Dacorum Borough Council, St Albans City and District Council, Three Rivers District Council, Watford Borough Council, Welwyn Hatfield Borough Council

Water Cycle Study

Scoping Study

Final Report

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This report has been prepared for Dacorum Borough Council, St Albans City and District Council, Three Rivers District Council, Watford Borough Council, Welwyn Hatfield Borough Council in accordance with the terms and conditions of appointment for Scoping Study dated December 2009. Hyder Consulting (UK) Limited (2212959) cannot accept any responsibility for any use of or reliance on the contents of this report by any third party.

Disclaimer:

This report was prepared prior to April 2010 and hence makes reference to the Floods and Water Management Bill. This Bill was amended and enacted after the publication of the draft report, and as such any further WCS work should revisit this topic.

CONTENTS

1 SUMMARY

1.1 Study Area

This WCS Scoping report has been conducted for the Local Planning Authority areas (LPA) of Dacorum Borough Council (DBC), St Albans City and District Council (SADC), Three Rivers District Council (TRDC), Watford Borough Council (WBC) and Welwyn Hatfield Borough Council (WHBC), located in the southwest of Hertfordshire in the East of England.

A Water Cycle Study (WCS) is required to inform the preparation of Core Strategy and Site Allocation Documents, and ideally provide evidence to support any polices included in the Local Development Framework (LDF) that relate to water resources, supply and sewerage, wastewater treatment, flood risk, water quality and the wider water environment.

1.1.1 Study Boundary

In addition to considering the growth in the five LPA areas, the study area also extends beyond the above LPA boundaries (see Section 5.7). The growth proposed will impact the wastewater treatment works (WwTW) and receiving watercourses at Blackbirds, Deephams, Rye Meads and Chesham, in addition to the WwTW within the five LPA areas. Although possible growth in the surrounding LPA areas may be referred to throughout the report, it has not been specifically accounted for in this WCS assessment.

1.1.2 Steering Group

The stakeholders involved in steering this WCS were:

- Dacorum Borough Council (DBC);
- Natural England (NE);
- St Albans City and District Council (SADC);
- Thames Water Utilities Ltd (TWU);
- The Environment Agency (EA);
- Three Rivers District Council (TRDC);
- Veolia Water Central (VWC);
- Watford Borough Council (WBC); and
- Welwyn Hatfield Borough Council (WHBC).

In addition, Hertfordshire Biological Records Centre (HBRC), Hertfordshire County Council (HCC) and British Waterways (BWW) have provided information throughout the consultation.

1.2 Policy Context

This WCS makes reference to national policy, in the form of Planning Policy Supplement (PPS), EA and Defra strategies and other national aspirations such as the Code for Sustainable Homes.

Regional policy, emanating from the Regional Spatial Strategy (RSS) and the Hertfordshire based Building Futures design guide, is referred to throughout the WCS.

Any existing Local Policies adopted by the LPAs in relation to water infrastructure or the wider water environment are also discussed.

1.3 Growth Proposals

Growth targets for the study area have been used to assess two scenarios:

- Scenario 1: Equivalent to the existing RSS targets (with some amendment due to the current legal challenge); and
- Scenario 2: Based on the highest target applicable to each LPA from either the existing RSS or the forthcoming RSS Review.

Scenario 1 sets a target of nearly 30,000 additional homes in the study areas from 2010 – 2031. The growth proposed under Scenario 2 is currently more than double this amount, with approximately 62,000 new homes proposed from 2010 – 2031.

The LPAs have provided a high-level assessment of where this growth may be accommodated, relying on existing committed sites, proposals in Local Plans and the outcomes of Strategic Housing Land Availability Assessments (SHLAA).

1.4 Baseline Data

A review of existing documentation and consultation with the stakeholders has allowed a baseline to be established for the current water infrastructure and wider water environment.

1.4.1 Water Resources

The study area lies within four separate river catchments:

- The River Colne (for the majority of the study area);
- The Lower Lee;
- The Thame and South Chilterns; and
- The Upper Lee.

The majority of the study area is underlain by the chalk aquifer (constrained in parts by a layer of clay), which is a regionally important source of groundwater.

An assessment of existing resources indicates that there is no additional water available for abstraction at times of low flow. Increased groundwater abstraction would be of detriment to the majority of the watercourses, as they interact with the underlying chalk, and already suffer from low flows (which are harmful to the biodiversity in the watercourse).

1.4.2 Water Supply

The majority of the study area is supplied with potable water by Veolia Water Central (VWC), with the exception of the area around Tring, which is supplied by Thames Water Utilities Ltd (TWU).

The supply to the area is well reinforced, with a number of reservoirs and strategic transfers in place to maintain an adequate security of supply.

1.4.3 Sewerage

Wastewater in the study area is collected by Thames Water Utilities Ltd (TWU) via their network of sewers. In the majority of the study area, there are separate sewerage systems for foul and surface water, although the foul systems are influenced by storm water due to infiltration and misconnections.

1.4.4 Wastewater Treatment

The wastewater from the potential growth locations is sewered to ten wastewater treatment works (WwTW). These are:

- Berkhamsted;
- Blackbirds;
- Chesham;
- Deephams;
- Harpenden;
- Maple Lodge;
- Markyate;
- Mill Green;
- Rye Meads; and
- Tring.

These WwTW discharge treated wastewater to the watercourses in and around the study area. TWU have provided a high-level assessment of the current capacity at each WwTW.

1.4.5 Water Quality

EA data suggests that all of the watercourses in the study area would fail to meet 'good status' under the Water Framework Directive (WFD). Common concerns throughout the study area are the impacts of excessive nutrients, which are of detriment to biodiversity, and low flow levels.

1.4.6 Ecology

The study area contains numerous water related sites of environmental importance. Whilst none of the sites are currently described as having significant problems with regards to water quality or flow levels, the rivers themselves also carry a great deal of importance with regards to biodiversity.

1.4.7 Flood Risk

Existing flood risk in the study area is well documented by LPA and EA studies. There are numerous historical records of surface water flooding, particularly with respect to the existing surface water drainage systems being overwhelmed during storm periods.

1.5 Issues and Constraints

1.5.1 Potable Water

The water companies have strategies in place to accommodate the potential increase in demand under the Scenario 1 growth whilst managing the limited water resources and accounting for future climate change. These strategies rely partially on increased water efficiency in both new and existing dwellings, making this an important topic for LPAs to consider.

The Scenario 2 growth may require the water companies to reassess their long-term plans for the study area. Additional import of water from outside of the study area, and rearrangement of the existing strategic infrastructure, may be required during peak demand periods to ensure that an adequate security of supply can be provided. Again, greater water efficiency throughout the study area will improve the situation, requiring less water to be imported (which is a relatively expensive and energy intensive operation).

1.5.2 Sewerage

The large scale growth within the Maple Lodge catchment will severely impact the existing trunk sewers as they approach Maple Lodge. Occurrence of sewer flooding may increase because of this. Network modelling is required by TWU to further assess this issue and potential options for strategic solutions.

On a localised scale, a number of potential growth locations are located to the opposite side of existing settlements with regards to the WwTW or trunk sewers. Any network upgrades required through the existing settlement will be expensive and disruptive, and may therefore be cost prohibitive, particularly if funded by developers. This must be further assessed with TWU, to see if there are any opportunities to construct new strategic sewers in line with the growth proposals – this is particularly important for TRDC and WBC, and the larger settlements in DBC, SADC and WHBC.

1.5.3 Wastewater

The majority of WwTW will require some capacity upgrades to accommodate the potential increases in wastewater. Key issues that may constrain growth are that:

- Harpenden WwTW may require a complete rebuild (taking up to ten years to plan, design and construct) to accommodate the proposed Scenario 2 growth; and
- Maple Lodge WwTW (or Blackbirds WwTW, dependant on TWU strategy) will require substantial upgrades under both growth Scenarios. Limited space at Maple Lodge WwTW may make this problematic.

There is uncertainty regarding future effluent discharge consents to meet WFD requirements in receiving watercourses and what impact future growth will have in the Region. This is currently being discussed by the EA and relevant water companies.

Further consultation will be required with TWU once current consent levels and development targets are confirmed, to develop a wastewater treatment strategy for the study area.

1.5.4 Water Quality and Ecology

The main potential impact on water quality in the study area from the proposed development is that increased flows from the WwTW will introduce additional pollutants and nutrients into the watercourses.

It is impossible to accurately assess the impact of such increases, or even the current performance of the WwTW, as the EA and TWU are currently in the process of revising the discharge consents - which dictate the quality and quantity of treated wastewater that can be discharged.

Current data suggests that increased volumetric discharge consents will be required at Maple Lodge, Mill Green and Harpenden WwTW. There is a risk that such an increase would be accompanied with a tightening of the relevant quality standards, to protect the downstream water quality of the receiving watercourses. This may particularly be a problem at Maple Lodge, where the current process may require the use of unconventional technologies to further reduce nutrient concentrations.

1.5.5 Flood Risk

The LPAs should continue to refer to their Strategic Flood Risk Assessments (SFRA) to ensure that development is steered towards areas of appropriate flood risk, and allows for increase in flood risk due to climate change, as per PPS25. In addition, the key implications of the emerging Flood and Water Management Bill should be considered.

Further work should be undertaken to assess the potential flood risk implications of increases in discharges from the WwTW due to the proposed growth.

1.6 Conclusions and Recommendations

Conclusions from the above Sections are presented in a constraint matrix for each of the LPA areas, which give details regarding each potential growth location.

Advice and recommendations regarding issues common to all LPA areas, policy development and further work are included at the end of the report. This section clearly highlights the need for immediate progression to the next stages of the WCS, as either a joint study, sub-area studies or individual studies depending on data availability, LPA timescales for their LDF, and other LPA priorities.

2 Introduction

Dacorum Borough Council (DBC), St Albans City and District Council (SADC), Three Rivers District Council (TRDC), Watford Borough Council (WBC) and Welwyn Hatfield Borough Council (WHBC) - *herein referred to as the Local Planning Authorities - (LPAs)* are currently in the process of preparing their Local Development Frameworks (LDF). The LDF will comprise statutory (and optional) documents that translate national and regional planning policy to local level strategy for each of the LPA areas.

A Water Cycle Study (WCS) is needed to ensure that water supply, water quality, sewerage and flood risk management issues can be addressed to enable the growth to 2031, as proposed in the Regional Spatial Strategy (RSS), the East of England Plan (and forthcoming review), whilst preserving and enhancing the water environment. Future stages of the WCS will form a key part of the evidence base for the LPA Core Strategies, and provide steer to the LPAs as they refine these Strategies and subsequent policies.

As the lead authority, DBC appointed Hyder Consulting (UK) in December 2009 to complete a Water Cycle Study - Scoping Report for the five LPAs. This high level study will provide the context for the more detailed studies which may be required for future Core Strategy Submissions and Site Allocations.

The Scoping phase will review the existing water cycle arrangements and infrastructure capacity, whilst considering the potential growth scenarios affecting the five LPA areas up to 2031.

Key objectives of the WCS Scoping phase are to:

- Define the study area and steering group;
- Identify existing and planned levels of water supply, taking account of available resources and consumption targets, to accommodate the planned levels of growth;
- Identify the capacity of existing trunk sewers and wastewater treatment works to handle wastewater over the period to 2031 whilst highlighting pinch points and other critical issues associated with wastewater treatment;
- Identify the likely ecological and water quality impacts of planned growth on receiving watercourses at the wastewater treatment works, against existing discharge consents, whilst taking account of the Water Framework Directive;
- Identify any significant impacts on river flows, hydrology and the quality of watercourses and aquifers in the strategy area whilst considering the potential impacts of climate change;
- Consider existing and potential flood risk, by linking into Strategic Flood Risk Assessment work already undertaken, whilst considering future work that needs to be undertaken by SADC and WBC regarding a Surface Water Management Plan;
- Identify any gaps in evidence in relation to proposed development, water drainage, water infrastructure, flood risk, water quality, water resource and ecological issues; and
- Recommend any further WCS work required, and provide the scope for such work.

2.1 Study Area

The five LPA areas are located in the southwest of the County of Hertfordshire, in the East of England.

The study area encompasses the major urban settlements, such as Watford, Hemel Hempstead, St. Albans and Welwyn Garden City, along with smaller outlying settlements and rural areas.

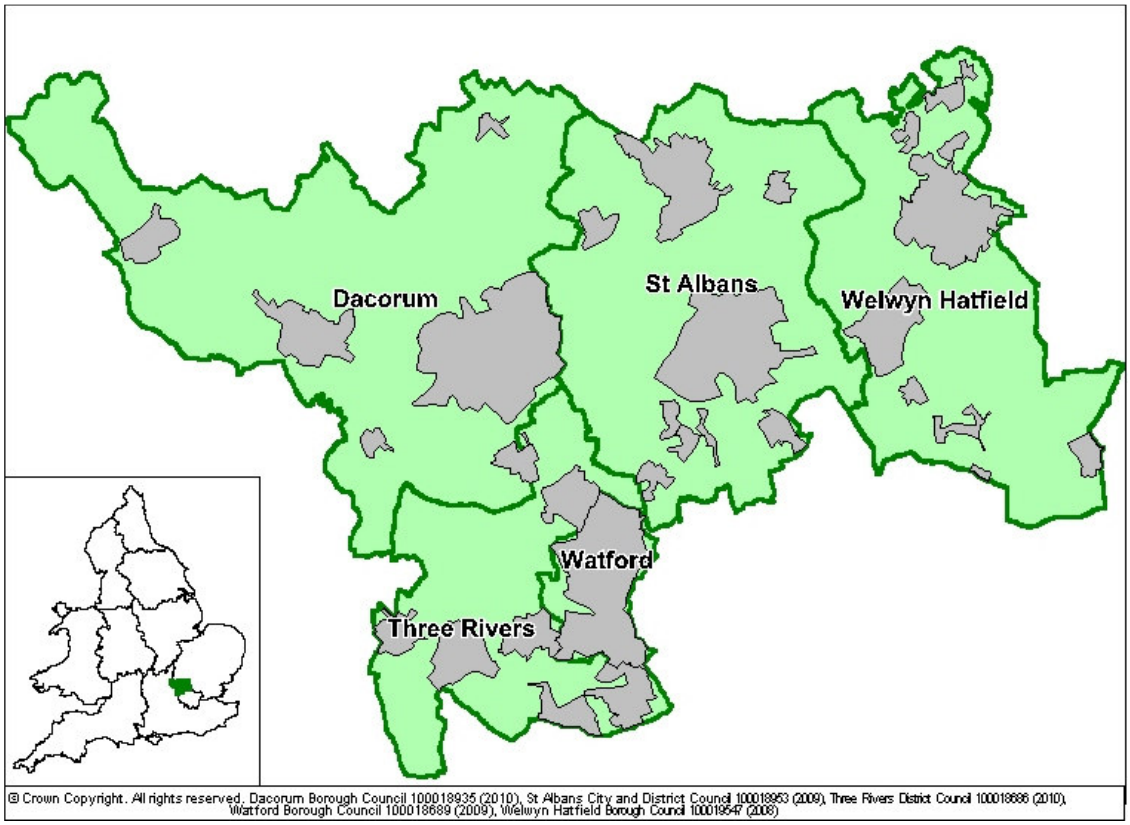

Figure 2-1 Study Area Overview

The study area is located within four river catchments:

- The Colne;
- The Lower Lee;
- Thame and South Chilterns; and
- The Upper Lee.

Figure A-1* illustrates the locations of the main watercourses within the catchment in relation to the larger settlements. These river catchments are described in more detail in Section 5.1.1.

The majority of the study area is underlain by the chalk aquifer (a major store of the UK's groundwater resources). More information regarding groundwater is included in Section 5.1.

* Figures A-1 to A-6 are contained in Appendix A due to size

Potable water is supplied to the study area by Veolia Water Central (VWC), and Thames Water Utilities Ltd (TWU). The study area is supplied via a number of groundwater abstractions from the underlying chalk aquifer and the import of treated water from Anglian Water Services' (AWS) Ruthamford Water Resource Zone (WRZ) and a water treatment works (WTW) on the River Thames. More information regarding potable water supply is included in Section 5.2.

The company responsible for collecting and treating wastewater within the study area is TWU. More information is included in Section 5.3.

Sources of flood risk within the study area were identified in the Strategic Flood Risk Assessments (SFRA) previously undertaken for the LPA. Key messages from these reports, and other relevant flood risk policies, are highlighted and built upon in Section 5.6.

2.2 Steering Group

The following stakeholders have been involved in the consultation process for this WCS Scoping report:

- Dacorum Borough Council (DBC);
- Hertfordshire Biological Records Centre (HBRC);
- Hertfordshire County Council (HCC);
- Natural England (NE);
- St Albans City and District Council (SADC);
- Thames Water Utilities (TWU);
- The Environment Agency (EA);
- Three Rivers District Council (TRDC);
- Veolia Water Central (VWC);
- Watford Borough Council (WBC); and
- Welwyn Hatfield Borough Council (WHBC).

In addition, British Waterways (BWW) have been contacted with respect to the Grand Union Canal (GUC), which runs through the DBC, TRDC and WBC areas.

Details of the information provided by these stakeholders is included in Appendix B.

2.3 The Water Cycle

The natural water cycle is the process by which water is transported throughout a region. The process commences with some form of precipitation, be it rain, snow, sleet or hail. This is then intercepted by the ground and either travels overland through the process of surface runoff to rivers or lakes, or percolates through the surface and into underground water aquifers.

