which can contain detergents, fats, nitrogen and phosphorous. For this reason most domestic greywater reuse or recycling systems exclude the later.

102. Greywater can be reused directly, i.e. without treatment, if it is not stored for any length of time. Direct reuse of greywater is generally limited to:

- Subsoil garden irrigation;
- Toilet flushing.

103. Untreated grey water can be used for more general use in the garden. For example once cooled it may be stored in a water butt for above ground irrigation. However, care should be taken avoid long storage periods, sprinkler or spray systems and direct reuse on fruit and vegetable crops. Short retention systems containing simple valves are available to discharge greywater either to storage for outside use or to waste. Systems are also available to automatically empty tanks if water turnover is poor.

Rain Water Recycling

104. Rain water harvesting systems potentially offer the combined benefits of reduced water consumption from the public water supply system and reduced surface water runoff discharged to the public sewerage system. Available systems vary from installation of a simple water butt for garden watering to propriety units providing treatment, storage and delivery; depending on the level of treatment provided harvested water can be used for all purposes except drinking and food preparation

105. At its simplest rainwater can be collected in above ground butt for outdoor use such as garden watering and car washing. Typical systems for indoor use comprise:

- **First flush diverter** - To divert initial rainfall containing dust or other material from the roof;
- **Filter** - to removes debris from the collected rainwater and discharge it to a soakaway or the storm water sewer;
- **Water storage tank** – such as "green wall" systems, consisting of modular sections of polyethylene vertical tank with high storage volume-low footprint designs (www.waterwall.com.au); or rainsaver storage gutters (www.rainsaverstoragegutters.com) fed by gravity to toilet cisterns or garden watering, with overflow going direct to the storm drain or discharge system.

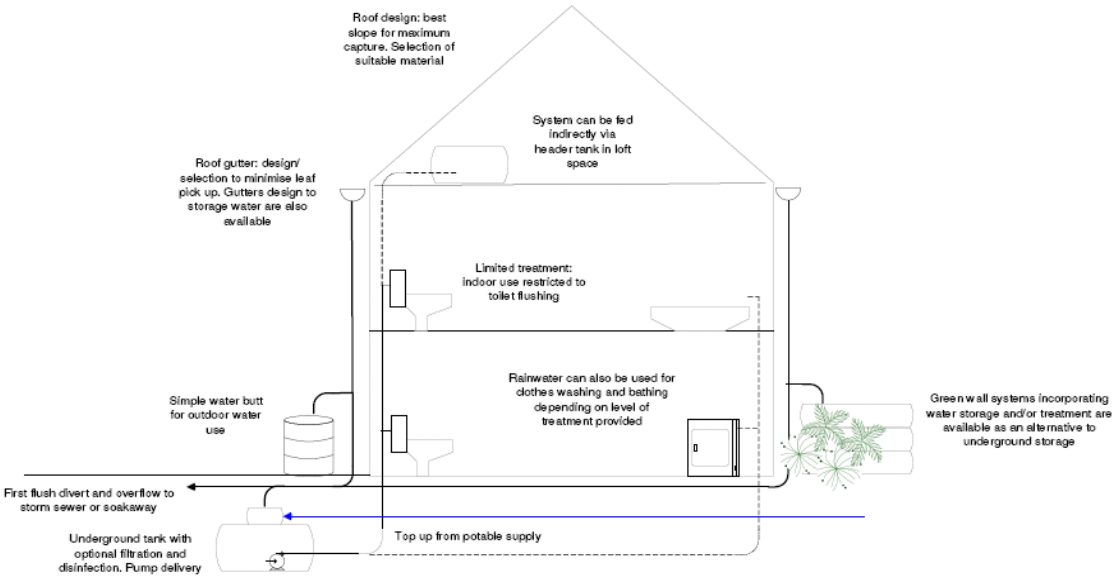


Figure 0.1: Rainwater Harvesting

Stormwater Harvesting

106. Stormwater Harvesting can be defined as the diversion, storage and treatment of stormwater runoff from urban catchments for reuse (see Figure 0.2). Roofwater harvesting differs from this in that it harnesses only relatively uncontaminated runoff from roof areas. Stormwater harvesting can include roofwater harvesting and non-urban runoff as part of a broader scheme.

107. The components of a stormwater harvesting system are:

- **Stormwater catchment** generating stormwater runoff;
- **Conveyance system** (conveying stormwater to the diversion) which could be a mix of overland and piped flows;
- **Stormwater quality treatment system** such as a bio-retention basin as part of a Sustainable Urban Drainage System;
- **Diversion** to take the primary treated stormwater to stormwater storage;
- **Stormwater storage system** (above or below ground);
- **Water treatment system** (to ensure water is fit for purpose);
- **Treated water distribution system** (pumped and piped reticulation).

108. Urban stormwater runoff can be considered a primary cause of aquatic ecosystem degradation due to pollution impacts on water quality, physical stream disturbance, sedimentation and alteration of riparian flow patterns.

109. The environmental benefits of stormwater harvesting and its associated water savings are not only reduced overall water demand, which could delay the need to build further infrastructure, but include the potential to:

- Reduce pollutant loads entering aquatic ecosystems;
- Manage peak stormwater flows discharged from urban catchments;
- Reduce the volume and frequency of stormwater runoff;
- Provide a valuable source of water to meet urban water demands.

110. A recent study was commissioned by the Queensland Water Commission on Stormwater Harvesting[3], involving case studies on two new mixed use developments in South East Queensland, Australia. The resulting factors for successful stormwater harvesting were found to be:

- Large scale development;
- High water demands;
- Moderate slopes which drain to singe/few points;
- Low cost storage.

111. In addition to the environmental benefits, the cost of stormwater was found to be around the lower end of costing for rain tanks, with cost of land for storage the main issue; though storage in an existing drainage reserve or aquifer significantly reduces costs.

[3] Stormwater Infrastructure Options to Achieve Multiple Water Cycle Outcomes, Bligh Tanner and Design Flow, August 2009.

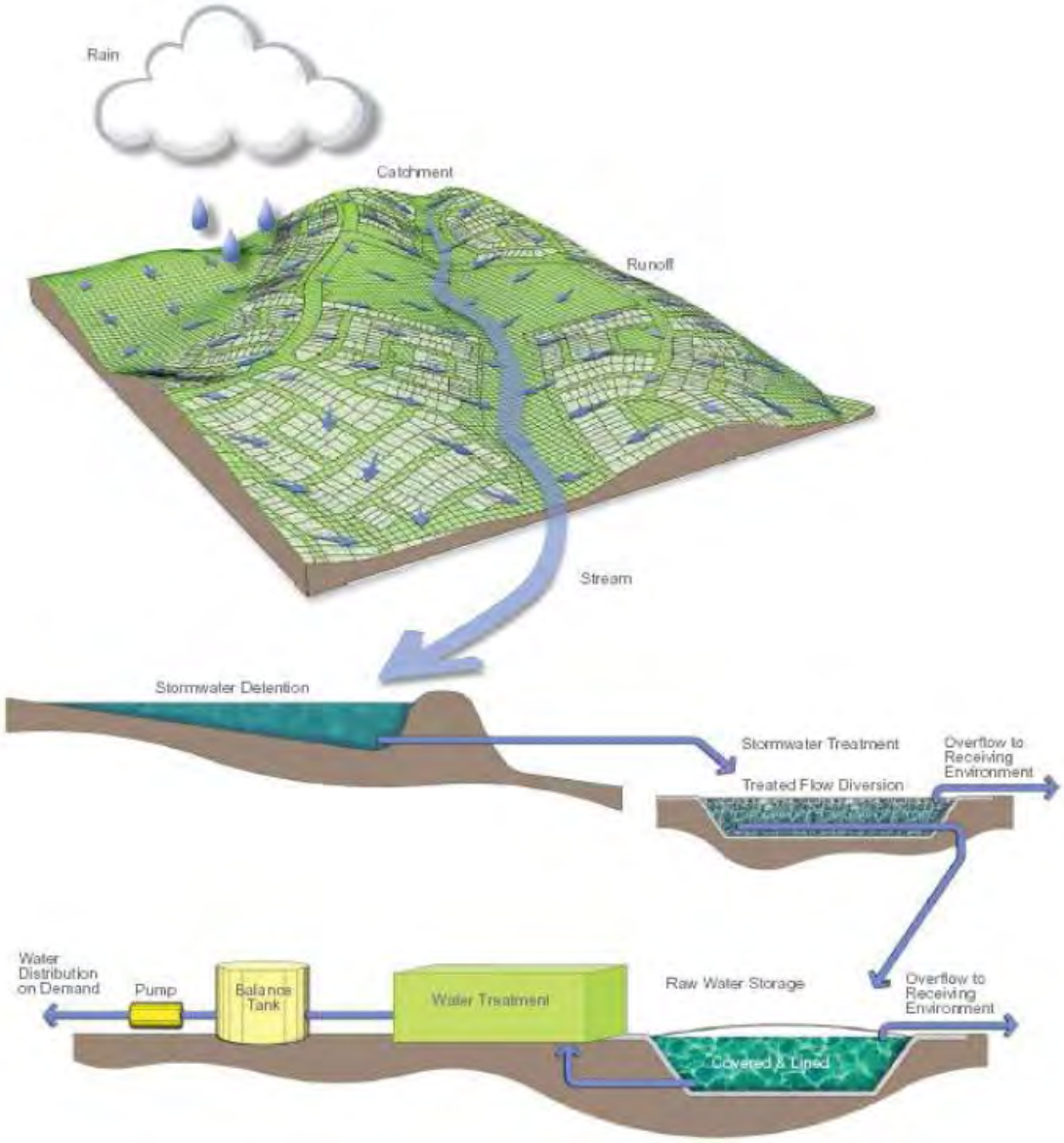


Figure 0.2: Stormwater Harvesting

Education and Community Wide "Soft" Measures

112. Water efficiency campaigns can be very successful in reducing water consumption and are continuously undertaken by water companies. AWS promotes a range of water efficiency measures and is involved in a number of trials and schemes to raise awareness of and promote water efficiency.