The presence of vegetation can also intercept this precipitation through the natural processes that plants carry out, such as transpiration and evapo-transpiration. The water will eventually travel through the catchment and will be evaporated back into the atmosphere along the way, or will enter the sea where a large amount will be evaporated from the surface. This evaporated water vapour then forms into clouds and falls as precipitation again to complete the cycle.

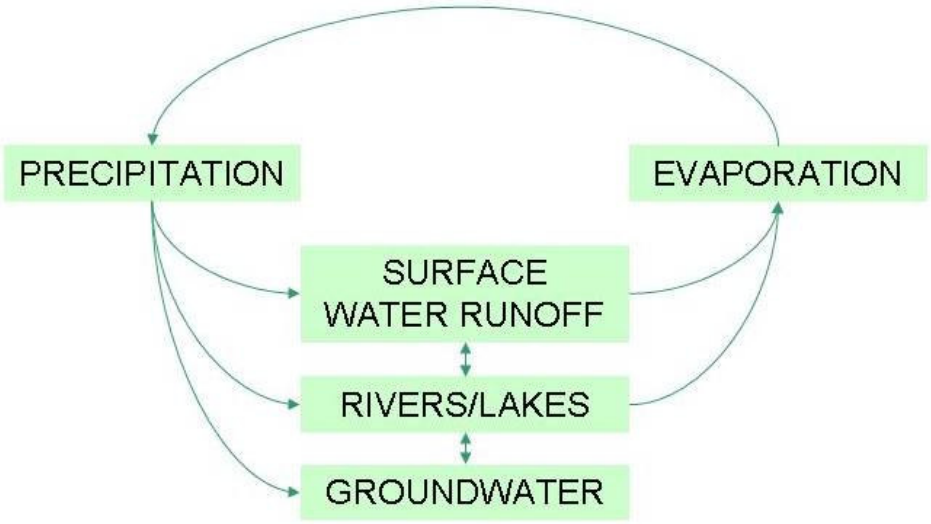

Figure 2-2 The natural Water Cycle

Urbanisation creates a number of interactions with the natural water cycle. Abstraction of water, from both surface water and groundwater sources for use by the local population, interacts with the water cycle by reducing the amount of water that is naturally held within the aquifers and watercourses. Following treatment at a water treatment works (WTW) this water, now potable, is transported via trunk mains and distribution pipes to the dwellings in the area. The potable water is then used by the population within the dwellings for a number of different purposes, which creates large volumes of wastewater.

The use of impermeable surfaces in developments also reduces the amount of water that is able to percolate through the ground to the groundwater aquifers. This therefore increases the rate of surface water runoff, which leads to flooding and increased peak discharges in rivers.

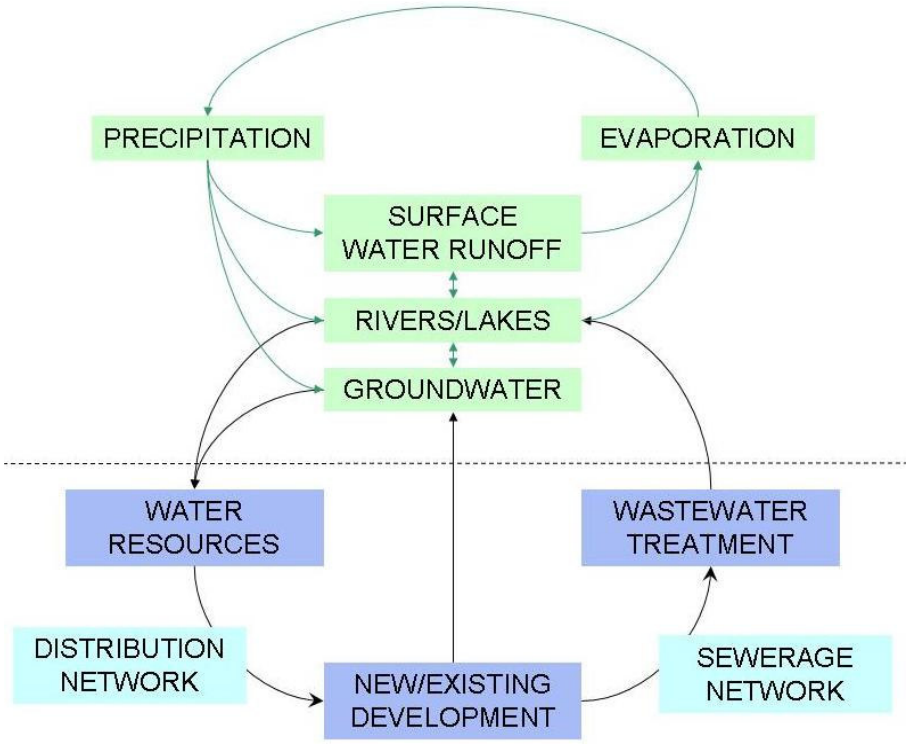

Figure 2-3 The wider Water Cycle

The wastewater from the settlements, and sometimes surface water drainage systems, is transported via the sewerage network to a wastewater treatment works (WwTW), where the water is screened, treated, and then discharged back into the rivers or groundwater.

Discharges from WwTW require consent from the EA. A consent document lists the maximum volume of discharge that can be discharged, and the quality limits that this discharge must meet. Typically, the consent will set limits on the concentrations of the following physio-chemical determinands*: Ammoniacal Nitrogen (Amm. N), Biochemical Oxygen Demand (BOD) and suspended solids in the discharge. In addition, the consent may also stipulate a Phosphorous (P) concentration, along with limits on the concentrations of other chemicals (such as Iron) used in the Phosphorous stripping process.

2.4 Current Funding Mechanism

The investment plans of water companies are based on a five-year cycle. In general, infrastructure funding comes from investment through the business plan process whereby the water regulator, Ofwat, sets customer bills. Water companies are required by Ofwat to plan in five-year periods known as Asset Management Periods (AMPs).

The current AMP is AMP 5 (2010-2015) and the water companies have just recently completed the process of preparing their programme and capital expenditure plan, referred to as Price review 2009 (PR09). The PR09 process involved Ofwat reviewing the water companies Final Business Plans, which set out the investment, resource development and infrastructure improvements required over the AMP. Ofwat regulate the levels of expenditure of water companies to a level that they see as being affordable by their existing customers.

* See Discharge Consent in Technical Glossary for description of determinands

Figure 2-4 illustrates the AMP5 process to 2015, which may dictate the constraints on capital project planning and funding and thereby influence the phasing of the planned development in the short term. Continued liaison between the LPAs and water companies is required, particularly as Core Strategies develop, as there is a risk that the funding required for the design and construction of strategic upgrades to WwTW, sewers and the potable supply network will be delayed by the AMP funding cycle unless specific growth points are considered during following Price Review processes.

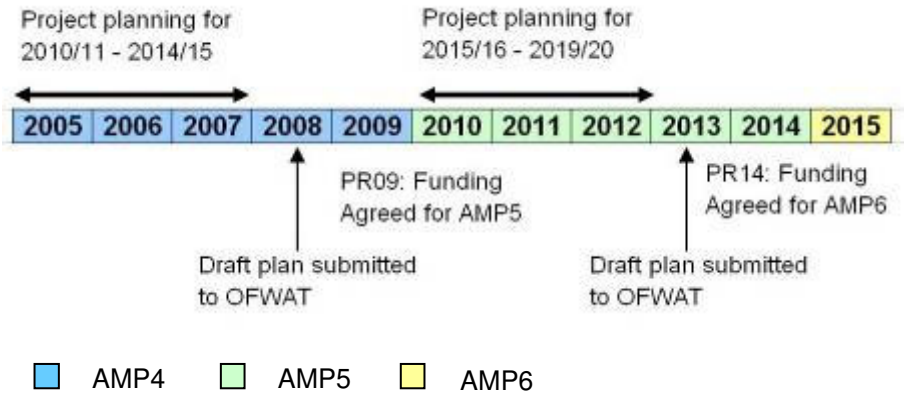

Figure 2-4 Water Company Capital Funding Cycle

Adapted from Rye Meads Water Cycle Strategy Scoping Report; EA, August 2007

Water companies have a duty to supply potable water to customers under Section 52 of the Water Industry Act 1991, and are hence obliged to connect developments to the network once planning permission has been received.

Water and sewerage undertakers have limited powers under the Water Industry Act 1991 to prevent connection of new dwellings ahead of infrastructure upgrades and therefore rely heavily on the planning system to ensure infrastructure is provided ahead of development, through either appropriate phasing or planning conditions.

Where there is no existing local infrastructure in the locality of a development, or the route of such infrastructure would be required to cross land owned by a third party, the provision of water and wastewater services to new homes is subject to the requisitioning process described in sections 90 to 99 of the Water Act 2003. The difference between the costs of infrastructure upgrades (including reinforcement to the existing network to ensure adequate capacity) and the predicted revenue from the new customers can be passed onto developers from water companies using Requisitioning Agreements. The amount charged is referred to as the "relevant deficit", and can be paid over a 12 year period, or one lump sum discounted to a net present value.

This ensures that water companies do not make a loss when connecting new developments into their networks. However, the majority of the capital funding required for major strategic infrastructure will be sourced from the expenditure approved by Ofwat.

3 Policy Context

The following sections introduce a number of national, regional and local policies that must be considered by the LPAs, water companies and developers. Key extracts from these policies relating to water consumption targets, and mitigating the impacts on the water environment from new development, are summarised below.

3.1 National

3.1.1 PPS

Planning Policy Statements (PPS), and some Planning Policy Guidance Notes (PPG) which have not yet been superseded by PPS, are national planning documents that provide guidance to LPAs on planning policy. LPAs should ensure that planning documents consider these policies, and may be able to use some of the policies contained within PPS to make decisions on individual planning applications.

The most relevant PPS to this WCS are:

- PPS1: Delivering Sustainable Development (and the 2007 Supplement entitled Planning and Climate Change);
- PPS3: Housing;
- PPS9: Biodiversity and Geological Conservation;
- PPS23: Planning and Pollution Control; and
- PPS25: Development and Flood Risk.

Relevant topics that consistently occur within the above mentioned PPS are:

- Resilience to climate change;
- Conservation / biodiversity;
- Sustainable use of resources;
- Mitigation of flood risk and the use of SuDS;
- Suitable infrastructure capacity; and
- Protection of groundwater and freshwater.

Key extracts from the above PPS are included in Appendix C.

3.1.2 Code for Sustainable Homes

The Code for Sustainable Homes (CSH) was introduced in England in April 2007. The code sets a framework, and acts as a tool, for developers to create homes to higher environmental standards than previously.

The CSH Levels require different levels of performance regarding water use, particularly per capita consumption (PCC). For internal domestic water use, these are:

- Levels 1/2 – 120 l/p/d;
- Levels 3/4 – 105 l/p/d; and

- Levels 5/6 – 80 l/p/d.

It became mandatory for new homes to be assessed under the Code from May 2008; however, the achievement of a certain CSH Level is only a requirement for social housing.

As of April 2007, all housing built on English Partnerships land and from April 2008 all social housing funded through the Housing Corporation has to be built to CSH Level 3, a performance standard of **105 l/p/d**, representing current best practice in water efficiency without requiring water reuse or rainwater harvesting.

The timetable for the implementation of the CSH requires that new homes are built to Level 3 from 2010 onwards and Level 6 from 2016.[1]

3.1.3 Building Regulations

In May 2009 the Department for Communities and Local Government issued a Circular[2] announcing changes to Part G of the Building Regulations.

A new requirement in the Building Regulations, regulation 17K, will require that water consumption in new dwellings must not exceed **125 l/p/d**. This also applies when a building is changed to a residential use, or where additional flats are added to existing premises.

A new regulation, 20E, will require that Local Authorities are provided with a notice specifying the calculated potential consumption within five days of work being completed. Local Authorities will not be able to grant a completion certificate until this notice has been received.

The Regulations require that potential consumption is calculated using the methodology described in The Water Efficiency Calculator for New Dwellings[3], as amended in September 2009. This methodology also replaces the existing methodology used to calculate water consumption under the Code for Sustainable Homes (CSH).

In September 2009 another Circular[4] was issued, which announced that the proposed changes to Part G of the Building Regulations will not come into force until 6th April 2010.

In addition, Part H of the Building Regulations requires that developers consider the following solutions regarding the drainage of surface water, in order of priority:

- Connection a soakaway or other adequate infiltration system (i.e. SuDS);
- Discharge to a river/watercourse; or
- Connection to a surface water sewer (or combined sewer if capacity exists).

3.1.4 BREEAM

The Building Research Establishment Environmental Assessment Methodology (BREEAM) is a suite of tools for measuring the sustainability of buildings. Sustainable design features, such as water conservation measures, are assessed against set criteria to provide an overall score leading to a BREEAM rating.

Different criteria exist for various non-domestic development types; more information can be found at www.breeam.org.

3.1.5 Future Water

The UK Government's strategy for water in England is described in Defra's Future Water[5] document. This strategy sets out an aspirational target for average PCC, across all dwellings, of **130 l/p/d**. Defra predict this target can be achieved by 2030 through a combination of water efficiency and demand management measures, such as low consumption appliances and fittings, and changes in metering and tariffs. Defra suggest that **120 l/p/d** may also be achievable dependant on new technological developments and innovation.

3.1.6 Water for People and the Environment

In 2009 the Environment Agency published its strategy for managing water resources in England and Wales to 2050 and beyond, entitled Water for People and the Environment[6]. This strategy supports the 130 l/p/d PCC target aspired to by Defra, and shows that the average PCC for England and Wales could be reduced from around 150 l/p/d to close to 120 l/p/d by 2030. To achieve this, PCC for new dwellings would have to meet CSH Level 3 (105 l/p/d plus 5 l/p/d for outside use) and near universal metering of properties in water stressed areas would be required by 2020.

The EA strategy concludes that the above demand management approach has the potential to be cost effective when compared to the development of new resources or desalination plants.

The EA also suggest that, as metering becomes more widespread and incentives to use water efficiently increase, rainwater harvesting and grey water recycling systems will become more cost-effective and could play an increasingly important part in managing water resources in the future.

In addition, the EA strategy suggests that all planning applications for significant new housing developments should be accompanied by a water cycle strategy.

3.1.7 Groundwater Protection: Policy and Practice

In 2008 the EA published a document that sets out the legislative and policy framework within which they will protect and manage groundwater, entitled Groundwater Protection: Policy and Practice. Part 4[7] of this document is directly relevant to this WCS, particularly the policies that set out the EA's requirements for surface water drainage in relation to its possible detrimental impact on underlying aquifers, if pollution risks are not adequately managed.

In addition, policies are also included regarding the management of abstractions and discharges.

3.1.8 The Pitt Review

Following the floods of summer 2007, an independent comprehensive review was published by Sir Michael Pitt, entitled 'Learning Lessons from the 2007 Floods.' This review contained 92 recommendations to the Government, Local Authorities and others. In December 2008, Defra published the UK Governments response[8] to the Pitt review.

Within this response, it is proposed that Local Authorities or HCC will be taking on a local leadership role, including responsibility for local flood risk management including surface water risk.

Local Authorities will be required to co-ordinate and lead local flood management activity, they will know where all local flood risk and drainage assets are and who owns them, and they will be able to assess the needs and desires of local communities in the area. There will be clear local responsibilities and people will know to approach the Councils for advice if there are problems. This will be within the context of the additional Strategic Overview role provided by the EA, which will also retain its responsibility for flooding from main rivers and the sea.

The Government intends that Local Authorities should be responsible for adopting and maintaining new and redeveloped sustainable drainage systems on highways and the public realm, so as to increase their uptake and effectiveness.

Full implementation of the Pitt Review recommendations will require appropriate resource and legislative backing from the Floods and Water Bill (see Section 3.1.9).

Flood risk management activity by Local Authorities is supported by the Revenue Support Grant. The need to spend more in this area was foreseen by the Government, and additional funding was provided in the local government settlement for 2008–09 to 2010–11. Further Defra funding may be made available in response to the Pitt review.

3.1.9 Flood and Water Management Bill

In response to the Pitt Review, climate change projections and increasing industry pressure, the draft Flood and Water Management Bill was published in April 2009.

The relevant key features of the emerging legislation are that:

- The EA will be given an overview of all flood and coastal erosion risk management and unitary and county councils the lead in managing the risk of all local floods;
- The uptake of SuDS will be encouraged by amending the automatic right to connect to sewers, and providing for unitary and county councils to adopt SuDS for new developments and redevelopments;
- Sewerage undertakers may be made statutory consultees, to ensure that development cannot go ahead until it has been proven that there is sufficient infrastructure capacity; and
- It will be easier for water and sewerage companies to develop and implement social tariffs, where companies consider there is a good cause to do so, and in light of guidance that will follow on from a full public consultation.

At present, the Bill is currently waiting for its second reading in the House of Lords, with the aim of passing into law before the end of the current parliamentary session in May 2010.

More information, including a breakdown of the possible implications for the LPAs, Water Companies and developers can be found at the Defra website:

http://www.defra.gov.uk/environment/flooding/policy/fwmb/index.htm

3.2 Regional

3.2.1 East of England Plan

The 2008 Revision to the Regional Spatial Strategy (RSS) for the East of England, entitled the East of England Plan, is the document that provides a consistent framework to inform the preparation of Local Development Documents in the counties of Norfolk, Suffolk, Cambridgeshire, Essex, Hertfordshire and Bedfordshire. It sets out the housing targets for the LPAs in the study area from 2001-2021.