113. Public involvement is crucial if water resources are to be managed without the need for economic measures. Community wide soft measures are broadly designed to change water use behaviour and practices and create a water saving and efficiency culture. Provision of clear information about water use and the impact on the environment is of paramount importance if householders are to make informed decisions on water saving.

114. Water conservation messages can be quite difficult to market, encouraged by the perception of plentiful rainfall and the prevalence of flat rate pricing for water. Public awareness campaigns need to target long term changes in individual behaviour through:

- Creating awareness and interest;
- Educating;
- Providing necessary skills to effect change.

Components could include:

115. **Young persons' campaigns**: young people are agents of change. Engaging and making them interested in protecting water resources will help and impact the change of behaviour and habits from an early stage on. With the help of information and education materials, interactive games, cartoons, outdoor activities, etc. the young generation can learn about the importance of water in its different environments. Emphasis can also be placed on creative work incorporating water into different means of expression e.g. photographs, videos, theatre plays

116. **Adult campaigns**: these can include lectures, small workshops, exchanges with experts, public exhibition, water audit for typical household, water saving devices, details of cost and expected savings, provide details (with model?) of raw water sources used for public water supply and potential impact of over abstraction, public visits to headworks and treatment facilities, articles in local papers, lorry with volume of water consumed by typical household

117. **Self or water company led home water audits**: water audits provide householders with a complete picture of how and where water is used in the home and hence provides necessary information to be able to assess opportunities to save water.

118. Water company led audits can provide more easily accessible information on areas of high consumption or waste and the payback period of water conserving equipment. There is some merit in undertaking water audits with energy audits since reducing hot water consumption also reduces energy use.

119. **Raising the profile of aquatic environment:** the objective of these measures would be to engage existing residents in the local environment and in particular the aquatic environment, and hence increase their desire to protect and conserve it. Actions could include making sure all community areas are attractive, well maintained, with low water requirement; increasing access to the environment by for example, constructing attractive activity park(s) in areas of less ecological value – aerial runway, mountain bike tracks, café etc, regular events to shout about the local natural environment, kids after school activities e.g. green gym, local competition for best wildlife or natural environment photo.

120. Green labelling: clear labelling of the water efficiency of plant such as washing machines, dishwashers. Labelling is a simple and direct way of communicating information about a product to purchasers. There are a number of different green labelling schemes including Waterwise's Marque.

121. The Marque is awarded annually to products which reduce water wastage or raise the awareness of water efficiency. 27 Marques have been awarded across a broad spectrum of products including dishwashers, showerheads, water storing gels for the garden, toilets and urinals, drought resistant turf, domestic water recycling products, water butts, a waterless carwash, tap flow restrictors, a shower timer and devices to reduce the amount of water used when flushing the toilet.

122. Councils could be proactive in encouraging all retailers to 1) display green labels and 2) provide information on the different schemes where appropriate.

123. **Green plumbers**: council maintained and advertised register of plumbers having attended an accredited training programme on their role in protecting the environment.

Economic Measures

Volumetric Charging

124. Traditionally water use in England has been unmetered with customers paying according to the rateable value of the property. Volumetric charging increases the cost of billing but is deemed to be a fairer pricing mechanism and encourages water saving.

125. At present the Government does not compel water companies to install meters, although residents have a right to pay a metered charge and can request the water company install a meter free of charge, unless for particular reasons the cost is prohibitive.

126. As mentioned, AWS state they will maintain voluntary metering (for review in 2014), though as part of their customer demand management programme they underpin the encouragement of the change to measured charging with a 'switchback promise'. This enables customers to revert back to unmeasured charges within a year of choosing measured charges, though less than 2% do so.

127. Due to historic pricing polices, economic instruments have not been widely used to promote water conservation in the UK and limited data is available on the elasticity of demand. The recent introduction of volumetric charging for some households (in particular those electing to have a meter and new build houses) has had a limited impact on domestic water consumption (reported reduction of 10% over unmetered users). This is considered to be due to the relatively low price of water in the UK rather than the inherent value of the instrument as a means of reducing water consumption.

128. Notwithstanding significant real price increases since privatisation of the water companies, average water and sewerage charges in England are approximately 1% to 2% of household income. This compares to the recommended maximum (WHO) of 4% to 5% of household income.

129. The EU Water Framework Directive reinforces use of economic concepts to control water resource management. Article 9.1 states that member states shall ensure that, by 2010, water pricing polices provide adequate incentives to ensure the efficient use of water.

130. Assuming the adoption of volumetric charging, options exist in terms of the:

- **Type of meter**: dumb or smart, smart meters are approximately 3 to 5 times the price of dumb meters but provide greater opportunities for the introduction of varying tariff structures, more cost effective reading (and hence more frequent reading) and facilitate improved leakage detection. Smart meters also provide the opportunity of providing customers with an easily accessible readout of water use;
- **Level of charges**, water use being related to level of charges;
- **Tariff structure**, rising block and or seasonal tariff structure can provide good incentives to reduce excessive water consumption without raising the basic rate for low volume water use. Seasonal tariffs

are appropriate to encourage consumers to be extra careful with water during the summer months when water is less plentiful.

131. It is recognised that compulsory metering is not universally welcomed. Therefore, prior to the metering programme, consideration could be given to undertaking an intensive education and public awareness campaign together with the provision of subsidised water saving devices (cistern displacement, tap aerators, flow restrictors etc). Meters could be installed and read for a minimum of 3 months prior to the application of the new tariffs; this would allow residents to appreciate volumes of water used and undertake measures as appropriate to reduce consumption.

132. During this period, the water company could also consider undertaking a high profile leakage detection and reduction. In addition to reducing water abstraction, this will be designed to increase acceptance of water saving measures by existing households (surveys indicate a reticence on the part of the public to make savings whilst a significant proportion of water into supply is "lost").

133. In authorising the proposed tariff structure and level of charges, it is assumed that the economic regulator will make due allowance for the investment made by the water company in order to protect the environment at the cost of loss of sales.

Local Environmental Tax

134. The objective of the local environmental tax would be to provide economic incentive to conserve water and raise revenue for local projects. In principle, if viable and legal the tax for environmental conservation could be set by local council, collected by the water service provider and ring-fenced for local community projects. Alternatively the tax could be applied nationally and managed on similar lines to the land fill tax.

I.1 The Cost of Water Efficiency

135. Approximately 24% of domestic energy consumption in the UK goes to heating water (DTI 2002). This excludes space heating. Showering alone accounts for approximately 1% of total UK carbon emissions (MTP 2008). In addition, the treatment and distribution of water by water companies accounts for large amounts of energy consumption – e.g. Anglian Water is the largest single energy user in the East of England region, and recent estimates suggest that water companies consume more than 1% of the energy produced in the UK.

136. Energy prices are currently high and rising. In situations where more efficient hot water using fixtures and fittings, such as showers, baths and hot water taps are installed a major cost savings gained by the user will be through savings on the energy bill as well as the water bill.

137. The implementation of water efficiency measures not only reduce water demand and demand on water resources but produce associated savings in energy, financial costs and carbon emissions. Reductions in water demand can also reduce the need for additional infrastructure, resulting in further savings.

138. A specification for indoor water use of 120 litres per person per day, as per Part G of the Building Regulations and Levels 1/2 of the Code can be achieved through installing a combination of standard and efficient fittings and fixtures. CLG estimate that this will not add any cost to a new home (CLG 2008).

139. Code Level 3/4 with a water consumption specification of 105 litres per person per day can also achieved by installation of efficient water using fixtures and fittings, with CLG estimating an addition of £125 to the cost of a new home (CLG 2008). Developers Countryside Properties and Taylor Wimpey have estimated £400 and £280 respectively. The variation arises from different scales of business or assumptions on scales of business, dwelling type or assumptions on dwelling type and therefore style or desirability of fittings.

140. To achieve a specification of 80 litres per person per day required for Code Level 5/6, it is generally accepted that some form of water recycling is required. Inclusion of a rainwater or greywater recycling system is relatively costly. CLG estimate that achieving Code Level 5/6 would add £2650 to a new standard home. However, this is likely to be less per dwelling if communal water recycling systems are installed, and CLG (2008) estimate £800 for apartments.

141. The cost of meeting the Code will fall as demand increases. Bathroom manufacturer Grohe have estimated that, assuming bulk supply of the fittings and fixtures, the cost of meeting Code Level 3 /4 would drop to as little as £12.50 (Grohe 2008).

142. The Governments stated intention is to kick-start the market transformation process by requiring the public housing sector to build to medium level Code specification. However, this means that the relatively higher costs of meeting the Code during the early stages of market transformation are borne by housing associations. The National Housing Federation is lobbying for private developers to be subject to the same Code implementation timetable. At least at this stage, achieving Code Level 3/4 specification for water consumption is one of the cheapest aspects of Code implementation.

143. The average unit price for a metered water customer in 2008 is approximately 0.3 pence per litre including waste water charges. Average per capita consumption is about 150 litres per person per day. Assuming that actual water use in the home meets the target specification, savings on water bills can be estimated as shown in Table I-2.

Average PCC	Target Specification	Savings (litres per day)	Unit cost of water (pence per litre)	Savings (pounds per person per year)	Savings per household per year (assuming 2.4 people)
150	120	30	0.3	£32.85	£98.55
150	105	45	0.3	£49.27	£147.82
150	80	70	0.3	£76.75	£229.95

Table I-2: Savings on water bills calculated from average UK metered water price and assuming specification targets are met in practice.

144. For water bills, the payback time for specifications meeting Part G and Code Levels 1 through 4 ranges from immediately to a few years. If water recycling systems are added, the payback time is significantly longer – in the order of 10 years for systems supplying single homes. Savings on energy bills also need to be considered and in general these will at least match, and often exceed, the savings on metered water bills. Dwellings with water recycling systems will also save energy if efficient fittings are installed, but recycling systems will use energy for pumping and water treatment.

145. In conclusion, payback times for specifications involving efficient fittings and fixtures are reassuringly quick – a few years at most. Payback times for specifications that include recycling systems are significantly longer. Defra's water efficiency hierarchy illustrates this (Figure 0.3).

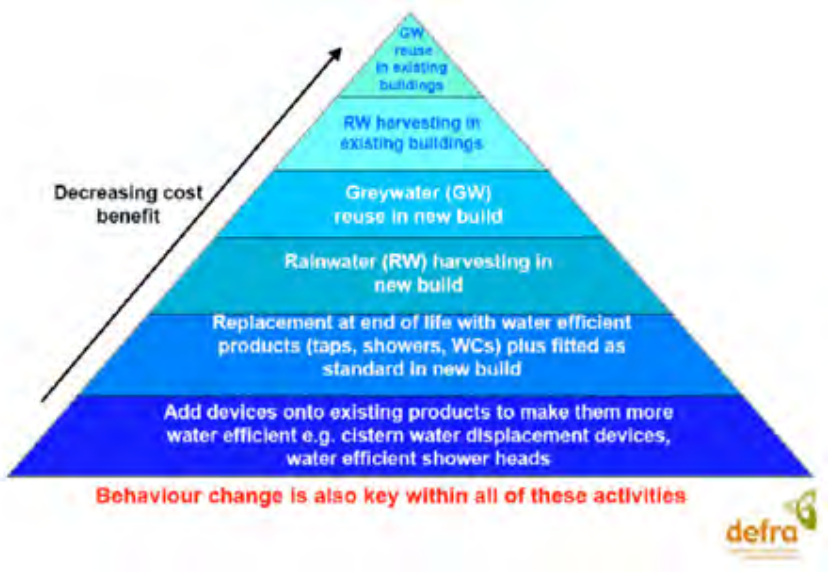
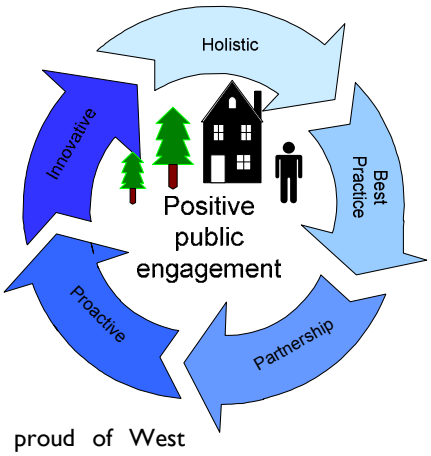


Figure 0.3 : Indicative illustration of cost-benefit of water efficiency strategies (Defra).

I.2 Indicative Action Plan

146. A possible future action plan could include:



Council Led

A. Local Development Framework policies

147. Given the well developed evidence base and clear policy at the regional level, West Northamptonshire should include a policy in their Local Development Framework requiring new development to be water efficient, inclusive of high levels of CSH and water resource augmentation such as rain water harvesting.

B. Pride in our community campaign

148. Objective – engaging existing residents, making them proud of West Northamptonshire's natural and built environment. Target – raising public awareness of their environment.

149. Action: review existing community facilities, are they good enough can they be improved? Brain storm additional facilities and events to improve quality of life.

150. Examples: make sure all community areas are attractive, well maintained, with low water requirement. Identify areas of woodland with lesser ecological value, construct attractive activity park – aerial runway, mountain bike tracks, café etc. Introduce regular events to shout about West Northamptonshire's natural environment, kids after school activities e.g. green gym. Local competition for best wildlife or natural environment photo.

C. Importance of water campaign

151. Objective – engage existing residents on need to conserve water.

152. Action: - review existing community facilities and implement measures to reduce water e.g. spray taps, grey water recycling, rainwater harvesting, advertise action taken and results achieved.

153. Education programmes in school. Public exhibition, water audit for typical household, water saving devices, details of cost and expected savings, make spray taps, flow restrictors, water butts etc available at subsidised cost. Provide details (with model?) of underlying aquifers. Public visits to headworks and treatment facilities. Articles in local papers. Lorry-side advertisement with volume of water consumed by typical households.

D. Reduction of water consumption in Social Housing

154. Objective: deliver significant water savings and catalyse residents of social housing to make pro-environmental changes.

155. Action – appoint part time facilitator to work with Anglian Water, housing authorities and other partners to support residents in green lifestyle changes through technological and behavioural change. Investigate options for joint water and power audit/saving campaign.

156. Note: Waterwise (www.waterwise.org.uk) are in the process of appointing a number of such facilitators and may be able to provide assistance.

E. Water use audit of all public buildings

157. Objective: reduce water consumption.

158. Action: structured audit of all public buildings. Measures implemented where appropriate to reduce consumption. Advertise successes in local paper etc.

F. Use of water efficient devices

159. Objective: raise awareness people's choices.

160. Action: encourage all retailers to stock water efficient devices, water consumption rating is prominently displayed. Maintain and actively promote a register of green plumbers. Show house where water saving devices such as simple bath waste diverters, green walls, etc can be seen in action by the public.

Water Company Led

G. Increased metering

161. Objective: to provide economic incentive to conserve water and better data on system performance

162. Action: progress enhanced metering scheme throughout the region with targeted advertising campaigns addressing the economic and environemtal benefits of water metering.

H. Leakage reduction programme

163. Objective: reduce water abstraction and also increase acceptability of meters.

164. Action: use improved data provided by universal metering to target areas of higher than average losses. Advertise successes in local paper etc.

I. Promotion of water efficiency devices

165. Objective: further general promotion of water efficiency devices.

Appendix J - Ecological Constraints and Opportunities

J.1 Objectives and Approach

J.1.1 Objectives

The primary objective of the ecological appraisal undertaken to support the West Northamptonshire Water Cycle Strategy (WNWCS) is to identify and summarise nature conservation issues, in terms of constraints and opportunities, related to the presubmission core strategy SUEs . It is intended that the output could be used as part of a decision support toolbox, to aid in the evaluation of development proposals within Northamptonshire and considers;

- Physical impact of development upon water and wetland ecological features.
- Drainage and flood defence associated with new developments.
- Water quality protection, in particular associated with wastewater treatment and disposal, as discussed in section 6.

Elements of the ecological appraisal have been included throughout this report where appropriate. The WCS has assessed the impacts of development on water-based and riparian ecology only.

This appraisal aims to provide guidance for those involved in the possible development and expansion of the potential development locations, by highlighting the possible impacts that future planned development(s) may have on water and wetland ecologically sensitive sites and species in and around these four development locations.

J.1.2 Approach

The approach to ecological appraisal for the water cycle study makes use of the *River Basin Biodiversity Framework* concept including compiling information on existing nature conservation features, objectives and targets (e.g. Biodiversity Action Plan (BAP) targets, designated sites and protected species). The use of GIS to display information is a key feature of this approach.

J.1.3 Information Sources

The information within this study has been collated from a number of sources, namely;

- Northamptonshire Biodiversity Record Centre.
- Published and web-based information on ecological features from Natural England, Northamptonshire County Council, MAGIC, and the Environment Agency.
- Environment Agency regional sources.
- Northampton Landscape Sensitivity and Green Infrastructure Study (February 2009).
- Towcester Landscape Sensitivity and Green Infrastructure Study (June 2009).
- Brackley Landscape Sensitivity and Green Infrastructure Study (June 2009).
- Anglian River Basin Management Plan (Environment Agency, December 2009).

J.2 Ecological Features Considered

The following features within the study area have been considered:

- Main rivers. This includes the River Nene south of Northampton and its tributaries such as Brampton Branch with runs north to south through Northampton, the Grand Union Canal which runs south of Northampton and north east of Daventry and the River Tove running through Towcester.
- Tributaries downstream of sewage treatment works at Whilton, Great Billing, and in Towcester.
- Standing open waters and wetlands in the vicinity of potential development sites.
- Designated sites featuring notable water and wetland features.
- BAP habitats (water and wetland) and protected and notable species.

J.2.1 Ecological Constraints

The full list of ecological constraints considered is drawn from the *River Basin Biodiversity Framework* model and also informed by the approach taken for other WCSs.

J.2.2 Overview of the Study Area

There are four major development locations within the study area, all of which are situated in West Northamptonshire. These locations are; Northampton, Daventry, Towcester and Brackley. A number of SUEs have been proposed in and around each of these urban areas.

Natural England's Natural Area profile for the *West Anglian Plain* identifies features and contributions to biodiversity. No "Prime Biodiversity Areas" are identified within Northamptonshire; however there are a number of important and relevant habitats within the study area. These include:

- The large, slow-flowing River Ouse and River Nene (and a small stretch of the River Welland).
- A multitude of smaller watercourses including small drains, marshes and wetlands which support a number of protected birds.
- Lowland meadows occur on the seasonally flooded (winter and spring) alluvium.
- An extensive series of old flooded gravel pits, clay pits and reservoirs, many of which have swamp vegetation or reed beds along their margins.

J.2.3 Designated Sites Considered

The following types of water and wetland designated sites of nature conservation importance have been considered in this study;

- International Sites of Nature Conservation Importance - Special Protection Areas (SPAs), Special Protection Areas (SPAs), Special Areas of Conservation (SACs), and Ramsar Sites.
- National Sites of Nature Conservation Importance - Sites of Special Scientific Interest (SSSIs), National Nature Reserves (NNRs).

- Local Sites of Nature Conservation Importance - Local Nature Reserves (LNRs), Country Wildlife Sites (CWSs).

J.2.4 BAP Habitats Considered

The following BAP Habitats from the Northamptonshire LBAP have been considered in this study;

- Broad habitats - Fen, marsh and swamp, Rivers and Streams, Standing Open Water and Canals.
- Local habitats - Quarries and Gullets, Wet and Marshy Grassland.
- Priority Habitats - Reedbeds, Wet Woodland.