The RSS contains a number of polices regarding water use, water infrastructure and the wider environment:

- Policy WAT1 – States that development must be matched with a year on year reduction in **water consumption** rates;
- Policy WAT2 – States that the **water infrastructure** required to support the new development must be provided in a timely fashion (or the development phased so this can be provided), and that development should make the best use of existing infrastructure;
- Policy WAT3 – Requires partnership and cooperation between Local Authorities, the EA, water companies and others to ensure plans do not adversely affect the **water environment**; and
- Policy WAT4 – States that new development should be located away from areas of high **flood risk**, and existing properties should be protected (including through the use of SuDS).

3.2.2 Regional Economic Strategy

The Regional Economic Strategy[9] for the East of England sets a challenge of achieving a PCC of around 120 l/p/d by 2030, by incorporating high, water-efficient standards into future development, reducing leakage rates, increasing the efficiency of existing buildings and behavioural change regarding the use of water in homes and businesses.

3.2.3 East of England Review

At the time of writing this Scoping WCS, the East of England Regional Assembly are yet to finalise the review of the RSS, which extends the plan period for the region to 2031. The draft RSS review[10], released in March 2010, amends policy WAT1 to state that where WCS demonstrate the need for water efficiency standards for new development beyond the regulatory minimum, Local Development Documents should reflect these findings by specifying standards.

The draft review amends policy WAT2 to reinforce that Local Development Documents should plan to site new development to maximise the potential of existing water/waste water treatment infrastructure and minimise the need for new/improved infrastructure.

3.2.4 Building Futures

Building Futures is an online guide that provides guidance on sustainable development within Hertfordshire. All of the LPAs involved in this WCS were involved in the production of the guide, and it is referred to in numerous LDF documents.

The 'Water' section of the guide explains the principles behind the sustainable management of development alongside the challenges of the water environment. Guidance is given on the costs and potential savings from water efficient fittings and practices.

The Building Futures principles of minimising water consumption, reusing water where possible, managing wastewater and controlling drainage align well with the National and Regional Policies described in above Sections.

3.3 Local Policy

The following Sections highlights the local policies and guidance that have been developed to date by the LPAs, which are directly relevant to the issues discussed in this WCS.

3.3.1 Dacorum BC

The DBC Emerging Core Strategy[11] paper, published for consultation in June 2009, states that DBC intend to develop policies in line with the principles of the Hertfordshire Building Futures Guide to new development, and therefore will seek to:

- Minimise the use and consumption of water;
- Minimise the adverse effects on water quality; and
- Incorporate facilities for recycling of water and waste.

DBC state that they will:

promote the efficient use of water in new development through water conservation measures (e.g. dual flush toilets), the effective management of grey water, and the use of sustainable drainage systems in the management of run-off, whilst following the recommendations in the Strategic Flood Risk Assessment to locate development away from floodplains and to manage run-off.

In addition, DBC support both the CSH and BREEAM standards for future development.

3.3.2 St Albans DC

The SADC Emerging Core Strategy[12] paper, published for consultation in July 2009, states that SADC intend to develop policies that will require new development to be built to high water efficiency standards, such as those in the CSH.

SADC propose that development will be located where it will minimise the need for new water and wastewater infrastructure. If it becomes clear that there are capacity problems, development will be phased so it is not built before the necessary infrastructure.

3.3.3 Three Rivers DC

The TRDC Sustainable Communities SPD[13], adopted in 2007, requires that developers:

- Submit details of water conservation and sustainable drainage solutions, including water saving devices, rainwater collection/harvesting, and grey water recycling;
- Incorporate low water use gardens in designs for new development (e.g. drought resistant plants and utilisation of existing vegetation); and

- Provide sustainable drainage solutions e.g. swales and basins, ponds, wetlands, permeable surfaces, and green roofs whilst taking account of areas sensitive to groundwater pollution.

TRDC require that surface water arising from a developed site must, as far as is practicable, be managed in a sustainable manner to mimic the surface water flows arising from the site prior to the proposed development, while reducing flood risk to the site itself and elsewhere, taking climate change into account.

The TRDC Core Strategy Preferred Options[14] consultation document makes reference to the following policies:

- Development should result in no net loss of biodiversity value in the key biodiversity areas of the Mid Colne Valley, Whippendell Woods and River Chess Valley;
- The use of Sustainable Drainage Systems should be incorporated in all new development where technically possible;
- New development will need to ensure that the quantity and quality of surface and groundwater resources are protected from aquatic pollution and where possible enhanced;
- There is an adequate and sustainable means of water supply and sufficient foul and surface water drainage; and
- Efficient use is made of water resources and account taken of climate change. This means incorporating water conservation measures.

3.3.4 Watford BC

The WBC Building New Homes[15] SPD, adopted in 2008, recommends the installation of water efficient fixtures in houses, and recognises the role that recycling rainwater and grey water can have in reducing overall consumption.

In addition, the SPD recommends that all medium to large-scale housing developments should incorporate the use of SuDS.

3.3.5 Welwyn Hatfield BC

The WHBC Core Strategy Issues and Options[16] consultation document, published in 2009, seeks to determine whether there should be a requirement for new homes in the Borough to meet the CSH Level 3/4, or Level 5/6 PCC rates.

The document also recognises the importance of avoiding development in flood plains, considering the need for any new flood storage areas and ensuring that development incorporates SuDS wherever necessary to manage surface water from development as close to its source as possible.

In addition, the document reiterates messages from the RSS regarding known capacity issues at Rye Meads WwTW (which serves the northern half of the Borough), and the potential impact such capacity issues may have on development location and phasing.

4 Development

4.1 Growth Scenarios

In order to robustly assess the impact of the proposed growth on the water infrastructure and environment, it is necessary to consider both the currently proposed growth, and the potential highest growth level, which could be influenced by the finalisation of the RSS Review.

The following two scenarios were developed in consultation with the LPAs, to reflect the dwellings they would need to see completed to meet their existing, and highest, growth targets by 2031.

4.1.1 Scenario 1: Current Growth

Scenario 1 is based on the current growth targets that the LPAs have been working to throughout the ongoing development of their LDF documents.

Local Planning Authority	Current level of growth planned (2006-31)	Plan document considered for current levels
Dacorum Borough Council	9,000	Draft RSS, 2004 (rolled forward)*
St. Albans City & District Council	9,000	RSS
Three Rivers District Council	5,000	RSS
Watford Borough Council	6,250	RSS
Welwyn Hatfield Borough Council	5,975	Draft RSS, 2004 (rolled forward)

Table 4-1 Scenario 1 Growth proposals

4.1.2 Scenario 2: Highest Growth

There is currently uncertainty over the growth targets for the LPAs in the study area due to the following two factors:

- The 'repair' of the 2008 RSS is currently being considered by the Government Office for the East of England, following the outcome of the legal challenge in 2009; and
- The East of England Regional Assembly is currently preparing a review of the RSS, entitled East of England Plan > 2031, which will set policy and targets for the period 2011-2031, and may contain significantly higher targets for the LPAs.

To overcome this uncertainty, the LPAs have established the highest growth targets that they may be asked to provide by examining the separate scenarios being considered under the RSS

* figures from Draft East of England Plan, 2004 – The recent quashing (May 2009) of Policies LA2 and LA3 in the RSS have left DBC and WHBC without housing targets, therefore both authorities have been advised to plan growth using the Draft East of England Plan 2004 housing figures.

Review, and combining the highest dwellings per annum (dpa) targets from either the Draft RSS 2004, the RSS 2008 or the Review Scenarios.

The outcome of this exercise is illustrated in Table 4-2 below.

Local Planning Authority	Highest level of growth being considered (2006-2031)	Plan documents relating to highest growth levels
Dacorum Borough Council	17,000	25 years x 680 dpa (relates to RSS 2008 pre-challenge)
St. Albans City & District Council	18,200	5 years x 360 dpa (relates to RSS 2008) + 20 years x 820 dpa (relates to RSS Review Scenario 3)
Three Rivers District Council	10,000	5 years x 200 dpa (relates to RSS 2008) + 20 x 450 (relates to RSS Review Scenario 4)
Watford Borough Council	6,250	5 years x 250 dpa (relates to RSS 2008) + 20 years x 250 dpa (relates to RSS Review Scenario 3)
Welwyn Hatfield Borough Council	15,400	5 years x 480 dpa (relates to RSS 2008) + 20 years x 650 dpa (relates to RSS Review Scenario 4)

Table 4-2 Scenario 2 Growth proposals

Whilst it is unlikely that all of these Scenario 2 growth targets would be required for every LPA, it is important that each LPA understands the impacts of their specific target on the water infrastructure and environment in the study area. As such, the aggregate of the Scenario targets will be used in development impact calculations, which should provide some flexibility to accommodate growth to beyond 2031.

4.1.3 Development Summary

As there have been a number of dwellings completed in each of the LPA areas from 2006-2009/10, these figures have been subtracted from the targets described above.

The following summary table illustrates the dwellings that will need to be completed within each LPA area from 2010/11 onwards in order to meet or exceed their targets under Scenario 1 and 2.

LPA	Scenario 1	Scenario 2
DBC	8,878	15,798
SADC	7,847	17,047
TRDC	4,082	10,560
WBC	4,969	4,869
WHBC	4,216	13,718

Table 4-3 Dwellings required 2010/11 - 2031

4.2 Potential Growth Points

In order to accurately assess the potential impact of the two growth scenarios on the water infrastructure and environment within the study area, the potential location of the development needs to be considered.

Consultation was taken with the LPAs to identify where in their areas the dwellings would be built. This consultation focussed on the following type of growth:

- Committed dwellings – sites with outstanding planning permission or legal agreements, where location is already decided;
- Allocated dwellings – sites identified through either existing Local Plans, Core Strategy Documents or which have been favourable assessed in the Strategic Housing Land Availability Assessments (SHLAA); and
- Remaining dwellings – sites that the Council may have to consider, perhaps through the strategic release of additional greenbelt land, to accommodate the remaining dwellings to meet the growth targets. This was based on SHLAA data, information on past completions, and emerging information from each of the LPA Planning Policy Teams.

To facilitate consultation with the WCS stakeholders, the multiple records of SHLAA sites, Local Plan sites and Core Strategy Sites were combined into a series of growth points, as illustrated in Figure A-2. These growth points are a rough guide to where the growth may be accommodated under the two Scenarios, based on the grouping of potential site locations identified by the LPAs, but do not represent individual sites.

A breakdown of potential growth locations, and the assumptions behind these, for each LPA is provided in the following Sections.

4.2.1 Dacorum BC

Potential Growth Location	Dwellings required 2010/11–2031	
	Scenario 1	Scenario 2
Berkhamsted	777	1,742
Bovingdon	83	134
Hemel Hempstead	7,218	11,727
Kings Langley	66	117
Markyate	124	327
Rural development	324	1,034
Tring	286	718
TOTAL	***8,878***	***15,798***

Table 4-4 DBC Potential Growth Locations

The above figures are based on existing commitments, SHLAA and Local Plan sites, with the DBC planning policy team providing an estimation of where the remaining dwellings can be accommodated. For Scenario 2, the remaining dwellings were allocated to each of the settlements based on past completions.

4.2.2 St Albans DC

Potential Growth Location	Dwellings required 2010/11–2031	
	Scenario 1	Scenario 2
Bricket Wood	23	23
Chiswell Green	26	26
Harpenden	737	1,372
How Wood	16	16
London Colney	832	2,101
Park Street/Frogmore	50	50
Redbourn	36	36
Rural Development	68	68
St Albans	5,919	13,216
Wheathampstead	139	139
TOTAL	***7,847***	***17,047***

Table 4-5 SADC Potential Growth Locations

The above figures are based on existing commitments, SHLAA and Local Plan sites, with the remainder under both Scenario 1 and Scenario 2 allocated based on a percentage which corresponds to the dwellings predicted in five of the original eight 'Areas of Search' from the

SADC Core Strategy[12]. The SADC planning policy team advise that, whilst these areas are no longer being considered by the Council, at the present time they provide the most robust estimation of where the large amount of remaining dwellings would have to be allocated to meet the RSS targets. Any significant change in possible allocations, as the LDF progresses, would have to be tested during further stages of the WCS work.

4.2.3 Three Rivers DC

Potential Growth Location	Dwellings required 2010/11–2031	
	Scenario 1	Scenario 2
Abbots Langley	1,642	3,683
Chorleywood	149	592
Croxley Green	772	2,203
Eastbury	95	309
Rickmansworth	696	2,083
Rural development	25	85
South Oxhey	703	1,605
TOTAL	***4,082***	***10,560***

Table 4-6 TRDC Potential Growth Locations

The figures are based on current planning permissions, and housing sites consulted on as part of the Core Strategy Further Preferred Options[14]. Whilst these sites have not yet been adopted as allocations, they represent the best available information at the current time and any changes will be tested through further WCS work. The remaining dwellings required in both Scenario 1 and 2 are based on past completion rates.

4.2.4 Watford BC

As the settlement of Watford is the only possible location for growth within Watford Borough, the breakdown appears simplified compared to the other LPAs. However, WBC have been able to provide indicative locations within the settlement of Watford, primarily through the use of SHLAA data as reported in their 2009 Annual Monitoring Report, as part of the WCS consultation. This will enable any significant water services infrastructure constraints to be identified.

Potential Growth Location	Dwellings required 2010/11–2031	
	Scenario 1	Scenario 2
Watford	4,969	4,869
TOTAL	***4,969***	***4,869***

Table 4-7 WBC Potential Growth Locations

4.2.5 Welwyn Hatfield BC

Potential Growth Location	Dwellings required 2010/11–2031	
	Scenario 1	Scenario 2
Brookmans Park	195	2,105
Cuffley	153	1,378
Digswell	55	55
Hatfield	1,629	7,457
Little Heath	72	170
Oaklands and Mardley Heath	55	55
Rural Development	52	52
Welham Green	37	478
Welwyn	131	131
Welwyn Garden City	1,828	1,828
Woolmer Green	9	9
TOTAL	***4,216***	***13,718***

Table 4-8 WHBC Potential Growth Locations

The above figures are based on existing commitments, SHLAA and Local Plan sites, with the remainder under both Scenario 1 and Scenario 2 allocated to catchments other than the adjoining Rye Meads WwTW catchment, to provide a worst-case scenario for the Deephams, Maple Lodge and Mill Green WwTW catchments. This allocation of the remaining dwellings corresponds with the percentage allocation of the 'high figures' in the WHBC Core Strategy Issues & Options[16] document.

5 Baseline Data

5.1 Water Resources

5.1.1 Hydrology

As illustrated in Figure A-1, the study area encompasses four river catchments, each covered by a separate EA Catchment Abstraction Management Strategy (CAMS).

The River **Colne**, and its tributaries the Rivers **Bulbourne**, **Chess**, **Gade**, and **Ver**, are part of the Colne catchment. The following key points have been extracted from the Colne CAMS[17] document:

- The north and west sections of the catchment border the southerly edge of the Chilterns and are predominantly rural whilst the central, south and east sections are more densely populated in the urban areas of for example St Albans, Hemel Hempstead and Watford;
- Within the northern and western areas of the catchment, the topography slopes steeply away from the Chiltern Hills towards the south east;
- Within the easterly and southerly areas of the catchment, where the majority of the rivers converge or meet the River Colne, the topography is lower lying with a gentle slope towards the south;
- The watercourses are chalk streams and their sources are subject to seasonal and annual climatic variations;
- Throughout the catchment the Grand Union Canal (GUC) interlinks with the Rivers Colne, Gade and Bulbourne;
- The majority of the rivers in the Colne catchment are susceptible to low flows due to low groundwater levels, which are increasingly exacerbated by drought conditions and abstractions;
- 60% of the total licensed abstraction in the Colne CAMS area is for public water supply. These abstractions are all from the groundwater; and
- The Colne CAMS rivers are tributaries of the River Thames and as such, any licensing strategy for this CAMS needs to take into consideration the flow requirements of the River Thames.

The watercourses draining the area to the northwest of Tring form the upper tributaries of the River Thame, and as such lie within the Thame and South Chilterns catchment. The following key points have been extracted from the Thame and South Chilterns CAMS[18] document:

- The major urban areas in the catchment (outside the study area) are experiencing significant growth and development, increasing the demand for water resources across the catchment. TWU is currently re-evaluating the requirements for a major water resource development in the Upper Thames area; and
- The Thame and South Chilterns CAMS rivers are all tributaries of the River Thames and as such, any licensing strategy for this CAMS needs to take into consideration the flow requirements of the River Thames.

The Rivers **Lee** and **Mimram**, and associated tributaries, lie within the Upper Lee catchment. The following key points have been extracted from the Upper Lee CAMS[19] document:

- Almost 90% of the volume abstracted in the catchment is for public water supply, however there are also many licences for small volume, high-loss agricultural use;
- Upstream of the study area, the flow in the River Lee is joined by flow from East Hyde Sewage Treatment Works downstream of Luton, which makes up the bulk of the flow. This is also the source of the river during prolonged dry periods;
- On the River Lee, new or additional abstraction may only be considered at times of very high flow. These high flows may not occur every year and there will be a need to invest in water storage reservoirs to store water when it is available;
- The River Mimram was found to have insufficient flows to meet the ecological need at all times even during higher flows, hence no further consumptive licences will be granted from this river; and
- No further consumptive licences will be granted from the Upper Lee groundwater. This is to protect the river flows.