J.2.5 Protected and Notable Species Considered

Protected and notable species that are aquatic or primarily associated with water or wetland habitats and relevant to the study area include the otter (*Lutra lutra*); water vole (*Arvicola terrestris*); great crested newt (*Triturus cristatus*); white-clawed crayfish (*Austropotamobius pallipes*); bullhead (*Cottus gobio*); eel (*Anguilla anguilla*); common toad (*Bufo bufo*); a range of aquatic and water-associated birds including the great crested grebe (*Podiceps cristatus*), cormorant *(Phalacrocorax carbo)* and the kingfisher (*Alcedo atthis*), and aquatic invertebrates such as dragonflies and damselflies (e.g., ruddy darter *Sympetrum sanguineum*).

With regard to bats, only those species which use water sites as their main feeding areas have been considered in this study, i.e. Daubenton's bat *(Myotis daubentoni)*.

J.2.6 Fisheries

The River Nene from Northampton and downstream is designated as a cyprinid river under the EC Freshwater Fisheries Directive. Most of the reaches for which water quality data are available are at their target River Ecosystem (RE) Classifications of 2 or 3, indicating that they are of good to fair quality and can support either all fish species (RE2) or high class coarse fish populations (RE3).

J.3 Sensitive Ecological Features Identified

This section highlights the sensitive ecological features (sites and species) identified within each of the study locations.

Sensitive water or wetland sites within approximately 1km of each of the proposed SUEs for Brackley, Towcester and Daventry locations are considered. For Northampton, Sensitive water or wetland sites within 1km of existing urban extent has been considered on compass quadrant basis. This 1km distance has been increased where applicable to consider particularly sensitive designated sites. The following sensitive water/wetland sites were identified;

J.3.1 Northampton;

- Pitsford Water SSSI (SP780708).

- Upper Nene Valley Gravel Pits SSSI/pSPA4 (SP966717).
- Bugbrooke Meadows SSSI (SP672586).
- Sywell Reservoir and Country Park CWS (830655).
- Barnes Meadow LNR (785600).
- Nobottle Wood (BAP Wet Woodland) (675635).

J.3.2 Daventry;

- Daventry Reservoir and Country Park LNR (SP580640).
- Drayton Reservoir CWS (SP570646).
- Braunston Marsh CWS (SP7066).
- Badby Woods (BAP Wet Woodland) (SP560580).

J.3.3 Towcester;

- Kingsthorne Wood BAP Wet Woodland (SP660490).
- BAP Floodplain Grazing Marsh (SP705485).

J.3.4 Brackley;

- One un-designated nature reserve (St James Fishing Lake) featuring standing open water (SP580367).

A brief overview of these sites, giving consideration to their proximity to the four development locations is provided below. Site locations are shown on Figures 9.1, 9.2 and 9.3 in Appendix K. Protected and notable species recorded in and around each of the development locations are listed at the end of each location section. This species data was obtained from the Northampton Biodiversity Record Centre. It should be noted that this data is spatially and temporally limited and therefore follow-up surveys would be required to confirm site-specific species constraints.

J.3.5 Northampton

North*;* To the north of the town lies Pitsford Water SSSI, fed from Faxton Brook and other water courses flowing south westwards. The reservoir discharges into the Brampton Brook or branch of the Nene which flows southward to Northampton where it joins the main course of the river. The reservoir is the largest water body in Northamptonshire and serves as a major site for passing and wintering waterfowl. Negative impacts could occur as a result of increased run-off or discharge, reduced water quality, or low water levels as a result of over abstraction.

North East; There are a number of areas of standing open water in the area north of the town. One notable site to the north east of the town is Sywell Reservoir and Country Park CWS, a tranquil area dedicated to preserving wildlife habitats. The waters and banks of the Edwardian reservoir provide habitat for water birds. Development to the north east of Northampton should therefore give careful consideration to possible

[4] Please note that the term Upper Nene Gravel Pits includes the Northampton Washlands, both are treated as the same proposed Special Protection Area.

negative impacts on these sites which could occur as a result of, for example, reduced water quality from increased surface run-off.

East/South East; There are a number of sensitive water/wetland sites to the east of Northampton, which include a number of BAP standing water habitats. However, the most notable site to the east of Northampton is the Upper Nene Valley Gravel Pits SSSI/pSPA, which is considered to be of exceptional significance for the variety and quality of breeding birds associated with the opens water and marginal habitats. It is also nationally important for its rare example of wet floodplain woodland. The gravel pits offer an extensive series of shallow and deep waters which occur in association with a wide range of marginal features. These would be sensitive to changes in water levels which may occur if flows were to increase (due to new additional surface runoff and/or wastewater discharge) water along the River Nene and Grand Union Canal which flow through the town.

West/South/South West; Barnes Meadow LNR is situated to the south of the town centre. A large area of BAP floodplain grazing marsh is situated on the town's south west urban fringe. Bugbrooke Meadows SSSI is situated approximately 3km away from the town's western urban fringe. The site contains a group of low lying meadows alongside the River Nene which have escaped drainage and improvement. They tend to flood in winter and often remain wet well in to the growing season. As a result they support a range of damp grassland communities which are remarkably diverse and rich in species. These sites may be adversely affected if increased flows in the River Nene were to occur as a result of development.

North West; A large area of wet woodland (Nobottle Wood) is situated some 3km from the town, and is fed by a tributary of the River Nene. Wet woodlands occur on poorly-drained or seasonally wet soils, therefore reductions in water levels in the future could have an adverse effect on the site.

J.3.6 Protected and Notable BAP Species

Data requests have confirmed that the following protected and notable species have been recorded within Northampton and its urban fringes;

- Freshwater crayfish *Austropotamobius pallipes.*
- Common toad *Bufo bufo.*
- Daubenton's bat *Myotis daubentoni.*
- Great crested newt *Triturus cristatus.*
- Otter *Lutra lutra.*
- Spined loach *Cobitis taenia.*
- Water vole *Arvicola terrestris.*
- Kingfisher *Alcedo atthis.*
- Reed bunting *Emberiza schoeniclus.*
- Water rail *Rallus aquaticus.*

J.3.7 Daventry North East SUE

J.3.8 Development to the north of the town could have a negative impact on the Daventry Reservoir and Country Park LNR which is located on the town's northern urban fringe. The Park is centred around the reservoir which is used to provide water for the Grand Union Canal.

166. Protected and Notable BAP Species

Data requests have confirmed that the following protected and notable species have been recorded within Daventry and its urban fringes;

- Freshwater Crayfish *Austropotamobius pallipes.*
- Common toad *Bufo bufo.*
- Water vole *Arvicola terrestris.*
- Otter *Lutra lutra.*
- Great crested newt *Triturus cristatus.*
- Great crested grebe *Podiceps cristatus.*
- Mute swan *Cygnus olor.*
- Cormorant *Phalacrocorax carbo.*
- Kingfisher *Alcedo atthis.*

J.3.9 Towcester South SUE

No sensitive water or wetland sites were identified in these areas.

167. Protected and Notable BAP Species

Data requests have confirmed that the following protected and notable species have been recorded within Towcester and its urban fringes;

- Water vole *Arvicola terrestris.*

J.3.10 Brackley East and Brackley North SUEs

No sensitive water or wetland sites of the designations considered in this study were identified in or around Brackley.

168. Protected and Notable BAP Species

Data requests have confirmed that the following protected and notable species have been recorded within Brackley and its urban fringes;

- Water Vole *Arvicola terrestris.*
- Freshwater crayfish *Austropotamobius pallipes.*

J.4 Potential Impacts of Development

There is currently insufficient information concerning future public water supply demands to permit accurate predictions of the likely impact of future developments on the identified sites and species. If additional water supplies were required and sourced from Rutland and Pitsford Reservoirs, this increased abstraction may reduce water levels, which may in turn have a negative impact on water birds reliant on the habitat provided by the reservoirs' deep waters. If any additional water supplies were to be conveyed via the River Nene then ecological impacts resulting from increased flows along the river would need to be addressed. For example increased flows could adversely affect otters, water voles, and kingfishers, which rely on river bank habitats.

J.5 Nature Conservation Threats and Opportunities

This appraisal, based on the approach outlined under the River Basin Biodiversity Framework concept developed by Halcrow, Natural England and the Environment Agency in 2005, aims to distinguish between critical, important and desirable contributions to water and wetland nature conservation.

In respect of the WNWCS, realistic contributions to nature conservation value have been identified as follows:

- **"Critical"** contributions relate to the preservation of existing international/national interests:
- **"Important"** contributions will protect existing regional/county interests whilst further promoting international/national interests;
- **"Desirable"** contributions will protect local interests and further contribute to regional/county and local value.

The water cycle area contributions (nature conservation threats and opportunities) for the five potential development locations are outlined in Table I.1. The level of negative impact (*high, medium, low, none*) or positive contribution from enhancements (*probable, tentative, none*) likely in each development location is also shown in the Table (see key below).

Negative impact	Positive contribution
H= High	Y = Probable
M = Medium	(Y) = Tentative
L = Low	
N = None	N = None

169. Table I-1: Nature conservation threats and opportunities for the WCS

Development Locations	Northampton	Daventry	Towcester	Brackley
CRITICAL				
Threat to integrity of statutory designated	H	N	N	N

Development Locations	Northampton	Daventry	Towcester	Brackley
sites (SACs, SPAs, pSPAs, SSSIs, NNRs)				
Threat to extent and quality of standing open waters	H	L	L	L
Threat to preserving extent and quality of floodplain grazing marsh	H	N	N	N
Threat to preserving extent and quality of rivers and streams	H	M	M	M
Threat to river water quality and (cyprinid) fisheries	H	H	M	L
Threat to otters and their habitats	H	M	L	L
Threat to water voles and their habitats	M	M	M	M
Threat to great crested newts and their habitats	H	M	L	L
Threat to bat habitats and breeding bird habitats	M	L	L	L
Threat to freshwater crayfish and their habitats	M	M	L	M
IMPORTANT				
Threat to integrity of LNRs and CWSs	H	H	N	N
Threat to Local BAP habitats	M	M	H	N

Development Locations	Northampton	Daventry	Towcester	Brackley
Threat to Local BAP species	M	M	L	M
Potential to increase linkages between designated sites	Y	(Y)	(Y)	N
Potential to enhance quality and extent of standing open waters	Y	(Y)	N	N
Potential to enhance extent and quality of floodplain grazing marsh	Y	N	Y	N
Potential to enhance otter habitats	Y	(Y)	Y	N
Potential to enhance fisheries habitats/ river water quality	Y	Y	Y	N
Potential to enhance water vole and otter habitats	Y	(Y)	Y	N
Potential to enhance great crested newt habitats and bat habitats	Y	(Y)	N	N
DESIRABLE				
Potential to improve water quality and river corridors for invertebrates and bats that feed on them	Y	Y	Y	Y
Maintain minor known populations of LBAP species (e.g., palmate newt)	(Y)	(Y)	(Y)	(Y)

J.6 Enhancement Opportunities

170. There may be opportunities to enhance the value of some of the ecological features identified within the study area. These opportunities are outlined below;

171. Certain designated sites could be connected/linked (using corridors) to enhance their ecological value (by increasing their overall size and stability). For example, Barnes Meadow LNR lies close to the Upper Nene Valley Gravel Pits SSSI/pSPA and there may be potential to further improve linking habitats between these two sites.

172. Areas of floodplain could be expanded which would enhanced opportunities for establishing BAP habitats such as reedbeds, which are relatively rare in Northamptonshire and have in the past been the focus of successful habitat creation schemes (e.g. Great Billing Sewage Treatment Works at SP817617).

173. There may be opportunities to improve and enhance existing areas of standing open water by creating/increasing shallow shelving margins to create a range of water depths and thus increase habitat diversity within these existing habitats (e.g. Upper Nene Valley Gravel Pits SSSI/pSPA). The creation of such habitat would be of benefit to the great crested grebe which build nests among reeds and vegetation fringing shallow lakes and disused gravel pits, and the water rail which favours swampy pond margins.

174. Opportunities may exist to increase riparian vegetation along the River Nene and Grand Union Canal which flow through Northampton. Such measures would improve the physical habitat for the Daubenton's bat, which has a strong association with riparian and open water sites for feeding, and also relies on linear features such as riverside scrub when flying between feeding sites.

175. New habitats for water voles may also be created by using SuDS in new development allocation areas to address issues of run-off, particularly in Northampton and Daventry.

176. There are opportunities to include wetlands (e.g. reedbeds) and pond habitats in drainage systems (SuDS) for developments notably in the allocation areas upstream of or adjacent to the River Nene and its Brampton branch to increase the total extent of wetland habitats and to improve downstream water quality. Soft engineering options should be the first consideration in all SuDS option development. Watercourses should be kept open by avoiding the use of culverts, e.g. through ths use of clear-span bridges at necessary crossing points. Open channels should be profiled in a manner which encourages marginal vegetation, such as stepped bank profile and creation of low flow channels within newly created watercourse.

177. Any habitat creation should use native plant species and should, where possible, be planted/seeded before development commences as this will give the habitats more time to establish, reducing habitat loss impacts to associated species.

178. The restoration and creation of habitats including enhancing watercourses is supported by the Northampton, Brackley and Towcester Green Infrastructure Studies. It is important that existing habitats and created habitats are connected throughout the whole of any developments as a network of habitats so that linkages between the various water and wetland features exist. The green infrastructure network within a development area also needs to tie into the wider countryside beyond the site boundary. This allows movement of species between habitat areas and minimises habitat fragmentation, thus supporting a greater overall biodiversity value by allowing habitats to function as a larger network or 'system'. This habitat network can be designed to also provide recreation and amenity benefits to the community, creating 'green infrastructure' (i.e. a network of multi-functional green space, both rural and urban) throughout the development areas, integral to the health and quality of life of sustainable communities. Primary green infrastructure corridors identified by the Green Infrastructure Studies include the Nene and Brampton valleys at Northampton, the Great Ouse at Brackley and the River Tove at Towcester. Specific measures appropriate to improve the physical quality of the rivers themselves in relation to land drainage and flood defence have been identified in the Anglian River Basin Management Plan. Appropriate considerations for any future development include:

- Increase in-channel morphological diversity (Tove, Brampton Branch, Nene, Great Ouse).
- Appropriate techniques to align and attenuate flow to limit detrimental effects of drainage features (Tove, Great Ouse).
- Appropriate management strategies in place for flow (locks, sluices, weirs etc), sediment, fish passage and woody debris (Brampton Branch, Nene).

179. Green infrastructure should be designed and managed to avoid conflicts between public access and wildlife. This can be achieved by ensuring public access is strategically planned and restricted in certain areas to retain some water and wetland features as undisturbed habitats for wildlife. For example;

- Any new footpaths should be established such that they discourage the public from accessing ecologically sensitive areas, e.g. water vole habitat. Paths should only occasionally approach the banks of brooks, to ensure the majority of the watercourse remains relatively undisturbed. Formal paths can "steer" the public away from sensitive area more successfully than informal paths.
- The establishment of dense scrub and man-made embankments at the edge of sensitive habitat areas can restrict views and discourage access, allowing for example undisturbed bird breeding.
- Boardwalks could be installed to keep the public to the periphery of sensitive wetland areas, e.g. reedbeds. Similarly, ponds could have restricted approaches and pond margin access, e.g. a boardwalk on one side, but the rest of the margin should be difficult to access, to ensure undisturbed shelter for wildlife.
- Ponds should not be stocked with fish as this will discourage amphibians from colonising them.

180. This ensures a robust and resilient ecologically functional landscape. This will give benefits such as ensuring the long-term integrity of these habitats as well as allowing greater movement of species.

J.6.1 Water Quality

181. Improved infrastructure for sewage treatment presents an opportunity to improve receiving water quality, in particular through high-level treatment of waters (especially for phosphates) prior to discharge. This would be potentially beneficial specifically for fisheries as well as for wider biodiversity.

182. At present, the Anglian River Basin Management Plan identifies that the Tove at Towcester and the Brampton at Northampton are only moderate quality for phosphate, and the Nene at Northampton poor quality, compared to the target of at least good quality required by the EU Water Framework Directive. Additional discharges from sewage associated with new commercial and residential developments need to avoid any further degradation in water quality as this could adversely affect species which require clean waters, but upgraded infrastructure presents the opportunity to actually improve receiving water quality if future discharge standards are improved.

183. Directly related to this, high-level treatment of wastewater before it is discharged presents the opportunity to establish wetland treatment systems as functional components of wastewater treatment works, providing a habitat resource as well as improved effluent quality.

J.7 Recent Projects and Initiatives

184. This appraisal has also considered recent projects aimed at improved water and wetland habitats within the WCS study area. Under the banner of the River Nene Regional Park the Wildlife Trust for Northamptonshire was awarded funding from the Growth Area Fund for a project to create an improved wildlife and community resource at Barnes Meadow LNR. The project had focussed on the creation of wet and marshy grassland to help reverse the decline in associated species with this habitat type, especially wading birds for which the county is of national importance. This is a key project under an initiative to improve the Upper Nene Valley Gravel Pits and other wetland habitats along the Nene valley in Northampton, which has included clearing ditches to balance water levels and digging pools and scrapes to provide feeding areas for wading birds.

185. No projects aimed at enhancing water and wetlands have been identified for Daventry Towcester, Silverstone motor racing circuit or Brackley.

J.8 Summary and Recommendations

186. This appraisal has identified the sensitive water and wetland sites and protected/notable species in or close to each of the four potential development locations (Northampton, Daventry, Towcester and Brackley) in West Northamptonshire. Several SSSIs, pSPAs, LNRs, CWSs and BAP Habitats have been identified, along with a number of associated notable a number of notable and protected species. Nature conservation threats and opportunities for the WNWCS are summarized in Table 9.1.

187. Potential development sites have been initially assessed to establish the risks (but also the opportunities) that they present to existing water and wetland nature conservation features in the area, associated with changes in surface drainage, hydrology and municipal wastewater discharge.

188. Due to a lack of information regarding future public water supply requirements, it has not been possible to provide accurate predictions of the effects that developments are likely to have on the sites and species identified.

189. Consideration of the wider environmental issues resulting from the proposals, with a particular focus on resource efficiency, mitigating and adapting to climate change, sustainable construction, and minimising waste streams arising from construction is not in scope of this report. However, consideration should be given to these issues in a sustainability appraisal.