In the southwest of Welwyn Hatfield Borough, the **Cuffley Brook** and its tributaries, which drain the potential growth area of Cuffley, falls into the London CAMS area. The following key points have been extracted from the London CAMS[20] document:

- The North London rivers flow over the London Clay (which overlies the Chalk and prevents any interaction of surface waters with the Chalk groundwater). The rivers therefore have very little supply from groundwater sources and rise quickly following rainfall;

As discussed above, the Rivers Bulbourne, Chess, Colne, Gade, Lee, Mimram and Ver are Chalk Rivers. These particular habitats are very important in terms of biodiversity, water supply, recreation and heritage, and are a priority UK Biodiversity Action Plan (BAP) habitat, for which the Environment Agency is the national lead. Abstraction of water resources and point source discharges are recognised as resulting in significant impacts on Chalk Rivers. This topic is further discussed in Section 5.5.3.

Each CAMS uses Water Resource Management Units (WRMU) to make integrated assessments of groundwater and surface water resources. Table 5-9 shows the relevant CAMS and WRMU for the study area, and highlights the availability (and limitations) of water for further abstraction.

CAMS catchment	WRMU reference	Study Area Rivers Affected	Resource Availability Status
Colne	Upper and Mid-Colne	Bulbourne, Chess, Colne, Gade and Ver	Over-abstracted, (the underlying chalk aquifer is assessed as Over-abstracted)
London	The River Lee from Feildes Weir to its tidal limit.	Cuffley Brook	Over-abstracted
	Confined chalk aquifer	Cuffley Brook	Over-licensed – little interaction between the confined aquifer and the watercourses
Thame and South Chilterns	River Thame and unconfined Chalk	Watercourses to the northwest of Tring	No water available - although the status is 'water available' locally, this surplus is required to meet the needs of the environment and abstraction downstream at times of low flow
Upper Lee	Rivers Lee, Mimram, Beane, Rib, Ash and Upper Stort	Lee and Mimram	Over-abstracted

Table 5-9 Resource Availability in the WRMU in the study area

As shown in Table 5-9, none of the WRMUs in the vicinity of study area are assessed as having water available; there is no additional water available for abstraction from surface or groundwater resources at low flows. There may be an opportunity to abstract additional water at times of high flow, although this will be subject to a number of restrictions and parameters being met in accordance with EA guidance. A 'hands off flow' (HOF) restriction may be applied to new abstraction points, particularly in the Thame and South Chilterns and London CAMS areas, to preserve flows to the River Thames. This restricts abstraction to periods when at least a minimum river flow is obtained at a nearby gauging point.

Restoring Sustainable Abstraction Programme reports for a number of watercourses in the study area have been made available by the EA:

The following key points should be noted:

- The upper reach of the River Colne[21] (from its source to the confluence with the River Gade) is mainly supported by flows from surface run-off, tributaries (primarily the River Ver), dewatering from quarrying operations, and discharge from Blackbirds WwTW. The river loses water to the chalk all along its course and only gains significant amounts of groundwater during times that groundwater levels are extremely high;
- In the middle reach of the River Colne[22] (from the confluence with the River Gade to beyond the southern extent of the study area) it is understood that there are degrees of hydraulic connectivity between the river, Mid-Colne Lakes and chalk aquifer, dependant on groundwater levels; and
- On the River Ver[23], at times of seasonally low flow, the discharge from Markyate WwTW is upstream of the natural river head, therefore making up the entire flow in this section.

However, previous studies have recommended that the discharge of treated wastewater into the Ver is limited to protect water quality.

5.1.2 Hydrogeology

The majority of the study area is underlain by a chalk aquifer, exposed in places, and overlain in others with clay with flints, sand and gravel or till, classed by the EA as having intermediate leaching potential, although the soils can possibly transmit a wide range of pollutants.

In some areas, notably the corridors of the Rivers Bulbourne, Chess, Colne, Gade and Ver, and the River Mimram and Lee downstream of Welwyn Garden City, the chalk aquifer is overlain with alluvium soils and river terraces that readily transmit liquid discharges, because they are shallow or susceptible to rapid flow directly to rock, gravel or groundwater.

The chalk aquifer is a major aquifer, in that it is a highly productive stratum, which is important for regional supply. The chalk aquifer in the East of England is extensively used for water abstraction. Groundwater within the chalk feeds many of the rivers, streams and wetlands of the area. In the upper reaches of the rivers in the study area winter rainfall percolates into the underlying chalk aquifer where it is stored. The chalk aquifer releases the stored groundwater slowly as base flow to these watercourses, attenuating the response of river flows to rainfall events.

Flow rates within the chalk aquifer vary from location to location due to the large number of fissures within the rock. This presents difficulty in modelling the groundwater flow using conventional methods, and increases the risk of contamination from polluted surface water entering boreholes and wells without being percolated through the rock matrix.

The risk of contaminating the chalk aquifer with pollutants from infiltration based SuDS is a key risk that must be mitigated by local onsite tests and choice of methods. This is discussed more in Section 5.6.3.

The southern half of Welwyn Hatfield Borough is underlain by numerous minor aquifers, important for local water supplies, with variable permeability and superficial deposits of sand and gravel. The major chalk aquifer in this area is confined by the London Clay and as such has little interaction with the surface water, but is still of significant importance to water supply in the area.

Hemel Hempstead, Chorleywood, Eastbury, Oxhey, St Albans, Hatfield, Welham Green, Brookmans Park, Little Heath and Cuffley are partially underlain by either the Lambeth Group or Thames Group of clay, sand, silt and gravel, which act as minor aquifers. The chalk aquifer underlies this area at a deeper level, but again is still of significant importance to water supply.

5.2 Water Supply

The majority of the study area is supplied with potable water by Veolia Water Central (VWC), with the exception of the potential growth point of Tring, which is supplied by Thames Water Utilities (TWU).

Figure A-3 illustrates how the majority of the study area is split between the VWC Northern and Central Water Resource Zones (WRZ). Tring is supplied from the TWU Slough, Wycombe & Aylesbury WRZ.

According to TWU, the area surrounding Tring is fed via a combination of 2 local sources and a strategic trunk main, supported by sources in High Wycombe/Slough area.

Potable water is supplied to the remainder of the study area via the VWC trunk main and distribution mains network.

Water is abstracted, treated and pumped into the supply area from a combination of local chalk aquifer derived sources, and the potable water supply in the area is augmented by bulk imports into the region from Anglian Water Services (AWS) to the north and from a river water treatment works taking water from the River Thames to the south. These strategic imports meet high demand in the area whenever this occurs, permit outages at local sources to be managed effectively, reinforce security of supply and allow planned levels of service to be maintained.

Supply into the study area through strategic transfers is well reinforced; however the network capacity at the periphery of the VWC operational area, to the west of Berkhamsted, is only adequate for rural levels of development and population without network improvements.

Figure A-4 is a high level schematic of VWC's potable supply network in the study area, produced by VWC during the WCS consultation.

The import of water from the Anglian Water Services (AWS) Ruthamford WRZ into the VWC Northern WRZ is a treated supply arrangement governed by the Great Ouse Water Act (1961) and currently has no restrictions imposed on it relating to drought or climate change.

In order to support their PR09 submission to Ofwat, VWC have produced a draft Water Resources Management Plan[24] (WRMP), which sets out the challenges they face with supplying their customers with potable water over the next 25 years. The VWC draft WRMP assumes that the full entitlement, amounting to 91 Ml/d at average and 109 Ml/d at peak, of the allowance in the Great Ouse Water Act will be available to be imported from AWS sources in the Ruthamford supply zone. This transfer was subject to a judicial review in 1999, which concluded that VWC average and peak entitlements were not at risk.

Demand management and resource development options, planned by AWS in the Ruthamford WRZ in the medium to long term (2015–2020 and beyond), already take account of this bulk export to VWC. The loss of the bulk transfer is therefore not a realistic risk to supply in the study area, according to the available information and consultation undertaken to date.

VWC plan to provide a level of service for all of its customers, which allows for demand restrictions such as hosepipe bans in times of drought with a frequency of one year in every ten. As over 60% of supply is obtained from groundwater (and VWC surface water sources are not subject to drought constraints), the availability of groundwater is critical to ensuring the required levels of service are met.

The VWC draft WRMP adopts a "twin track approach" to the future management of water by increasing supply as well as reducing demand. One key infrastructure related component of water demand is the amount of water lost through leakage. VWC have stressed that they will continue to make improvements in reducing the amount of water lost through both reactive and proactive leakage detection mechanisms.

Currently, 34% of VWC customers have water meters attached to their supply. By 2030, VWC have stated in their draft WRMP that they plan to accelerate the metering of properties to 90% of their customer base, at first metering on request and change of ownership, with the potential to move to compulsory metering in the longer term if required. The WRMP also states that on average, once metered, customers use approximately 12.5% less water, although there is much debate within the water industry as to whether metering reduces consumption for all customers. Options such as seasonally adjustable charge rates, at times of water stress, have been deemed the fairest method of payment for water, providing vulnerable customers are appropriately protected from significant price increases. This should raise the awareness of

customers, by increasing the unit price of water during times of peak demand and reducing it correspondingly at all other times. The overall objective is that it would be cost neutral over the course of a year, but will have the effect of reducing peak demand for non-essential use, such as washing vehicles, at times of greatest environmental stress.

The supply/ demand balance for the Northern and Central WRZ, as set out in the draft VWC WRMP, for both Dry Year Annual Average (DYAA) and Dry Year Critical Period (DYCP)* can be seen in Figure 5-5 to Figure 5-8. All figures show the increase in Water Available for Use (WAFU) that VWC are expecting following the completion of a number of resource refurbishment schemes (within the conditions of existing licenses) towards the end of AMP 4.

However, ability to achieve the final planning components of demand indicated in the figures will depend on expenditure on leakage reduction and metering approval by Ofwat. Constraints on funding will influence the phasing of planned demand reduction and leakage reduction measures.

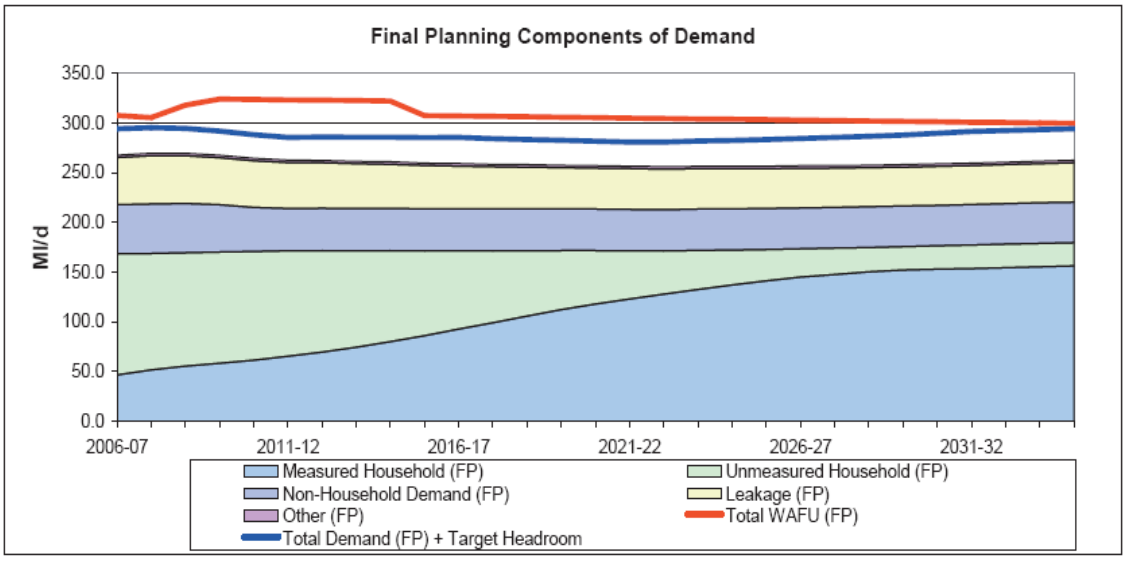

Figure 5-5 VWC Northern WRZ Dry Year Annual Average Supply-Demand Balance

* See Technical Glossary for explanation of DYAA and DYCP

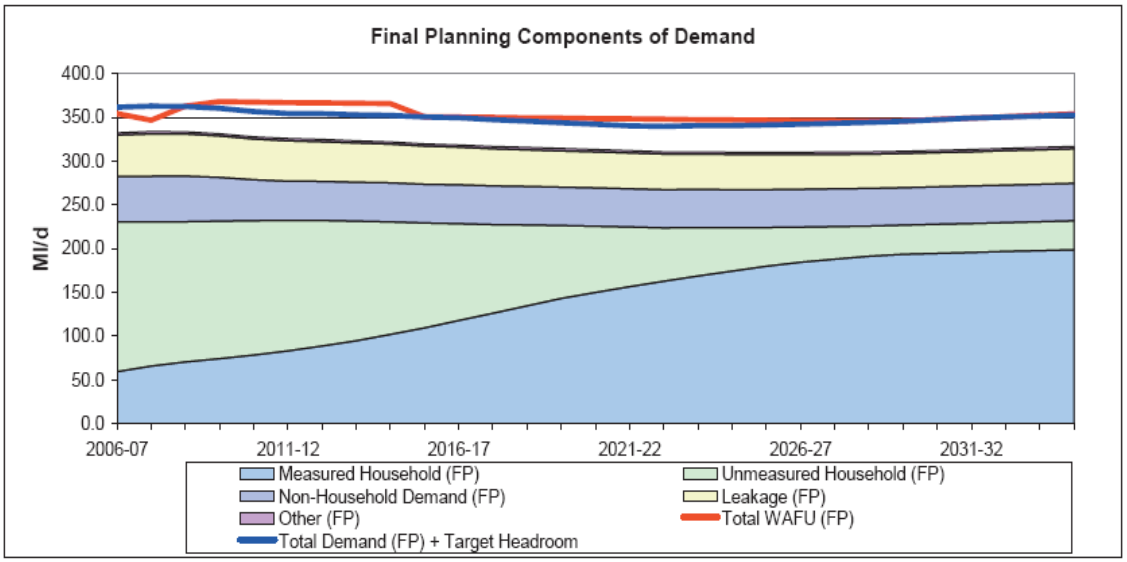

Figure 5-6 VWC Northern WRZ Dry Year Critical Period Supply-Demand Balance

Both figures above show a decrease in WAFU around 2015. This 15 Ml/d decrease is due to **sustainability reductions** that the EA have recently advised (following review of the draft VWC WRMP 2008) will be required at two VWC abstraction points, to reduce the effect of these abstractions on the environment, on the Rivers Mimram and Beane (to the northeast of the study area). VWC are concerned that reductions in these abstractions will pass on higher costs to their customers as assets may be abandoned, and other resources may need to be developed to ensure security of supply.

Further sustainability reductions may be required in the future to support the aspirations of the WFD. Development of additional resources, or increased efficiency through demand management, would then be required to maintain the supply required for the new development. If existing resources cannot be further optimised, and sufficient demand management is not realised throughout the Northern WRZ, VWC may have to rely more heavily on their import from the AWS Ruthamford WRZ, especially during periods of peak demand. The increased cost of importing additional water (which is relatively expensive and carbon intensive) in this manner may increase the cost that VWC seek to pass on to their customers in future AMP cycles.

Figure 5-5 shows that the target demand plus headroom at 2035 lies very close to the current baseline WAFU level based on annual average estimations. This further highlights the importance of the LPAs and VWC promoting widespread water efficiency measures in both new and existing dwellings, to further reduce average PCC past that predicted by VWC in their draft WRMP, and hence increase security of supply and reduce reliance on imported water.

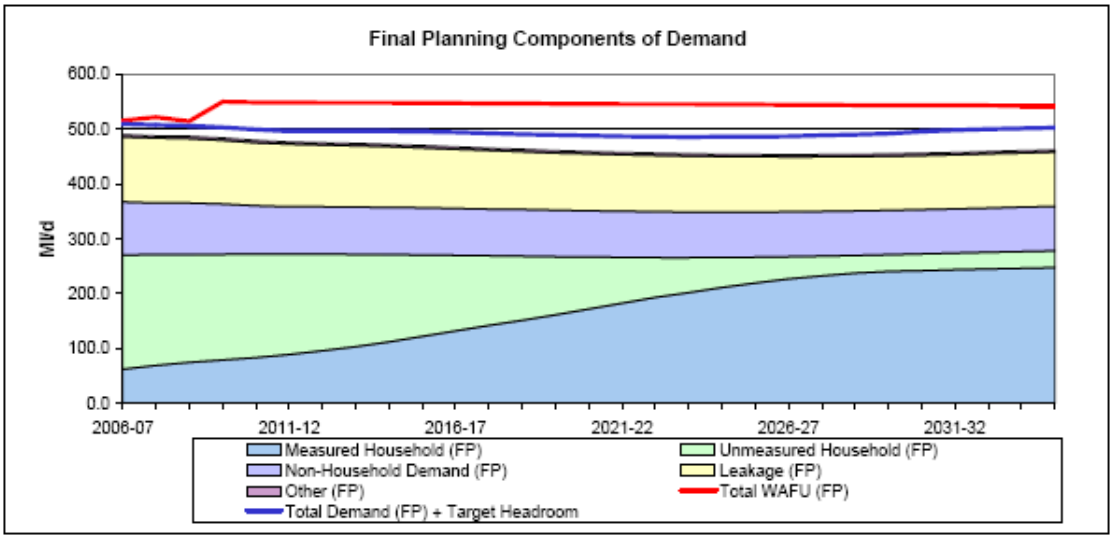

Figure 5-7 VWC Central WRZ Dry Year Annual Average Supply-Demand Balance

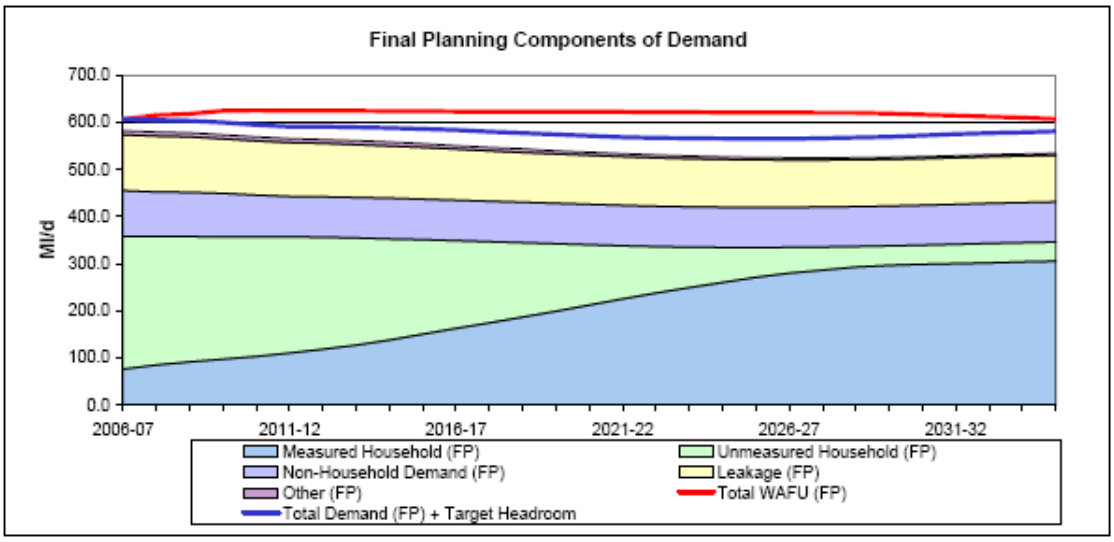

Figure 5-8 VWC Northern WRZ Dry Year Critical Period Supply-Demand Balance

(TVW [now VWC] Draft Water Resource Management Plan 2009: Supporting tables)

The above figures highlight that VWC are planning to maintain a surplus of supply over demand in the Central WRZ for the length of the WRMP period (to 2035) under both dry year annual average and critical period conditions. This is aided by reductions in leakage and demand, due to their leakage and metering strategies.

With regards to potable water supply to Tring, Figure 5-9 and Figure 5-10 below show the supply/ demand balance for the TWU Slough, Wycombe and Aylesbury WRZ, for both Dry Year Annual Average and Dry Year Critical Period.

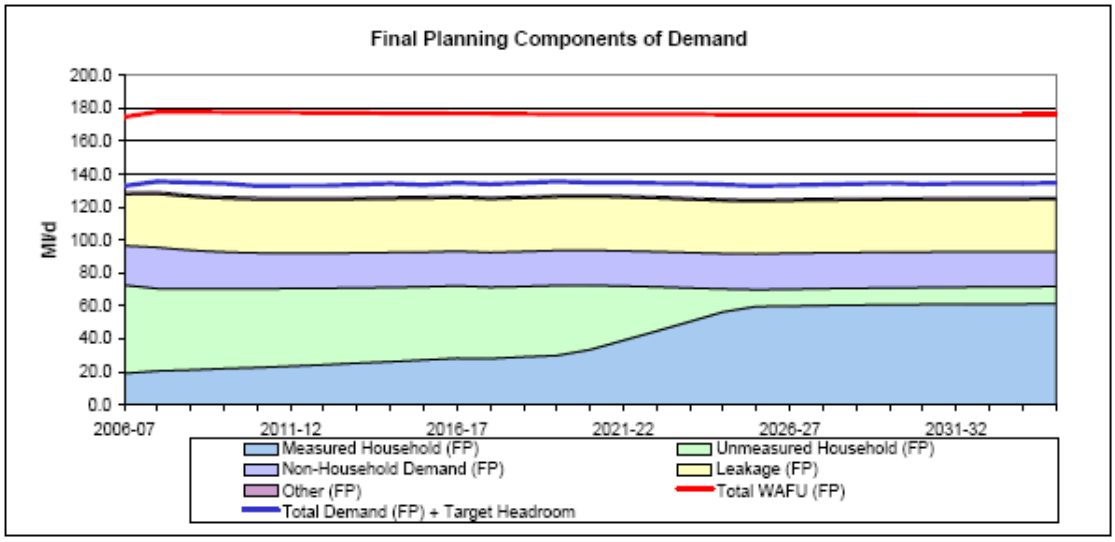

Figure 5-9 TWU Slough, Wycombe& Aylesbury WRZ Dry Year Annual Average Supply-Demand Balance

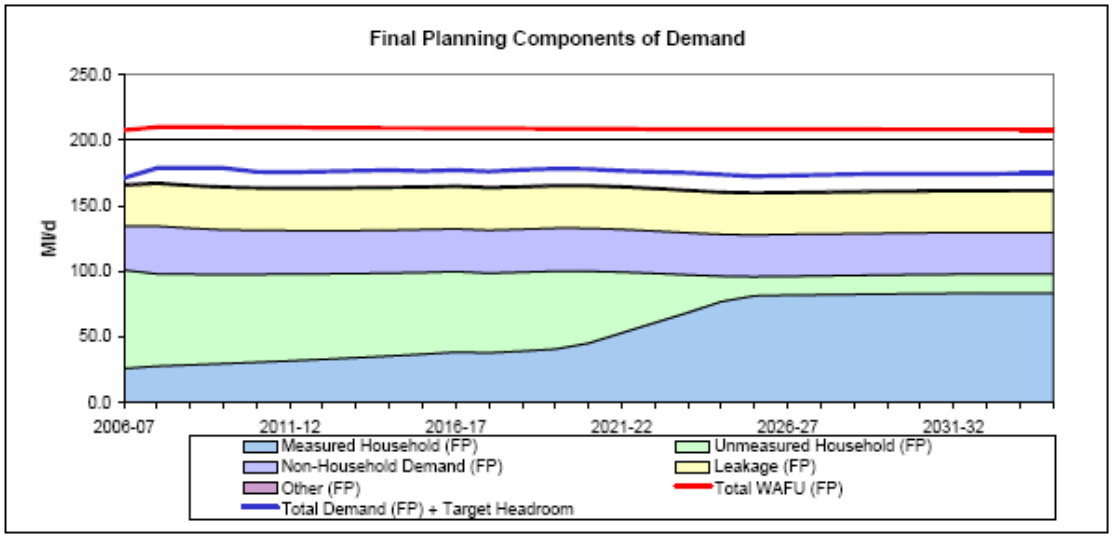

Figure 5-10 TWU Slough, Wycombe& Aylesbury WRZ Dry Year Critical Period Supply-Demand Balance

(TWU Water Resource Management Plan 2009: Supporting tables)

The figures above show that TWU are planning to maintain a significant surplus of supply over demand for the entirety of the WRMP period (to 2035): at no point during the planning period does the baseline demand forecast exceed the committed WAFU from the AMP4 programme.

According to the TWU WRMP[25], no water resource development schemes are required in this WRZ. The final plan does however include demand reduction through the introduction of targeted progressive metering, tariff changes and water efficiency.

It must be noted that the above supply/ demand balance figures take account of RSS growth (equivalent to Scenario 1) within each of the WRZ. If the additional demand in the WRZ, due to Scenario 2 growth, exceeds the planned surplus then the available headroom will begin to be eroded. Water companies aim to maintain a target headroom in each WRZ to account for sudden losses in resources, for example due to the contamination of a borehole. Should this headroom begin to be eroded by increased demand, it is likely that water companies would

have to investigate further resource development or demand management to maintain adequate headroom, and therefore guarantee a certain level or service and security of supply to all customers.

An assessment of the impact of the increased demand, from the Scenario 2 growth, on the planned supply/ demand balance is included in Section 6.1.

5.3 Wastewater Treatment and Sewerage

Regarding provision of wastewater services, the entire study area falls within the operational boundary of Thames Water Utilities Ltd (TWU). TWU collect wastewater from the five LPA areas through a network of foul and surface water sewers, and convey this wastewater to ten wastewater treatment works (WwTW).

5.3.1 Wastewater Treatment Works

Table 5-10 shows the WwTW serving the study area, with a breakdown of the potential growth locations served.

WwTW Name	LPA served	Growth location served
Berkhamsted	DBC	Berkhamsted
Blackbirds	SADC	Chiswell Green, How Wood, London Colney, Park Street/ Frogmore, Redbourn, St Albans
	WHBC	Brookmans Park, Hatfield, Little Heath, Welham Green
Chesham	DBC	Bovingdon
Deephams	WHBC	Cuffley
Harpenden	SADC	Harpenden, Wheathampstead
Maple Lodge	DBC	Hemel Hempstead, Kings Langley
	SADC	Bricket Wood, Chiswell Green, How Wood, London Colney, Park Street/ Frogmore, Redbourn, St Albans
	TRDC	Abbots Langley, Chorleywood, Croxley Green, Eastbury, Rickmansworth, South Oxhey
	WBC	Watford
	WHBC	Brookmans Park, Hatfield, Little Heath, Welham Green
Markyate	DBC	Markyate
Mill Green	WHBC	Hatfield, Welwyn Garden City
Rye Meads	WHBC	Digswell, Oaklands, Welwyn, Welwyn Garden City, Woolmer Green
Tring	DBC	Tring

Table 5-10 WwTW serving the study area

With regards to Blackbirds WwTW, the flows from the settlements in Table 5-10 are conveyed by a trunk sewer running parallel to the River Colne towards Maple Lodge WwTW. At a pumping station to the southeast of Bricket Wood approximately 17% of the wastewater from this trunk sewer is diverted and pumped to Blackbirds WwTW for treatment, and subsequent discharge to

the River Colne. The remaining flow continues through the trunk sewer network for treatment at Maple Lodge WwTW, and subsequent discharge to the GUC.

Figure A-5 illustrates the location of the WwTW catchment areas that serve the study area in relation to the potential growth locations.

The WCS stakeholders have identified the following baseline issues with respect to these WwTW:

- **Berkhamsted WwTW** – the WwTW is currently operating close to its discharge consent, and there are water quality concerns due to the discharge being to the GUC. The EA and TWU are proposing that the DWF consent be increased to 11,504m^3/day by the end of AMP5 (2015), along with a corresponding tightening of the physio-chemical standards;
- **Blackbirds WwTW –** the WwTW could potentially accommodate higher flows by fully utilising existing capacity, however it already has a tight ammonia consent (1.4 mg/l);
- **Chesham WwTW –** the EA advise that the WwTW may currently experience operational issues during times of intense rainfall;
- **Deephams WwTW** – the WwTW requires work to overcome existing hydraulic issues. Large growth is proposed in the catchment from nearby London Boroughs. The volumetric discharge consent is proposed to increase in 2017, accompanied by a tightening of the physio-chemical standards;
- **Harpenden WwTW –** the WwTW will require several process issues to be solved in order to optimise the existing capacity;
- **Maple Lodge WwTW**– current flows are approaching the current process and hydraulic capacity at the WwTW. Creation of additional capacity would require the construction of new assets, which would require changing the layout of the existing site. This is further complicated by the fact that north of the site is at a high risk of flooding. In addition, TWU are responsible for maintaining the level of the GUC where the WwTW discharges, and there are current water quality and quantity concerns. TWU are investigating diverting additional flows to Blackbirds WwTW in the future;
- **Markyate WwTW** – the WwTW is currently approaching capacity, and therefore is only suitable for infill development. Substantial development would require significant upgrades;
- **Mill Green WwTW** – the WwTW has recently been upgraded to accommodate a diversion of existing flows from southern parts of Welwyn Garden City. These is some remaining capacity, but large scale development in this catchment would require upgrades;
- **Rye Meads WwTW** – the WwTW is estimated to have sufficient capacity to accommodate RSS (2008) growth targets in the catchment to 2015. TWU will be investigating possible capacity upgrades in AMP 5, to be constructed in AMP 6. Long term, TWU and the EA will continue to assess the implications of the discharge on the River Lee, and possible strategic solutions in the catchment; and
- **Tring WwTW –** there are water quality and quantity concerns due to the discharge being to the GUC. Additional capacity could be provided for future growth, but would be relatively expensive due to the processes currently in operation at the WwTW. During AMP 5 TWU will investigate if storm discharges from the WwTW affect the Tring Reservoirs environmental site.

5.3.2 Sewerage Network

The data sets and comments provided by TWU suggests that the majority of the sewerage networks in the study area are separate systems for foul and surface water; however the foul water sewers will still be influenced to some degree during storm periods, due to infiltration and misconnections.

Figure A-6 illustrates the location of the WwTW and trunk sewers that serve the study area in relation to the potential growth locations. TWU have provided a high-level assessment of some areas of the sewer networks current capacity. Current sewer capacity is limited, particularly in the upstream extents of the Maple Lodge sewerage network. For example, TWU report that there are local capacity issues at Chorleywood, and very limited capacity throughout Hatfield. Where capacity information is available, it has been incorporated into the constraints matrix in Section 7.1.

5.4 Water Quality

Water quality has always been an important consideration; however, more stringent standards on surface and groundwater quality (and hence discharges into rivers from WwTW) than present are likely to be applied by the EA, as the Water Framework Directive (WFD) is gradually implemented at regional and local levels.

The WFD sets out a strategy for **protecting and enhancing** the quality of groundwater, rivers, lakes, estuaries and coasts. It introduces the integrated approach to river basin management that the EA is currently applying to the 11 River Basin Districts in England and Wales; identifying and characterising the water bodies and protected areas in each river basin, and the pressures and risks upon them.

The main objective of the WFD is to bring all water bodies up to 'good status' by 2015. The actual parameters for the assessment of a river have been set by the UK Technical Advisory Group (UK TAG)[26]. A requirement of the WFD is that a **no deterioration** policy is adopted for the WFD parameters, which could have potential implications for future developments.

A number of the watercourses in the study area have initially been classified as being Heavily Modified under the WFD:

- The River Bulbourne;
- The River Colne (and interactions with the GUC) from its confluence with the River Chess to the River Ash;
- Salmons Brook (the receiving watercourse for the Deephams WwTW discharge); and
- The River Lee from Luton to Hertford.

The categorisation of Heavily Modified Water Body (HMWB) means that the channel has undergone significant morphological changes. The requirement for HMWBs is to reach good ecological potential (GEP) as opposed to 'good status'.

River Basin Management Plans (RBMP) developed by the various regional offices of the EA were published in December 2009. The RBMPs set out a strategy, including a Programme of Measures, for each catchment to comply with the requirements of the WFD. An assessment of the current status of the rivers has been made, showing the rivers and lakes that currently fall below the 'good status' required to meet the WFD. The documents then set out those rivers that should be at 'good status' by 2015 with the remainder being at 'good status' by 2027. The study

area falls within the Thames RBMP area. Further information on the WFD, the current status, and future targets, of the watercourses, is included in Appendix D. A figure showing the current status of all the watercourses throughout the study area, supplied by the EA, is also included in Appendix D.

Reviewing the RBMP[27] reveals that **none of the receiving watercourses in the study area are currently classed as achieving 'good status'** (or GEP). Throughout the study area the main barriers to achieving 'good status' (or GEP) are:

- Excessive Phosphate concentrations;
- Low Fish and Invertebrate population levels;
- Low quantity and poor dynamics of flow; and
- Failure to adequately mitigate the impacts of modification (which is preventing the majority of the HMWB in the study area achieving GEP).

Discharges from WwTW and industry, and surface water runoff (in particular from agricultural areas) can lead to nutrient enrichment, or eutrophication, of the receiving watercourses. High levels of nutrients such as phosphorous or nitrates can encourage excessive algal growth. This can adversely affect the biodiversity of the watercourse, particularly as it decreases the oxygen levels in the water that other life forms depend upon.

The EA recognise that phosphorous removal at all WwTW* is not cost effective and may not be immediately achievable. For this reason WwTW that are negatively impacting conservation sites, or causing watercourses to become evidently eutrophic, have been prioritised for detailed investigation by the EA and water companies in the period to 2015.

TWU are planning to implement phosphorous removal via chemical dosing at Deephams WwTW in AMP 5, to reduce eutrophication in the River Lee Navigation Channel.

Whilst the EA is the 'competent body' tasked with implementing the WFD in England and Wales, other stakeholders will have an important part to play. The Programmes of Measures included in the RBMPs contain integrated solutions requiring input and action from Natural England, the water companies, the LPAs and developers.

Liaison panels have been setup within each of the River Basin areas, and include representatives from water companies, agriculture and industry, and non-government organisations amongst others.