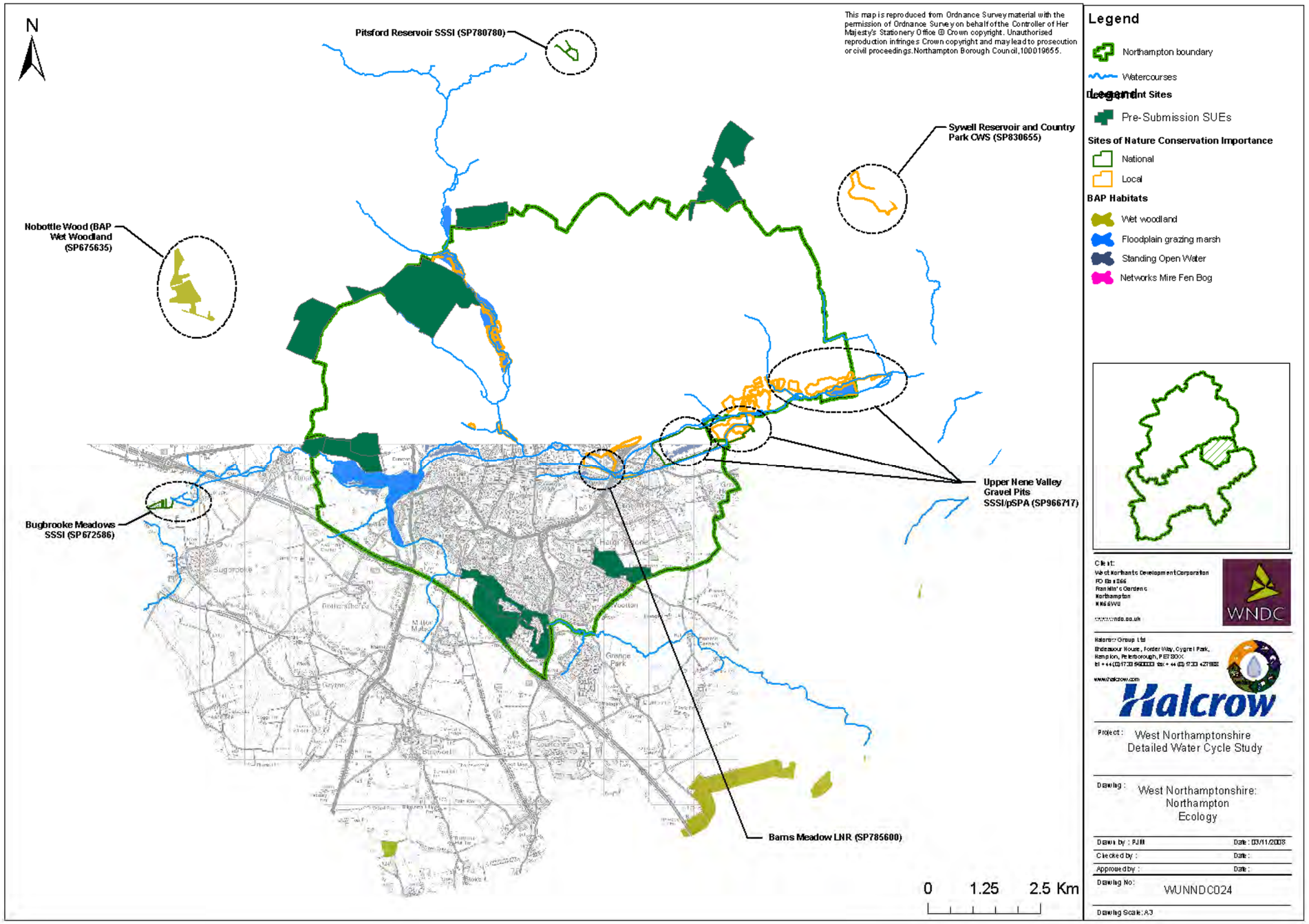


Figure I.1: *Sensitive water or wetland sites – Northampton*

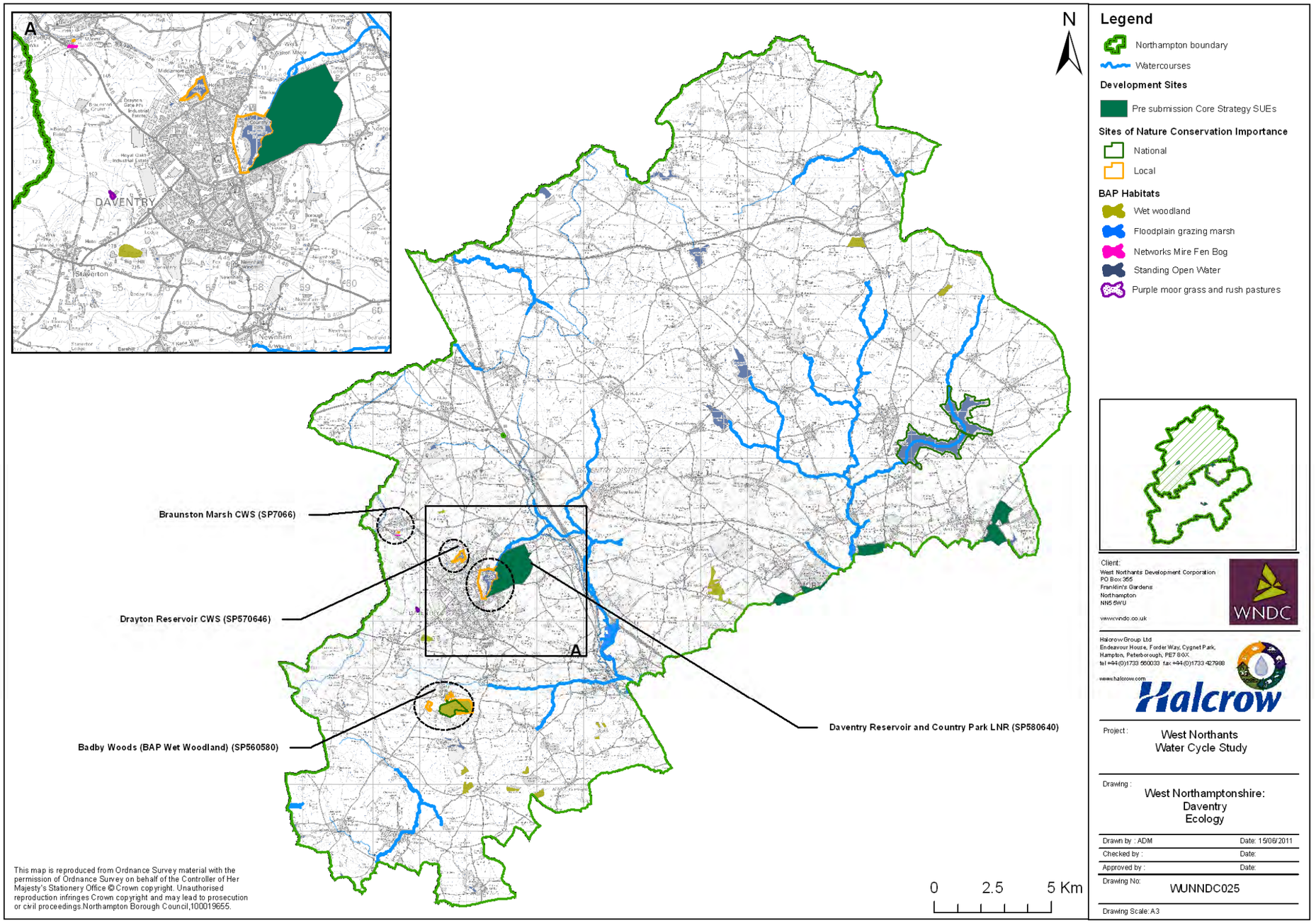


Figure I.2: *Sensitive water or wetland sites – Daventry*

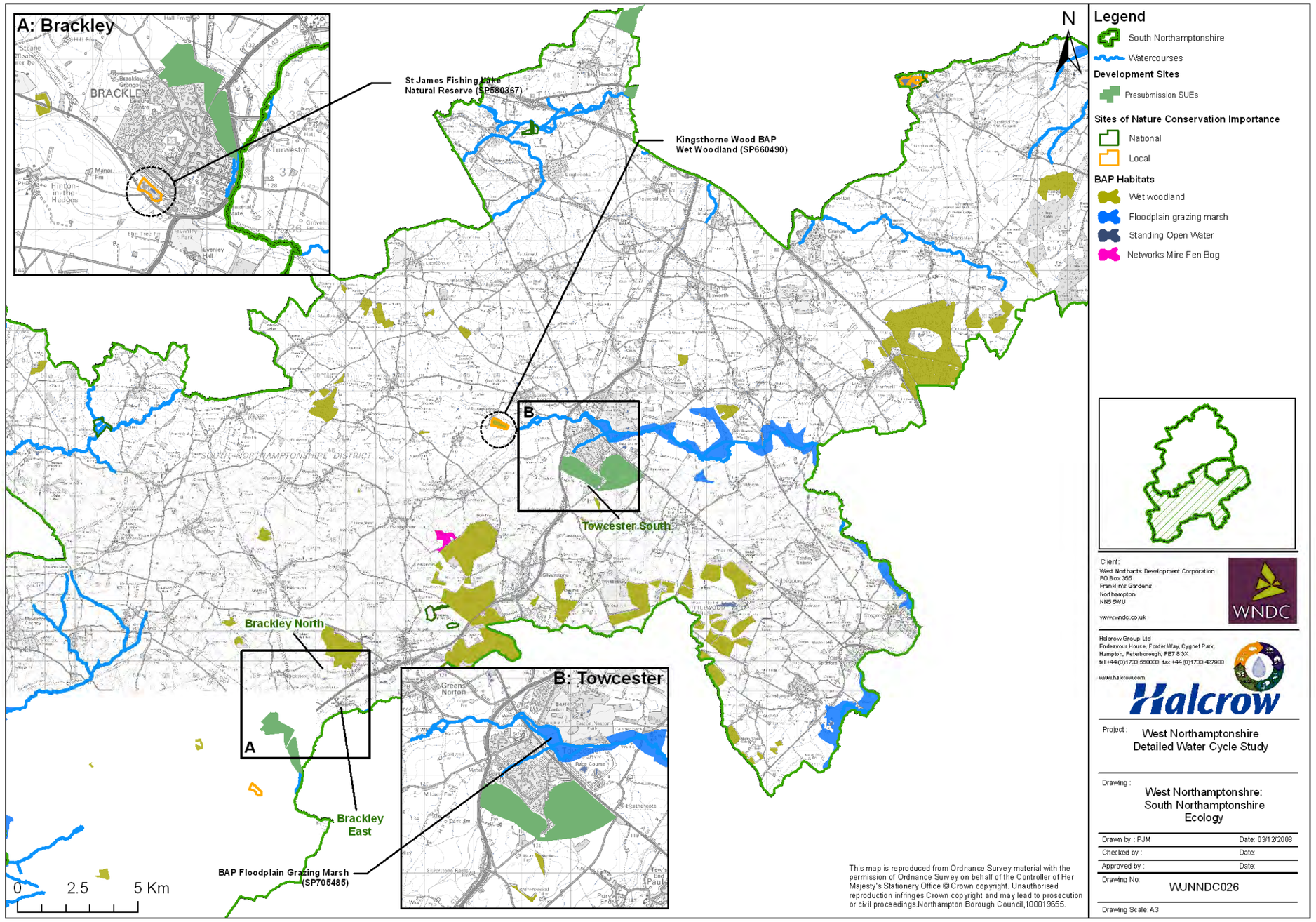


Figure I.3: *Sensitive water or wetland sites – Towcester and Brackley*

Table 1: *Nature Conservation Values of Features in the Study Area (High, Medium, Low)*

Sensitivity	191. Nature Conservation Value (water & wetland only)		
	International/National	**Regional/County**	**Local**
High	pSPAs, SSSI Important for UK BAP priority habitat or species Large population of protected species	LNR or NGO reserves CWS	Local BAP habitat or species significant locally
Medium	Limited area of UK BAP priority habitat or small population of priority species Limited population of protected species	Local BAP habitat or species outside of LNR/CWS/etc. Major river or other open water body	Minor watercourses including ditches & ponds with ecological value
Low	Small population of protected species	Local BAP species not occurring in designated areas and not protected or on national BAP	Local BAP species which occur only in low numbers

Appendix K - Environmental capacity flood risk assessment methodology

K.1 Flood Risk

198. The evaluation of flood risk has comprised three elements:

- Quantification of the increase in peak flows
- Evaluation of the likely sensitivity of flood levels to increases in flood flows
- Evaluation of the impact of increases in flood levels.