5.5 Ecology and Conservation

The majority of water dependant sites of environmental importance, which may be affected by the potential development, are situated along the river corridors in the study area.

Further information regarding these sites is included in the sections below. Descriptions of the various site designations can be found in the Technical Glossary.

In addition to the sites described below, Natural England (NE) are also concerned that increased abstraction across the study area, which may be required to supply potable water given the growth levels, has the potential to adversely affect a number of further sites. There is

* WwTW that serve a PE of more than 10,000 are required to employ phosphorous removal processes under the Urban Wastewater Treatment Directive

particular concern that woodlands may be affected, as the groundwater levels they depend upon reduce.

When considering options on how and where to increase groundwater abstraction (if deemed necessary by water company plans, following the normal investigation and consultation process) VWC and TWU will need to work in partnership with the EA, who will be responsible for granting any such licenses, and NE, to ensure that any local effects on important sites are fully accounted for, and mitigated where appropriate.

5.5.1 Sites of Special Scientific Interest

The condition of any Sites of Special Scientific Interest (SSSI) within the study area that are water dependant* has been assessed, by reviewing the latest data published by Natural England (NE). Table 5-11 lists the SSSI that have the potential to be impacted by the proposed development through a possible change in water quality or flow levels in the supporting watercourses, from either a change in the upstream surface water drainage regime, or an increase in WwTW effluent discharge. It should be noted that a number of these sites are outside the LPA boundaries.

* Water dependant in this context refers to SSSI containing open or standing water, or including bank side habitat as described in the relevant NE citation for each site

Site Name	Growth Point Affected	Current Status	Potential Risk from Development
Amwell Quarry	Mill Green WwTW catchment	Favourable	Change in water quality and flow levels due to an increase in Mill Green WwTW effluent discharge due to development in the south of WHBC
Cornmill Stream & Old River Lea	Rye Meads WwTW catchment (see Section 5.3)	Favourable	Change in water quality and flow levels due to an increase in Rye Meads WwTW effluent discharge due to development in the north of WHBC
Croxley Common Moor	West WBC and Croxley Green	Unfavourable Recovering	Change in surface water management regime in the west of Watford or Croxley Green
Frogmore Meadows	Chesham WwTW catchment (Bovingdon)	Unfavourable	Change in water quality and flow levels due to an increase in Chesham WwTW effluent discharge due to development at Bovingdon
Mid Colne Valley	Maple Lodge WwTW catchment (see Section 5.3)	Favourable	Change in water quality and flow levels due to an increase in Maple Lodge WwTW effluent discharge due to development Change in surface water management regime along the River Colne and tributaries
Rye Meads	North WHBC	Favourable	Change in water quality and flow levels due to an increase in Rye Meads WwTW effluent discharge due to development in the north of WHBC
Sarratt Bottom	Chesham WwTW catchment (Bovingdon)	Unfavourable	Change in water quality and flow levels due to an increase in Chesham WwTW effluent discharge due to development at Bovingdon
Tewinbury	North WHBC	Unfavourable Recovering	Change in surface water management regime at Digswell, Oaklands, Woolmer Green, Welwyn and Welwyn Garden City
Turnford & Cheshunt Pits	Rye Meads WwTW catchment (see Section 5.3)	Favourable	Change in water quality and flow levels due to an increase in Rye Meads WwTW effluent discharge due to development in the north of WHBC
Waltham Abbey	Rye Meads WwTW catchment (see Section 5.3)	Unfavourable	Change in water quality and flow levels due to an increase in Rye Meads WwTW effluent discharge due to development in the north of WHBC
Walthamstow Marshes	Deephams WwTW catchment (Cuffley)	Unfavourable Declining	Change in water quality and flow levels due to an increase in Deephams WwTW effluent discharge due to development at Cuffley
Walthamstow Reservoirs	Deephams WwTW catchment (Cuffley)	Unfavourable Recovering	Change in water quality and flow levels due to an increase in Deephams WwTW effluent discharge due to development at Cuffley
Water End Swallow Holes	South WHBC	Favourable	Change in surface water management regime at Brookmans Park and Welham Green

Table 5-11 SSSI with the potential to be impacted by development

None of the water dependant SSSI in the study area, or those immediately downstream of WwTW serving the study area, are listed by NE as having problems with water quality or flow levels. However, changes in physio-chemical standards and volumetric discharges from WwTW, coupled with possible reductions in river flow due to climate change have the potential to alter

the concentration of determinands in the watercourses, and hence negatively impact upon the SSSI. Variations in river flows, again from changes to WwTW discharges, increased abstraction, and the runoff of surface water from new developments, may also be of detriment to the sites.

As part of the Rye Meads WCS, Hertfordshire and Middlesex Wildlife Trust (HMWT) voiced concern that the floristic nature of the Rye Meads Nature Reserve (and SSSI) can be adversely impacted by backing up of the nutrient rich Tollhouse Stream (the discharge point for the Rye Meads WwTW) during periods of high discharge from the works[28]. Increasing flows to the WwTW may increase the frequency of this happening.

5.5.2 European Sites

Special Areas of Conservation (SAC) and Special Protection Areas (SPA) are sites of European importance for biodiversity. Under Regulation 48(1) of the Habitats Directive, an Appropriate Assessment needs to be undertaken in respect of any plan or project which:

- Either alone or in combination with other plans or projects would be likely to have a significant effect on a European Site; and
- Is not directly connected with the management of the site for nature conservation.

The SACs in the study area appear to be unaffected by the potential changes in the water environment due to the development proposals, as they are woodlands.

The Lee Valley SPA (and Ramsar site) consists of the Amwell Quarry, Rye Meads, Turnford & Cheshunt Pits and Walthamstow Reservoirs SSSI. These wetland sites are of international importance to birds, and are protected under the European Community Directive on Wild Birds and the Ramsar convention, as well as being established as protected areas under the Water Framework Directive. Whilst these sites are not directly within the LPA boundaries, the potential detriment in water quality and changes in water level, due to any increase in the discharge from Rye Meads WwTW, (partly arising from the proposed development in Welwyn Hatfield), must be considered by TWU, NE and the EA, to ensure these sites are not adversely affected.

It is recommended that WHBC consult regularly with NE and TWU, as their LDF progresses, to identify whether the impact on the SPA would be classed as significant.

5.5.3 UK Biodiversity Action Plan*

According to the UK Biodiversity Action Plan (UKBAP) Steering Group for Chalk Rivers[29], chalk rivers such as those in the study area are a precious resource. All chalk rivers are fed from groundwater aquifers, producing clear waters and a generally stable flow and temperature regime. These conditions support a **rich diversity** of invertebrate life and important game fisheries. Also, chalk rivers tend to be associated with a high water table on the floodplain throughout the year and hence the floodplains support a wide diversity of BAP habitats and species. Phosphate pollution, turbidity and protection of water resources from unsustainable abstraction are particular concerns in relation to chalk rivers, and therefore require attention through the WCS development process.

* See Technical Glossary for explanation of UK BAP

The principle objectives of the UKBAP for chalk rivers, which may influence the planning process, are to:

- Maintain and enhance the characteristic habitats, plants and animals of chalk rivers, including winterbourne stretches; and
- Restore water quality, flows and habitat diversity.

Increases of discharges from WwTW may have tight physio-chemical standards applied by the EA, because of the potential conflict with the above objectives.

The UKBAP Steering Group recommends the following actions for chalk stream catchments:

- Identify solutions to unsustainable abstractions;
- More efficient use of water in chalk river catchments including demand management and promotion of efficient practices; and
- Reduce rapid runoff and peak flows, enhance aquifer recharge and restore the natural function of the floodplain.

The other water related UKBAP priority habitats within, and bordering, the study area are described in Table 5-12 below.

UKBAP Priority Habitat	Location	Reason for Priority	Threats
Wet Woodland	Throughout study area	Found on floodplains, hillsides and plateaus, these woodlands support a large number of species of flora and fauna.	Unlikely that development will affect water quality or flow, as these woodlands tend to be upstream of WwTW or main channel of receiving watercourses. However, Cuffley Brook does run through a site downstream of the study area.
Floodplain Grazing Marsh	River Lee, downstream of Harpenden, Mill Green, and Rye Meads WwTW River Ver, downstream of Redbourn and St Albans River Colne, downstream of Watford	These areas of periodically flooded pasture are rich in plants and invertebrates. They may also support a variety of wading birds.	Any changes in water levels or quality, due to changes in flood management or WwTW discharge variations, may adversely affect these habitats.
Fen	River Mimram at Tewinbury River Lee at Rye Meads, Cornmill Stream & Old River Lea and Walthamstow Marshes River Chess downstream of Chesham WwTW River Colne at Croxley Common Moor and downstream of Maple Lodge	Fens are peatlands which receive water and nutrients from the soil, rock and ground water as well as from rainfall. Fen habitats support a diversity of plant and animal communities.	Variations in groundwater quality, due to the interaction between the chalk streams (which receive WwTW discharges) and the underlying aquifer, may be detrimental to these habitats.
Lowland Meadows	River Chess downstream of Chesham WwTW River Mimram at Tewinbury	These seasonably flooded grasslands support many scarce and declining plant species. Lowland meadows and pastures are important habitats for skylark and a number of other farmland birds	Any changes in water levels or quality, due to changes in flood management or WwTW discharge variations, may adversely affect these habitats.
Reedbeds	River Lee at Rye Meads and Walthamstow Marshes River Mimram at Tewinbury River Colne, downstream of Maple Lodge	Reedbeds are wetlands dominated by stands of the common reed, wherein the water table is at or above ground level for most of the year. They tend to incorporate areas of open water and ditches, and small areas of wet grassland and carr woodland may be associated with them. Reedbeds are amongst the most important habitats for birds in the UK	Any changes in water levels or quality, due to changes in flood management or WwTW discharge variations, may adversely affect these habitats

Table 5-12 Water related UKBAP priority habitats within the study area

A Local Biodiversity Action Plan (LBAP) has been developed for Hertfordshire, to identify the presences of UK priority habitats and species and inform relevant policies. Information from this Hertfordshire LBAP[30], and data received from the Hertfordshire Biological Records Centre (HBRC) provides an illustration of the water dependant priority species that should be considered by the WCS.

Otters have recently (2004) been recorded on the River Colne, at Broad Colney (south of London Colney). Less recently (1999) there are records of otters on the GUC near Kings Langley. This UKBAP priority species is impacted by water quality, which affects its food supply, and low flows. Addressing these issues are objectives for the Hertfordshire LBAP, and it is important that the wetland habitats that otters require are protected from any negative impacts due to development.

Records of **Water Voles** around the study area are widespread. The Lee Valley Park and the River Mimram are focus areas for the latest (2000-2008) records from the Hertfordshire Biological Records Centre. Other areas where sightings have recently been reported include:

- Croxley Green;
- Gadebridge Park in Hemel Hempstead;
- The GUC near Croxley Common Moor; and
- The River Chess north of Rickmansworth.

Water voles are afforded full protection under the Wildlife and Countryside Act 1981 (as amended). Water level changes can severely impact this UKBAP priority species by damaging its habitat. Water quality may also be an issue, although there are records of water voles thriving on polluted watercourses. Better management of water levels is needed to protect this species; it is important that areas where water voles are found are protected and enhanced where possible. Water voles are also threatened by predation from American Mink – habitat creation and protection accompanied by active management of mink populations has the highest potential to increase water vole numbers.

The Wetlands for Water Voles and People Project was launched in January 2008 and aims to provide people with a better understanding of water voles as well as surveying and monitoring key water vole sites. The sites relevant to this WCS, highlighted as being 'wetland havens' for water voles are:

- Tewinbury Nature Reserve in the Mimram Valley near Welwyn Garden City;
- Frogmore Meadows Nature Reserve in the Chess Valley near Sarrat; and
- Cassiobury Park Nature Reserve in the Colne Valley in Watford.

In addition, **Great Crested Newts** are found in a selection of locations throughout the study area but the population has been steadily reducing in recent years. The factors that have lead to the decline of Great Crested newts include:

- Loss of habitat;
- Pond management;
- Fragmentation of ponds; and
- Pollution of ponds from road and urban runoff.

5.5.4 Local Wildlife Sites

Local Wildlife Sites (LoWS), previously named as either County Wildlife Sites or Sites of Importance for Nature Conservation, are areas of land with **significant wildlife value** that complement and support the network of SSSI and other sites of European and national importance. Many of the sites contain species or habitats listed as a priority in either the UKBAP or LBAPs.

Therefore, LoWS should be a material consideration in the determination of planning applications, and any sites that are dependent on the water environment should be protected wherever possible. Aside from the obvious risk of encroachment and disturbance from development, any LoWS dependant on the water environment may be adversely affected by changes in water quality and flow levels due to increases in WwTW discharges and changes in surface water management.

The study area contains over 800 LoWS. The LoWS significant to this WCS are areas of marsh, meadow, fen or wet woodland that are periodically flooded by the watercourses, and are downstream of the WwTW that may experience an increase in flows due to the proposed growth. It is important to recognise that the periodic flooding of such sites with relatively nutrient rich water will be one of the factors that creates such a rich habitat. However, changes in water quality and flow levels can encourage the growth of other plant species, which may displace the BAP priority plants, and may eradicate the food supply and/or the habitat of BAP priority wildlife. All of the river corridors in the study area include LoWS such as those described above, often correlating with SSSI, Local Nature Reserves (LNR) and BAP priority habitats. Within the five LPA areas, there are at least 60 water related LoWS downstream of the WwTW which will serve the growth, including stretches of the rivers and GUC.

The presence of LoWS downstream of a WwTW discharge point will not necessarily constrain development being connected to a WwTW. However it is important that their presence is considered along with SSSI, SPA and BAP habitats and species, so that the LPAs can develop policies that mitigate the impact of the development on the water environment.

Any requirement to mitigate against adverse changes in water levels or increased flood risk at a specific site, due to increased discharge, will need to be discussed with the EA following modelling at either the Outline or Detailed Stage of further WCS work, dependent on impact.

5.6 Flood Risk

The sources of flood risk within study area have been identified as:

- Fluvial flooding – due to watercourses spilling over their banks into the floodplain;
- Surface water flooding – due to the pooling and flow of surface runoff during storm events;
- Groundwater flooding – due to the level of the groundwater in an aquifer exceeding ground level;
- Sewer flooding – backing up and surcharging of wastewater in the sewerage network due to either operational issues or capacity being exceeded; and
- Artificial flooding sources – due the overtopping and/or breaching of reservoirs, lakes, flood storage areas and canals. These sources have been investigated in more detail in Strategic Flood Risk Assessments carried out for the LPA areas, see Section 5.6.2.

The study area contains 120 formal flood defences (i.e. a flood defence maintained by its owner with the intention of managing flood risk). There are a number of weirs, sluices and embankments maintained by private landowners, which contribute to the management of water levels and may serve indirectly as flood defences. However, these structures can sometimes have negative implications on local flood risk and biodiversity if not managed sympathetically. There are also numerous informal flood defences, such as roads and railway embankments, which may retain or enclose floodwater.

The responsibility of managing channel sides (both natural and modified), bridges and culverts is spread within the study area between the EA, British Waterways, Local Authorities and private riparian landowners. The designated main rivers are the responsibility of the riparian owners, although the EA have powers that allow them to carry out maintenance work in these locations.

The other ordinary watercourses are the responsibility of LPAs and other riparian landowners. Local Authorities have powers as the operating authority to require maintenance be carried out on ordinary watercourses belonging to other riparian landowners.

Other sources of flood risk within the study area include the potential of overtopping, and/or breaching of reservoirs, lakes, flood storage areas and the GUC.

Whilst LPAs are required to understand and document these risks, for example in Strategic Flood Risk Assessments, this will be more an issue for development control than planning policy (with the exception of possible increases in flows in the GUC, due to increased WwTW discharges, discussed further in this WCS). LPAs should ensure that flood risk from all sources is analysed, and development controlled accordingly, as per PPS25 and the emerging Flood and Water Management Act.

5.6.1 Catchment Flood Management Plans

Catchment Flood Management Plans (CFMP) have been developed by the EA to understand flood risk within a river catchment, and recommended the best way of managing this risk over the next 50 to 100 years. The study area falls within Thames CFMP.

The CFMP underwent a period of consultation in 2006/07, with the final plan being signed off by the EA in July 2008.

A review of the CFMP summary document[31] highlights that the EA class the study area into two separate sub areas for the purposes of assessing flood risk.

The first of these sub areas includes the settlements along the River Colne where the flood plain is relatively open, such as Watford, London Colney and Rickmansworth.

The EA suggest that this stretch of the River Colne is quite sensitive to climate change, with more properties at risk of flooding more frequently. The EA estimate that the number of properties with a 1% risk of fluvial flooding will increase by 12% by 2100.

However, the large, wide and flat floodplains of the Colne store water naturally and can help reduce the risk of flooding to the surrounding settlements. It is therefore crucial that the existing undeveloped floodplain is safeguarded from development through LPA policies.

The remainder of the study area (i.e. the settlements along the Colne tributaries) is classified by the EA as chalk catchments, where the major source of flooding is fluvial, sometimes in combination with high groundwater levels. The river valleys are primarily steep with narrow

floodplains. In many of the urban areas the river channels have been modified, creating pinch points such as bridges and culverts that can contribute to localised flooding.