199. For each element the impact at each site has been classified as high, medium or low and a multi-criteria analysis applied to combine these elements.

200. The analysis has been conducted using the 1 in 2 year flood. The 1 in 2 year flood has a probability of occurrence in any one year of 50% and is more correctly referred to as the 50% Annual Exceedance Probability (AEP) event. This flood severity was selected because:

- Increases in WwTW discharge would contribute a relatively greater proportion of flood flows than if a more extreme flood event had been used, and hence results are likely to be conservative
- The 1 in 2 year event is, very crudely, considered to approximate bank full conditions. Any increase in the 1 in 2 year event would therefore be expected to result in out of bank flooding.
- The 1 in 2 year event is the smallest event which can practically be estimated using standard techniques.

K.1.1 Increase in Peak Flows

201. The increase in the 1 in 2 year peak flow in the receiving watercourse has been computed by:

- Calculating the baseline peak flow in the receiving watercourse using the Flood Estimation Handbook (FEH) method;
- Estimating the increase in discharge from the WwTW using population growth figures.

202. The FEH is the UK industry standard method for flood estimation and the recommended method adopted by the EA. It has been assumed that additional runoff generated from new housing development will be mitigated by flood-risk management options in line with statutory requirements. The increase in flood flows is therefore associated only with treated effluent discharge from the WwTW.

203. Following the methods described in the FEH manuals, an initial estimate of the 1 in 2 year peak flow has been derived by applying an empirical equation with parameter values extracted from the FEH CDROM. This contains a database of catchment descriptors, such as catchment area, slope, wetness and runoff parameters, extracted from a digital terrain model.

204. However, estimates based on the empirical equation are prone to relatively large errors and it is good practice to verify or adjust estimates using observations of flood flows measured at gauging stations. The FEH provides such information within the HiFlows-UK gauging station database and WINFAP-FEH software, and the user must identify suitable donor (nearby) or analogue (distant) sites for adjusting the initial estimates. A suitable site is one which replicates key hydrological characteristics, these being catchment area, annual rainfall, and soil type.

The initial estimates have therefore been improved, where necessary, by applying an adjustment factor calculated from the observed data.

K.1.2 Sensitivity of Flood Levels

205. The analysis reported quantifies the likely increase in the 1 in 2 year flood flow. However, in order to evaluate the importance of these additional flows it is necessary to consider how flood levels may change. It is the change in flood level which dictates whether flood flows may exceed bank tops or reach properties. Flood levels are usually determined by applying the flood flows to a hydraulic model. For this study hydraulic modelling was not appropriate, given the large number of sites to be considered and the onerous data gathering and modelling requirements. The approach adopted has been to use engineering judgement to identify sites where development of a hydraulic model would be recommended in a future study because of the potential for notable changes in flood levels.

206. Flood levels are very sensitive to the channel shape and slope and to the presence of structures which may restrict flow, such as bridges. The location of a bridge immediately downstream of a WwTW discharge may result in increased flood levels for a significant distance upstream.

207. The adopted methodology has been to develop a decision tree (see Appendix A) which has been applied to all 105 priority sites, the first element being to estimate the length of the affected reach. The length of reach affected by additional flows is determined by the slope and shape of the channel and by constrictions to flood flows such as bridges, weirs and sluices. The reach length decision tree uses engineering judgement to estimate both the upstream and downstream affected reach lengths based on channel widths and slopes extracted from OS maps at 1:10 000 scale.

208. Having identified the study reach for each WwTW a second decision tree was developed and applied to identify the risk category. The decision trees identify the most common controls of flood levels and are shown in Appendix A. In each application the identified result was recorded so that the decision flow path could be traced if required.

209. For each WwTW site the sensitivity of flood levels to increasing flows was recorded as high, medium or low.

K.1.3 Impact

210. The final analysis considered the likely impact of the changes in flood levels, in particular whether the affected reach of river was urban, sub-urban or rural in nature. After identifying the affected reach lengths, the third decision tree was applied to determine whether the impact was considered high, medium or low. High impact was considered to be an urban area containing at least 50 properties whilst low impact was considered to be a rural area with less than 5 properties affected. The higher of either the upstream or downstream reach has been accepted.

Appendix L – wastewater network planning technical note – February 2010

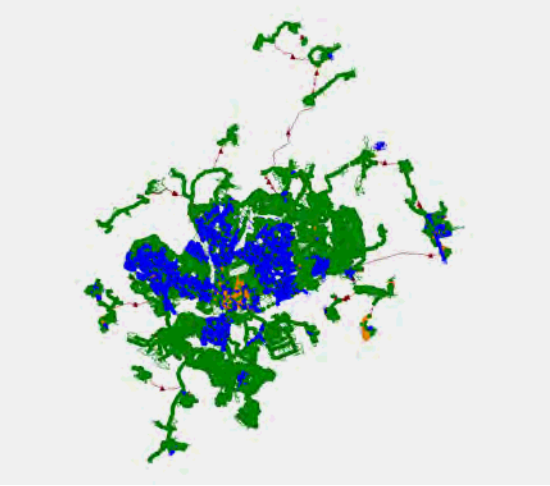
L.1 Current understanding of network

L.1.1 Ongoing studies and modelling projects

211. Anglian Water are currently preparing a **drainage area plan (DAP)** for the urban area of Northampton, and those surrounding villages that drain to Great Billing STW.

212. The drainage area plan requires (amongst other things) extensive runoff area, sewer and manhole survey; detailed flow survey of dry and wet weather flows in the sewerage network; Infoworks CS™ model verification and calibration; 3rd party model audit, sewer capacity analysis, and strategy development.

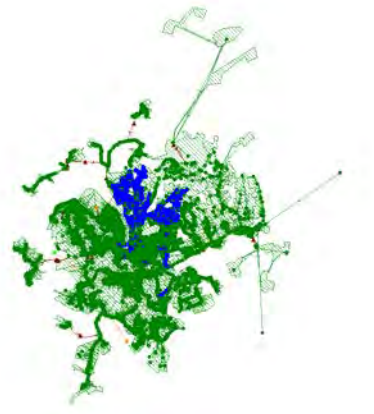
213. The model verification process (stage 3) is currently underway and will complete at the end of March 2010. The model will then be subject to audit for approximately 6 weeks. Following model audit, Anglian Water will be able to use the model to develop their wastewater strategy for Northampton, which is expected to be completed in Q3 or Q4 2010.



214. Anglian water are also developing an **urban pollution model (UPM)** for the Northampton network. This model looks at the implications of growth on wet weather discharges from the sewerage network, and resultant water quality in the receiving waters and rivers of Northampton. This model is being developed in parallel to the DAP. The model will produce early results in March 2010 that can feed into the water cycle study, but these cannot be fully verified until the DAP model has been completed and audited. Uncertainty analysis will be undertaken to attempt to account for this, however, the UPM model results that feed into the water cycle study cannot be confirmed as accurate and robust until the DAP model has been fully verified.

L.1.2 Completed studies and models

215. Anglian Water have undertaken a number of previous capacity studies for the phase 1 WCS and for their business planning purposes. These have been based on an existing Infoworks model developed during a previous drainage area plan exercise. However, the model is now out of date, is known to have some modelling inaccuracies and not fully represent the wet and dry weather response in the catchment. These



inaccuracies, which along with growth issues were the driver for the current ongoing DAP project, also mean that the existing capacity studies may not be fully robust.

L.2 Gap analysis

L.2.1 Water cycle study requirements

216. The water cycle study phase 2 detailed strategy needs to be completed and agreed by July 2010 to inform the submission of the Core Strategy.

217. In order for a Core Strategy to be sound we understand that a planning inspector will be looking for evidence that development has been located to make best use of existing infrastructure capacity and for confidence that there is a reasonable prospect of infrastructure being delivered in advance of development where additional infrastructure is required. In addition, the Environment Agency will need confidence that the infrastructure can be delivered within environmental capacity, i.e. that development and additional infrastructure will not cause a deterioration in water environmental quality.

218. At present, the water cycle study is generally confident that wastewater treatment capacity will not be a constraint to growth in West Northants, and that river water quality will not be impacted by development. This position will be confirmed for the production of the draft report by the end of March 2010. However we will not be a in a position to do the same for wastewater network capacity over the same time period. Until AWS have completed the DAP, it will be impossible to determine in detail what capacity there is within the existing network for new development, what the impact of new development would be without additional infrastructure, or what additional infrastructure would be needed and how feasible it is to deliver the infrastructure in advance of development.

219. The UPM model will able to inform a limited understanding of the implications of development on storm sewer discharges and river quality, but because the initial outputs of this model are based on the existing DAP model not the new model, the results can only be viewed as interim.