In these areas, the EA will continue with activities to maintain the existing capacity of the rivers that pass through developed areas. More sustainable management of the risk will be achieved by opening up river corridors through town centres and increasing the resilience to flooding through redevelopment. LPAs and the EA will need to liaise throughout the planning process to retain the remaining floodplain for uses that are compatible with flood risk management, in compliance with PPS25, and put in place polices that lead to long-term adaptation of urban environments in flood risk areas.

5.6.2 Strategic Flood Risk Assessments

When planning and designing new development, the LPAs must ensure that the development will not add to and should, where practicable, reduce flood risk. PPS25 should be adhered to in order that new development is steered to Flood Zone 1*. Where there are no reasonably available sites in Flood Zone 1, decision-makers identifying locations for development and infrastructure, allocating land in spatial plans or determining applications for development at any particular location should consider sites in Flood Zone 2. This decision should take into account the flood risk vulnerability of land uses and apply the Exception Test if required. Only where there are no reasonably available sites in Flood Zones 1 or 2 should decision-makers consider the suitability of sites in Flood Zone 3, again taking into account the flood risk vulnerability of land uses and applying the Exception Test if required following the Sequential Test.

In 2007 DBC, SADC, TRDC and WBC and completed a joint Strategic Flood Risk Assessment Level 1[32] (SFRA), to be used as a planning tool to aid in the location of future development away from areas of high flood risk, therefore aiding the LPAs with complying with PPS25. WHBC completed an SFRA[33] in 2009. The following key issues are discussed within the SFRAs:

Fluvial Flood Risk

- The Lakes at Luton Hoo provide some attenuation to the flood events on the River Lee upstream of Harpenden and Wheathampstead, however increasing runoff and WwTW discharge from Luton is reducing the benefit of the attenuation;
- Overtopping of the GUC at Berkhamsted is a concern. Hazard information regarding this risk should be refined, and any potential development sites should include an assessment of this risk as part of their site specific FRA;
- The diversion of the majority of the River Gade into Flood Relief Culvert (owned by TWU) presents a flood risk to the north of Hemel Hempstead should the culvert become blocked. Any potential development sites in this area should include an assessment of this risk as part of their site specific FRA;

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* Definition of Flood Zones (FZ) –

FZ1: Less than a 0.1% (1 in 1000) annual probability of flooding in any year

FZ2: Between a 0.1% (1 in 1000) and 1% (1 in 100) annual probability of flooding in any year

FZ3a: 1% (1 in 100) or greater annual probability of flooding in any year

FZ3b: Functional Floodplain, equivalent to a 5% (1 in 20) annual probability of flooding in any year

- The culverting of the River Bulbourne through the built up areas of Berkhamsted presents a similar risk to that described above;
- Any potential development sites in this areas of Rickmansworth protected from fluvial flooding by the Lower Colne defences and the Chess Wall should include an assessment of the risk of these defences being breached as part of their site specific FRA;
- Any potential development sites in WHBC within 100 m of Brocket Hall Lake, the Broadwater, Stanborough Lake or the sand and gravel pits near Coopers Green should consider the risk of breach/ overtopping in their site specific FRA;
- Liaison between the LPAs and Hertsmere Borough Council is required to discuss potential flood storage areas on the Mimmshall Brook; and
- WHBC should liaise with Broxbourne Borough Council to discuss the safeguarding of potential flood storage areas in the Cuffley Brook area.

Surface Water Flood Risk

- Recent significant surface water flooding occurred on the 20th June 2007 following an intense, short duration rainfall event, where the equivalent of a 1 in 1 to 1 in 2 year return period storm fell within one hour, causing surface water flooding to areas of DBC, SADC and WBC, resulting in disruption to traffic, and damage to commercial and residential premises;
- A number of locations in Harpenden and St Albans have flooded due to surface water accumulating on the surrounding agricultural land, and the urbanised area itself, and lack of capacity in the existing soakaway and drainage systems;
- A number of locations in Watford are at risk of surface water flooding due to outlets of the existing drainage systems not functioning correctly at times of high flow in the receiving rivers, and lack of capacity in the existing culverts, drains and pump systems;
- A key electrical sub-station in Watford is at risk from surface water flooding; and
- The steep topography at Cuffley, east Hatfield and north Welwyn Garden City is likely to generate significant overland flow, increasing the risk to downstream properties unless development sites incorporate attenuation features on site.

Groundwater Flood Risk

- The Sandridge and Marshalswick areas of St Albans are particularly at risk from groundwater flooding.

In addition to the above, DBC completed a Level 2 SFRA[34] in 2008 which concentrated on the areas of Berkhamsted and Hemel Hempstead. This study modelled the possible effects of a blockage to the Flood Relief Culvert on the River Gade, and identified that potential development sites in the Leighton Buzzard Road, Moor End Road and Waters Road would be at risk of flooding. Regarding the GUC, the study identified a number of areas in Berkhamsted at risk of flooding in the event of a canal breach. DBC should use this additional hazard data to ensure that certain developments are restricted from high-risk zones, and that individual site FRA consider how best to deal with these risks on site, as per PPS25.

5.6.3 Sustainable Drainage Systems (SuDS)

Unless suitably managed, new development can affect the quantity and quality of the receiving water cycle in several ways by:

- Altering the natural surface water runoff rate and quality;

- Passing more wastewater to the treatment works and hence discharging more treated effluent to receiving watercourses, and perhaps more untreated effluent during storm conditions;
- Discharging un-attenuated or poorly attenuated storm water runoff into storm sewers or receiving watercourses; and
- Discharging storm flows into the existing network with the associated risk of increasing discharges from any Combined Sewer Overflows (CSOs) on existing sewers.

The sustainable management of surface water will therefore ensure that:

- The risk of surface water flooding is reduced through the attenuation or infiltration of surface water;
- The quality of the runoff is improved, to lessen the effect of poor quality surface water draining to watercourses or aquifers; and
- The environmental biodiversity of the development is increased through the allocation of more green areas and techniques such as reed beds and wetlands.

Fully developed SuDS schemes, in accordance with EA[35] and CIRIA[36], guidance should ensure that all three of these elements are considered thoroughly during the early stages of design.

The EA currently suggest that the SuDS hierarchy is adopted when considering SuDS techniques for new development, showing the preferred order in which different SuDS techniques should be considered for a site. SuDS techniques at the top of the hierarchy are preferable for their potential ecological and water quality benefits, as illustrated by Figure 5-11.

	SUDS technique	*Flood Reduction*	*Pollution Reduction*	*Landscape & Wildlife Benefit*
Most Sustainable	**Living roofs**	✓	✓	✓
↑	**Basins and ponds** - Constructed wetlands - Balancing ponds - Detention basins - Retention ponds	✓	✓	✓
↓	**Filter strips and swales**	✓	✓	✓
	Infiltration devices - soakaways - infiltration trenches and basins	✓	✓	✓
	Permeable surfaces and filter drains - gravelled areas - solid paving blocks - porous paviors	✓	✓	
Least Sustainable	**Tanked systems** - over-sized pipes/tanks - storms cells	✓		

Figure 5-11 SUDS Hierarchy[35]

It is the responsibility of the LPAs to promote the use of SuDS for the management of surface water runoff, and they will potentially have increased powers to do so following the enactment of the Flood and Water Management Bill. The successful implementation of SuDS requires the early consideration of a wide range of issues surrounding their management, long term adoption and maintenance. The designers and stakeholders should take every available chance to discuss SuDS early in the development phase, with the overall aim of reducing runoff rates to

the equivalent greenfield rate or better. It is essential that responsibility for future adoption, management and maintenance is established in the use of any SuDS in any development in order to ensure that it is successful and worthwhile. This must be an early consideration in the planning process for each potential development site.

The common method of developing SuDS schemes is through the concept of a 'management train'. A conceptualisation of this can be seen in Figure 5-12. It shows that a combination of individual SuDS elements is required to contribute to the overall effectiveness of the SuDS scheme. Single elements such as a soakaway or infiltration basin may not be suitable in a number of circumstances due to, for example, the potential to contaminate groundwater sources or impermeable ground conditions.

The Interim Code of Practice[36] for SuDS, which was published by CIRIA in 2004, sets out the management and adoption of SuDS elements within the context of urban planning policy. CIRIA have also produced three model agreements[37] that have been designed as a binding agreement between the organisation involved in developing the SuDS scheme, the local authority and the water company, which can be used to bridge the gap until national guidance is released following the potential enactment of the Flood and Water Management Bill.

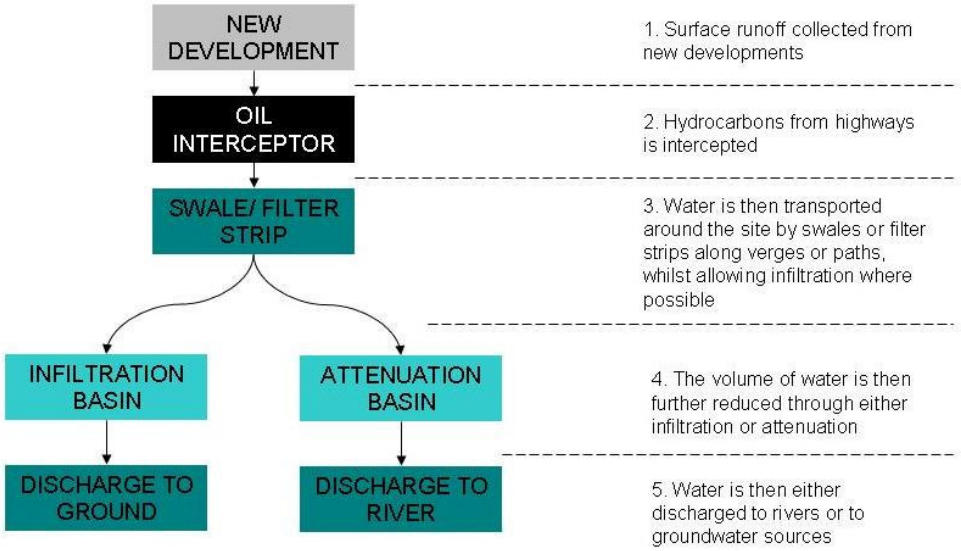

Figure 5-12 Example of SuDS management train

SuDS elements can also be retrofitted to existing developments or to the current urban fabric. An example is the use of rainwater harvesting techniques such as a simple garden water butt or permeable driveways or car parking areas. A water butt collects a proportion of the rainwater that falls onto the roof of a property, which subsequently can be used, for example, to water the garden. Although legislation cannot oblige residents to fit rainwater harvesting solutions to their property, the promotion of these elements through guidance by the LPAs and the water companies is vital to increase the uptake within the community.

An opportunity exists to link the design of SuDS with Green Infrastructure Strategies, to provide an integrated network that relieves flood risk whilst enhancing biodiversity. Attenuation basins and wetlands can provide valuable habitats for wildlife, as well as forming parts of green corridors between environmentally important sites. LPAs should encourage developers to incorporate SuDS from the higher levels of the SuDS hierarchy (Figure 5-11) into development sites wherever possible.

The WHBC SFRA contains mapping of SuDS policy areas, indicating at a strategic level the type of SuDS suitable for an area given the underlying ground conditions and aquifers. DBC,

SADC, TRDC and WBC may wish to consider including such work in either the next stages of the WCS, SFRA or in any forthcoming Surface Water Management Plans, to aid in the visualisation of the policy guidance contained within the 2007 SFRA Level 1.

5.6.4 Surface Water Management

A review of the surface water susceptibility data (April 09 revision) from the EA has been conducted for the study area. This data maps out the areas that are more or less likely to experience overland flow and ponding of water during an intense storm event. The LPAs have access to this data to assist in the development of high level policies – it must be supplemented with local knowledge and studies before decisions regarding individual sites can be made.

Initial conclusions that can be drawn from this data are that the following key areas fall within the 'more susceptible' band:

- Parts of Maple Lodge WwTW;
- Parts of Markyate WwTW;
- Potential sites in southeast Berkhamsted adjacent to the GUC;
- Potential sites in Hemel Hempstead adjacent to the River Gade and south of the junction with the M1;
- Potential sites in Markyate adjacent to the River Ver;
- Potential sites in the south and centre of Tring adjacent to the Long Marston Brook;
- Potential sites to the north of St Albans;
- Potential sites in South Oxhey adjacent to the railway line;
- Potential sites in north Watford, and the southeast of Watford adjacent to the River Colne; and
- Potential sites in Welham Green adjacent to the railway line.

The LPAs should ensure that suitable site-specific investigation and mitigation measures/ strategies accompany any development proposals in these areas. Development proposals should include details of how surface water run-off will be attenuated/ infiltrated to limit flows to that of the previous greenfield use or better. Similar levels should be required for brownfield development, to lessen the impact on the surrounding urban area.

The LPAs should seek to promote the integration of ecological benefits into any on site surface water management regime. As described in Section 5.6.3, significant ecological benefits can be gained by specifying the inclusion of 'living' (often referred to as green or brown) roofs for domestic and commercial properties.

The emerging Surface Water Management Plans for SADC and WBC should take account of the proposed development, to ensure that long-term surface water flood risk solutions can be identified, and that any capital improvement works take account of both future climate change, and future development pressure.

In addition, the emerging Flood and Water Management Bill may also place obligations on LPAs, and require additional work throughout the study area to indentify and manage surface water flood risk. Further WCS work should highlight any additional requirements.

5.7 Confirmation of Study Area

Given the baseline data described in the above Sections, it is clear that the development proposed in the LPA areas will impact the water environment in other adjoining areas. This is particularly apparent when considering sewerage, wastewater treatment and water quality.

The proposed growth in the WHBC and SADC areas has the potential to impact levels of wastewater received at Rye Meads and Deephams WwTW, and the water levels and quality of the receiving watercourses and environmental sites in this area (on the River Lee). Likewise, the proposed growth at Bovingdon (in the DBC area) has the potential to impact the water environment on the River Chess, downstream of Chesham WwTW.

The proposed growth throughout all of the LPA areas has the potential to significantly impact the water environment on the River Colne downstream of the Maple Lodge WwTW discharge.

Figure 5-13 illustrates the wider study area described below at a conceptual level. Impacts of the proposed growth in the LPA areas on this wider study area are referred to in the following Sections.

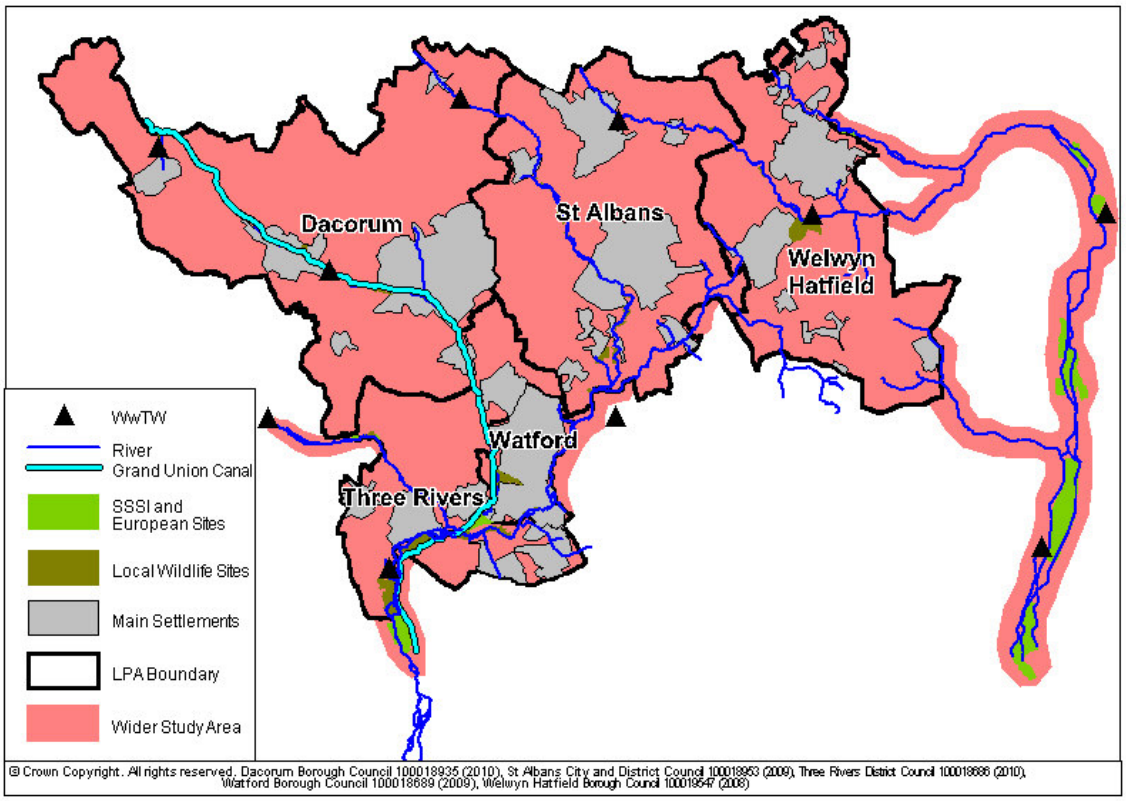

Figure 5-13 Wider Study Area

6 Issues and Constraints

6.1 Water Resources

6.1.1 Methodology

The impact on water resources and associated infrastructure from the proposed development does not solely depend upon the number of dwellings constructed. Demographic changes, i.e. changes in population and occupancy rates, will influence the impact of each new dwelling. Behavioural changes such as changes in per capita consumption (PCC), in both new and existing dwellings, will also affect the impact that the development has on the water infrastructure.