Peripheral urban extensions

220. Options exist for urban extension developments on the periphery of Northampton to be connected directly to Great Billing STW without draining through the existing wastewater network. The closer these developments are to the STW, the more feasible and deliverable such solutions are. Such direct connections are often funded directly by developers through the 'requisition process' in negotiation with Anglian Water Services. The water cycle study will undertake a feasibility analysis of direct connections. However, a recent legal ruling[5] has reinforced the right of developers to connect to a wastewater sewerage system at the nearest point to their development, which may make developers more reticent to agree commercial terms for requisition of strategic infrastructure, and instead seek to pass the cost of such infrastructure back to the water company directly. Anglian Water have considered the implications of the legal ruling and do not consider it to be a threat to delivering wastewater infrastructure through the requisition process[6].

[5] Barratt Homes vs Welsh Water Dwr Cymru - See Appendix A for a summary of the ruling

[6] Pers comms – see Appendix B

Central Area

221. The Central Area Action Plan is of particular concern with respect to wastewater capacity. There are unlikely to be alternative direct connection strategies that could be pursued because of the location of the Central area. Therefore the issue of whether or not there is capacity within the existing system becomes critical. The recent supreme court decisions reinforces the opinion that once planning permission is granted developers have right to connect to the existing sewerage system without needing to fund such infrastructure improvements as would be required within the existing downstream network to cope with the additional load. Therefore, it could be argued that development should only be planned or permitted where the water company has provided evidence that there is existing or planned capacity within the downstream network to cope with any additional load from new developments. It is not possible to make this assessment for the Central Area for the Water Cycle Study report to be published before July because of the progress of the drainage area plan.

L.3 Implications

222. If development is allocated without an understanding of wastewater infrastructure, the Core Strategy is at risk of:

- Failing to allocate development to make best use of the existing infrastructure capacity. It is not considered that there is a significant risk of this happening. It is the understanding of the water company, the drainage modellers and the water cycle study, that there is limited capacity within the existing system to cope for the scale of development planned.
- Allocating development where additional load on the sewerage system will require additional infrastructure that cannot be funded or delivered by the requisition process or the water company within the right timescale.

223. Without a clear understanding of the wastewater infrastructure capacity and additional infrastructure required to serve new development, it is possible that the Core Strategy will pursue a housing delivery timescale that is inconsistent with wastewater infrastructure delivery. Anglian Water have reiterated their responsibility and commitment to providing such infrastructure as would be required, when it is required[7] in light of the recent Supreme Court decision. However, this commitment is subject to there being no water quality or planning constraints. Whilst we are seeking to address the issue of water quality constraints through the UPM modelling, it will not be possible to confirm categorically that there are no water quality or planning constraints until the DAP has been completed. Therefore the risk remains that wastewater infrastructure constraints could be a constraint to achieving the Core Strategy housing trajectory. This risk is even greater with respect to the Central Area where there are unlikely to be direct connection to the STW alternatives for wastewater conveyance.

- Causing existing residents to be subject to foul flood risk if upstream development overwhelms their existing sewerage system.

224. Should development be permitted and the developer enforce their right to connect to the wastewater network where there is no downstream capacity, the downstream network may be at risk of foul flooding or of water quality pollution of rivers from wet weather discharges. It is impossible to assess the risk or consequence of this happening until the DAP is completed, although preliminary assessments would suggest that there is limited risk of the proposed allocations having an impact on foul flooding, but that there is likely to be an increase in wet weather discharges from the wastewater network.

[7] Per comms - see last paragraph appendix 2

L.4 Way forward

225. We are recommending that the water cycle study draft report, to be published at the end of March 2010 undertakes a feasibility analysis of direct connection of the allocations we are testing. This will assume that there is no current capacity within the existing wastewater network and will estimate how long a direct connection to the wastewater treatment works would take to plan and deliver.

226. Anglian Water believe that they can create significant capacity within the existing network by managing infiltration through better surface water management. The ongoing DAP modelling process has confirmed that infiltration is an issue, but it is not possible at this stage to fully quantify the capacity that can be created. It is possible that the Central Area Action plan can help reduce the infiltration and surface water connections to the wastewater drainage network as the central area is redeveloped. This approach will require planning policy to help ensure that this happens, and to ensure that development does not occur until capacity has been created.

227. It is likely that it will not be possible to create as much capacity as is required to offset additional load from new urban extension developments. In this case additional wastewater drainage infrastructure will still be required. Until AWS complete their DAP is it difficult to determine what the most cost effective balance of infrastructure and demand management is, and if it can be delivered in accordance with the Core Strategy. We are proposing to manage this risk by recommending policies in the WCS for the Core Strategy to consider that will allow planning permissions to be conditional on AWS agreement that there is capacity within their network, or that phasing of dwelling completion is consistent with the planned delivery of wastewater network infrastructure.

L.5 Annexes

Annex 1

Barratt Homes vs Welsh Water Supreme Court decision

The law

It is commonplace for a developer to use the power of requisition under section 98 of the Water Industry Act 1991 to require a sewerage undertaker to provide a new public sewer to serve its development. The sewerage undertaker has powers to deliver new sewers over third party land and the developer has to cover the whole cost of both providing the new infrastructure and upgrading the existing system to cope with the additional demands that will be placed upon it.

Perhaps less well known, until recently, was the right of a developer to connect into an existing public sewer under section 106 of the same Act. This right is useful where new development takes place next to an existing public sewer and, crucially, the developer cannot be required to pay for anything more than the cost of the connection into the existing sewer.

The facts

In this case Barratt sought to use section 106 to connect into an existing sewer at the point nearest its development. Between that point and the sewage treatment plant there was a section of the existing network that was restricted and it was agreed by all parties that it simply would not cope with the extra demands that the new development would place upon it - an increase of more than 25 per cent in the load.

By the time the matter came before the Supreme Court, Welsh Water had conceded that they could not require Barratt to cover the £200,000 or more that it would cost to upgrade capacity in the sewer. Instead they were seeking to argue that they could require Barratt to connect further down the system, where capacity was not a problem. Crucially, Welsh Water felt that Barratt should be responsible for the additional cost of getting to this alternative connection point, requisitioning a sewer over third party land

under section 98 if necessary.

The decision

The Supreme Court held that there was very little ability under the legislation for Welsh Water to direct the point at which a new connection to the existing sewer should be made. The judges recognised the extreme difficulties that their decision would cause for sewerage undertakers, whose investment plans and charges are approved over a five year cycle by the industry's regulator, OFWAT, but felt that they could do little about it. The judges also confirmed that the costs of upgrading the existing network to cope with the new connection were the responsibility of the sewerage undertaker and not the developer.

The planning system

In coming to its decision, the court recognised that the planning system has an important role to play in moderating the impact of the absolute right to connect given by the legislation. They emphasised that local planning authorities will often consult with water companies when dealing with planning applications and should, where appropriate, impose Grampian conditions preventing development from starting until an acceptable drainage scheme has been submitted.

Sewerage undertakers need to ensure that they have in place systems to ensure that they are monitoring planning applications and making appropriate representations to protect the integrity of their network. In this case the local planning authority approved details of the connection, apparently without consulting with Welsh Water.

Conclusion

This important decision has far-reaching implications for developers, water companies and local planning authorities alike. It may also have implications for other utility providers with similar legislative frameworks.

Whilst developers will welcome confirmation of their right to connect into the existing sewer at the point of their choice and without liability for any costs beyond the cost of the physical connection, sewerage undertakers will be concerned about the implications for their ability to fund necessary capacity improvements. Local planning authorities will also be reminded by the decision of the need for them to properly take into account the impacts of development proposals on local sewer networks.

In addition, the decision may well have an impact on existing and planned tariff/Community Infrastructure Levy arrangements. Where it was anticipated that the costs of providing infrastructure improvements to accommodate new development would be met by an individual development outside the tariff/CIL payments, such payments may now need to be reviewed to ensure the infrastructure can be funded

Annex 2

Water Company Water services infrastructure

Legislation

Anglian Water Services Limited is appointed as the water and sewerage undertaker for the Anglian region through an appointment made under the Water Industry Act 1991 (see attached map with operating boundaries). The principal duties of a water and sewerage undertaker are set out in that legislation. Section 37 of that Act places a duty upon a water undertaker to develop and maintain an efficient and economical system of water supply within its area. Similarly Section 94 places a duty upon a sewerage undertaker to provide, improve and extend a system of public sewers to ensure that its area is effectually drained and the contents of those sewers effectually dealt with.

Regulation

The Water Services Regulation Authority (Ofwat) is the economic regulator of water and sewerage companies in England and Wales.

For every five year asset management planning (AMP) cycle, companies submit a business plan to Ofwat. The plans set out each company's view of what it needs to do to maintain its assets, improve services to customers and deal with its impact on the environment. The funding is linked to the setting of customer bills (the so-called "price review" or PR).

Any infrastructure requirements which arise after agreement of the five year AMP will normally be considered for the following AMP period. AMP5 will cover the period 2010 to 2015.

Developer Contributions

When a developer wishes to proceed with a particular site, they will requisition the appropriate water company (or companies if separate for water and wastewater) to provide infrastructure in accordance with the relevant provisions of the act (Section 98 for sewerage and Section 41 for water) The cost of this is shared between the developer and undertaker in accordance with provisions of legislation.

For infrastructure serving more than one development site, it is necessary to share costs equitably between developers.

The current system of "section 106 agreements" between planning authorities and developers is not available as a mechanism for recovering the cost of water or wastewater infrastructure. These agreements can only be used for public sector works e.g. highways, health, education, flood mitigation.

Sewer requisitions

Our approach to developer requisitions used in the PR09 business plan would not be affected by the ruling in the case of Barratt Homes vs DCWW; infrastructure will be provided regardless of whether Anglian Water is requisitioned. The case confirms Anglian Water's understanding of the legal position. Note that Section 41 of the Water Industry Act which relates to water requisitions is very different and also unaffected by the ruling.

Sewer schemes for growth have been included in AMP 5 only where there is a high degree of certainty that they will be requisitioned in the period to 2015. Where Anglian Water is requisitioned for something not included, this would still be undertaken in AMP 5 provided there are no constraints in terms of water quality or planning. As such it is not relevant which schemes are in AMP 5.