In order to assess the impact of the growth in the study area on water resources, it is necessary to calculate the increase in demand due to the new residential development.

The calculations are based on three sets of PCC variables:

a) New dwellings continue to use the average PCC of each WRZ, similar to existing properties i.e. ~160 l/head/day reducing to ~150 l/h/d by 2031 *i.e. a 'do-nothing' scenario*;

b) All new dwellings use 105 l/h/d, + 5 l/h/d for outside use, equivalent to Code for Sustainable Homes Levels 3/4; and

c) All new dwellings use 105 l/h/d, + 5 l/h/d for outside use until 2016. After 2016, all new dwellings use 80 l/h/d equivalent to CSH Level 5/6.

Occupancy rates are assumed to remain constant at water company estimations for 2009/2010. Whilst reductions in household occupancy have the potential to reduce the demand from each new household, the conventional understanding within the water industry is that smaller households tend to have higher PCC rates, as there are less opportunities to 'share' demand for washing machines, dishwashers etc. For this reason, assuming steady occupancy rates produces a conservative estimate of future demand.

Following discussions with the water companies, it has been assumed that the demand for water and wastewater services from businesses remains constant for the foreseeable future. Intensification of existing employment areas is unlikely to result in a net increase in industrial demand, as it is predicted that companies with heavy water use will be replaced with service-orientated industry over time.

However, the development of new employment sites will obviously require modification and upgrades to the existing network. Where new sites are proposed, any likely constraints that may restrict the provision of potable water or wastewater services should be discussed in the future stages of the WCS, once site locations are better defined.

6.1.2 Results

Table 6-13 shows the predicted increase in demand of potable water in the study area due to the growth scenarios, calculated as part of this WCS using the above methodology. It must be noted that the Water Resource Zones (WRZ) extend beyond the study area, so will in fact experience higher demand due to growth in other areas.

Water Resource Zones: Increase in Demand by 2031 (Ml/d)	VWC Northern	VWC Central	TWU Slough, Wycombe and Aylesbury
Scenario 1 Growth			
a) Existing PCC Levels	6.16	5.26	0.10
b) CSH Level 3/4	4.29	3.70	0.08
c) CSH Full Implementation	3.45	2.98	0.06
Scenario 2 Growth			
a) Existing PCC Levels	14.52	9.16	0.28
b) CSH Level 3/4	10.12	6.45	0.20
c) CSH Full Implementation	8.15	5.19	0.16

Table 6-13 Predicted increase in domestic potable water demand (by 2031) due to development

The above table suggests that if new developments are designed to encourage a PCC in line with CSH Level 3/4, and existing dwellings see a gradual reduction in PCC due to VWC strategy, then the increase in demand 2010 – 2031 can be reduced by around 28% compared with the demand resulting from the existing PCC levels.

Full implementation of CSH (Levels 5/6 from 2016 onwards) will reduce the increase in demand (compared with existing PCC levels) by around 43%.

As discussed in Section 5.2, current water company plans make allowances for the current RSS targets (i.e. Scenario 1). The VWC Central and TWU Slough, Wycombe and Aylesbury WRZ will continue to maintain an adequate supply/demand balance despite the Scenario 1 growth. However, the VWC Northern WRZ is predicted to be in a slight supply/ demand deficit around 2015 (due to the predicted sustainability reductions), and have no supply/demand surplus by around 2030, during critical periods. VWC will develop plans to manage this deficit, to protect the target headroom that they aim to provide in the Northern WRZ. VWC will continue to monitor the situation as the realisation of the predicted growth, and additional sustainability reductions, will affect when and if such a deficit occurs, and what resource development/ demand management options will be required to maintain the target headroom.

Figure 6-14 shows the additional increase in demand in the VWC Northern WRZ due to the Scenario 2 growth, over and above the Scenario 1 demand, for all three sets of PCC variables.

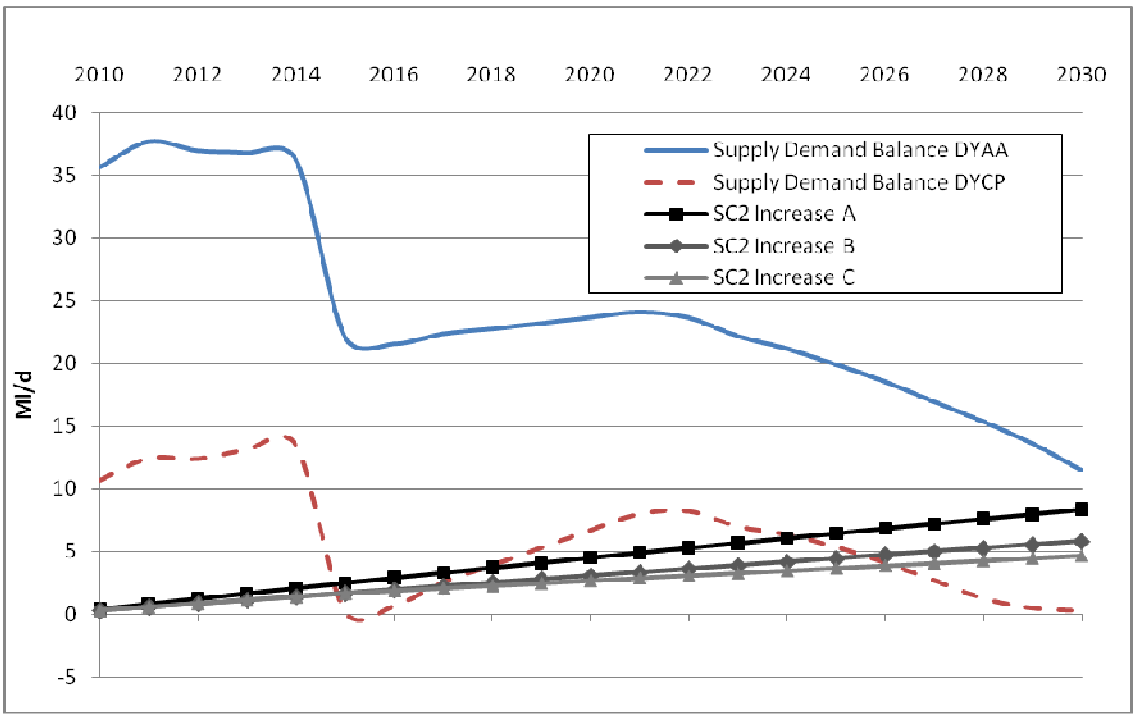

Figure 6-14 Planned Supply/ Demand Surplus in VWC Northern WRZ

The higher level of growth proposed under Scenario 2 has the potential to exacerbate the supply/ demand deficit around 2015 and create a deficit from approximately 2024 onwards during critical periods. VWC would need to consider additional resource development, import of water and demand management measures to maintain their target headroom in these years.

Regarding the issues highlighted in 2015, it must be noted that the above graph assumes a linear progression of development (which may be unlikely in the next few years due to the economic climate) and that weather conditions leading up to 2015 actually produce a dry year. Combined with the fact that the potential reduction in target headroom, under the above worst case conditions, is less than 0.3% of total deployable output according to VWC, then this is unlikely to significantly constrain VWC's ability to offer a secure level of supply. Nevertheless, this issue will need further consideration through the future iterations of WCS and WRMP, as growth targets are confirmed.

As the VWC Central and TWU Slough, Wycombe and Aylesbury WRZ are planned to maintain a larger supply/ demand surplus over the study timeframe, the projected increase in demand due to Scenario 2 should not create a deficit prior to 2031.

6.1.3 Conclusion

The water companies supplying the study area have long-term strategies in place to balance the available water resources against the demand from the existing and new dwellings, under growth Scenario 1. VWC are currently predicting that, in their Northern WRZ, this new demand may cause a reduction in headroom available in 2015, and not allow any surplus past 2030. The Scenario 2 growth would exacerbate these issues, causing a supply demand deficit during critical periods from 2024 onwards. It is likely that the water companies would revise parts of their WRMP should the Scenario 2 growth targets be finalised following the RSS Review outcome.

The water company plans depend upon average PCC rates reducing in the future. Whilst this may be driven partly by metering strategies, a proportion of the reduction must come from increased efficiency in homes and businesses through the use of water efficient fittings, changes of consumer behaviour, and the specification of performance levels for new dwellings. Future climate change has the potential to decrease the availability of water resources and increase peak demand. Reducing PCC levels in both new and existing properties will allow a greater surplus between the water available under current licences and the demand in the study area. This allows a greater security of supply to be achieved, regardless of whether the WRZ is predicted to enter a deficit or not, and helps water companies to accommodate the potential sustainability reductions that may be imposed to protect the water environment.

This highlights the importance of LPAs implementing policies to reduce potable water demand in both new and existing dwellings.

6.2 Water Supply

Regarding development in Tring, TWU estimate that the Scenario 1 growth can be accommodated by the existing supply infrastructure, with any new local network required likely to be funded through the requisition process as described in Section 2.4.

A full assessment of the impact of the Scenario 2 growth on the supply infrastructure would require an internal study by TWU. However, initial high-level assessment indicates that only minor upgrades would be required.

The development required to meet the Scenario 1 targets in the remainder of the study area is located around the existing settlements. As such, VWC predict **no major constraints** to supplying these sites with potable water, providing the EA do not enforce further sustainability reductions affecting their WRZ. Any upgrades to the existing supply network required in these locations are likely to be funded from the usual water company investment process and developer requisitions, as described in Section 2.4.

As described in Section 6.1, the Scenario 2 growth targets may require VWC to revise their plans for the future supply of water into the study area. Changes in the way this water is supplied may require the construction of new strategic infrastructure, which would have to be funded primarily through the usual water company investment process.

Until growth levels in the study area are finalised, VWC will be unable to assess the changes in strategic infrastructure, or resource development options, which may be required.

6.3 Sewerage

TWU have provided a high-level assessment of some areas of the trunk sewer network that may be impacted by the proposed growth scenarios. Where capacity information is available, it has been incorporated into the constraints matrix in Section 7.1.

The impact of the proposed development on the sewerage network can only be accurately assessed using TWU network models during future WCS stages. This is most efficient when potential site locations and dwelling numbers are finalised, or at least more certain.

TWU indicate that there are some interaction points between the foul and surface water sewer systems, however location and maintenance records of such assets may not be complete. LPA's should continue to liaise with TWU to ensure that any relevant constraints are identified in future work, particularly once site locations and dwelling numbers are confirmed.

6.4 Wastewater Treatment

6.4.1 Methodology

The potential impact of the proposed growth in the study area has been estimated by calculation of the increase in foul water arriving at each of the WwTW from the new dwellings.

The calculations are completed in terms of Dry Weather Flow (DWF) i.e. foul water only, assuming that the majority of storm water from the new developments is separated at source following the principles of PPS25 and the Flood and Water Management Bill.

To account for infiltration and misconnections to these new sewers in the long term, an additional proportion of 'unaccounted for' flows has been included in the calculations. The value of this is in accordance with the unaccounted for flows currently received by TWU in the existing WwTW catchments.

Similarly, PCC and occupancy rates used in the calculations correspond to current values used by TWU for planning purposes in each of the WwTW, and remain constant at this level to 2031. This produces the most conservative estimate of the flow increases at the WwTW. Sensitivity testing using varying PCC and occupancy rates may be appropriate for further WCS work, once development locations and numbers are more certain.

In addition, TWU are under no obligation to accept trade effluent to their wastewater systems. In doing so, they may require an improvement to some network or process streams, depending on the chemical consistency and volume of the effluent. The capital required for this work will be a consideration that the water companies take into account when making a financial agreement with the business in question.

The proposed increases in DWF due to the residential development has been added to the existing flows recorded at the WwTW (reported in 2009). This was then compared against the existing volumetric discharge consent for the WwTW; the results of this exercise are illustrated in Section 6.4.2 below.

However, it must be noted that the current volumetric discharge consents for the WwTW are prescribed in terms of maximum flow. The EA have informed TWU that they intend to change the existing maximum flow consents to DWF consents imminently (from April 2010 onwards).

Current DWF consents are therefore not technically in place at the WwTW as of yet. A standard approximation suitable for high level planning is that the DWF consent is approximately 1/3rd of the maximum flow consent. This has been used for the calculations. However the final figure applied by the EA can vary, dependant on receiving water quality and current flows at the WwTW.

Therefore, any conclusions drawn from the calculations will be subject to change following the finalisation of the DWF consent data in the following months.

It should also be noted that the WwTW may not have the process and hydraulic capacity to treat flows up to all of existing flow consent. TWU have provided a high-level assessment of the impact of the WwTW on the process/ hydraulic capacity of the receiving WwTW. Where such capacity information is available, it has been incorporated into the constraints matrix in Section 7.1.

6.4.2 Results

The following graphs display the predicted total domestic foul water flow predicted at the WwTW due to the existing dwellings, and new dwellings under each growth scenario. This is plotted against a theoretical DWF consent, subject to the assumptions made in the above Section.

The 90% of DWF consent line is also illustrated, as this has been used in previous WCS as an indicator of when the water company should apply for an increased consent, to ensure that seasonal variations in flow can be accommodated.

Dwellings predicted by the LPAs in rural areas have been apportioned to the main settlement catchments in line with the overall share of growth at these settlements.

Should small pockets of this rural growth fall into the catchments of the smaller rural WwTW within the study area, it is unlikely that a strategic solution would be required.

It has been assumed that 17% of the increased flow from the following settlements continues to be diverted to Blackbirds WwTW:

- Brookmans Park;
- Chiswell Green;
- Hatfield;
- How Wood;
- Little Heath;
- London Colney;
- Park Street/Frogmore;
- Redbourn;
- St Albans; and
- Welham Green.

In addition, due to the likely locations of development, it is assumed that:

- 25% of the increased flows from development in Hatfield is connected to the Mill Green WwTW catchment, with 75% connected to the Maple Lodge/ Blackbirds WwTW catchment; and
- 33% of the increased flows from development in Welwyn Garden City is connected to the Mill Green WwTW catchment, with 67% connected to the Rye Meads WwTW catchment.

The potential impact of the proposed growth within the study area on the adjoining Chesham, Deephams and Rye Meads WwTW is negligible given the scale of new flows compared to existing flows. Therefore, no graphs are presented for these WwTW. There may be an opportunity for the settlements connected to these WwTW (Bovingdon, Cuffley and north WHBC respectively) to accommodate higher proportions of the growth targets, subject to growth levels from other LPAs outside of the study area.

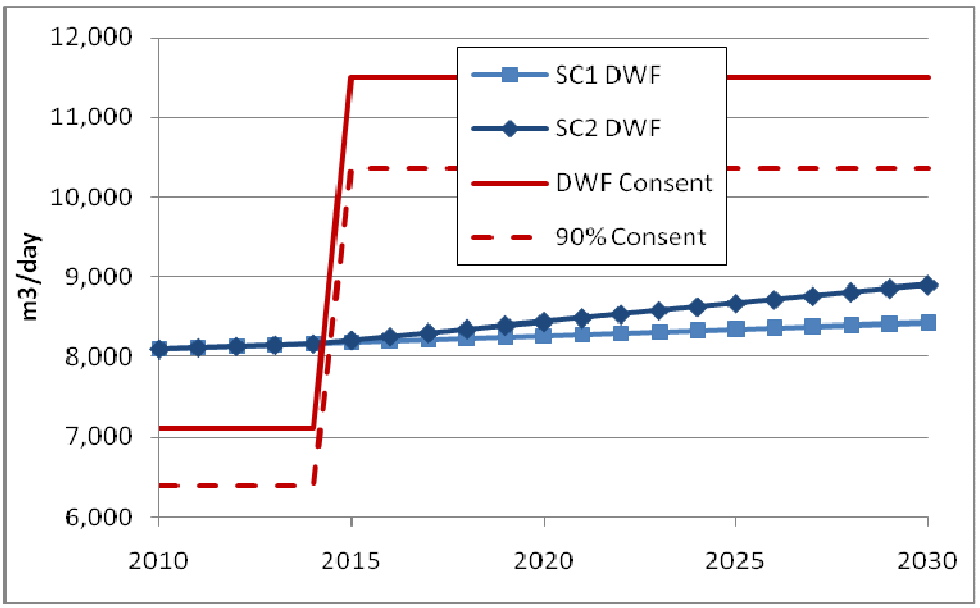

Figure 6-15 Estimated increase in DWF at Berkhamsted WwTW

Figure 6-15 suggests that current flows at **Berkhamsted WwTW** already exceed the theoretical DWF consent. However, TWU advise that the DWF consent at Berkhamsted is due to be increased from 7,100 to 11,504 m^3/day by the end of AMP5 (2015), with a corresponding tightening of physio-chemical standards. In the short term, a discrepancy exists between the existing flows and current DWF consent, however this may be resolved imminently as the EA and TWU rationalise existing consent levels. Longer term, Figure 6-15 suggests that the proposed growth in Berkhamsted (under both scenarios) should be able to be accommodated within the revised DWF consent from 2015 onwards, with TWU already committed to achieving the tighter quality standards necessary for such an increase.

It must also be noted that BWW have voiced a concern regarding current quality levels in the GUC downstream of the WwTW discharge. The improvements described above will go some way to improving the situation, however any future WCS work in the area should continue to consult with BWW regarding this matter.

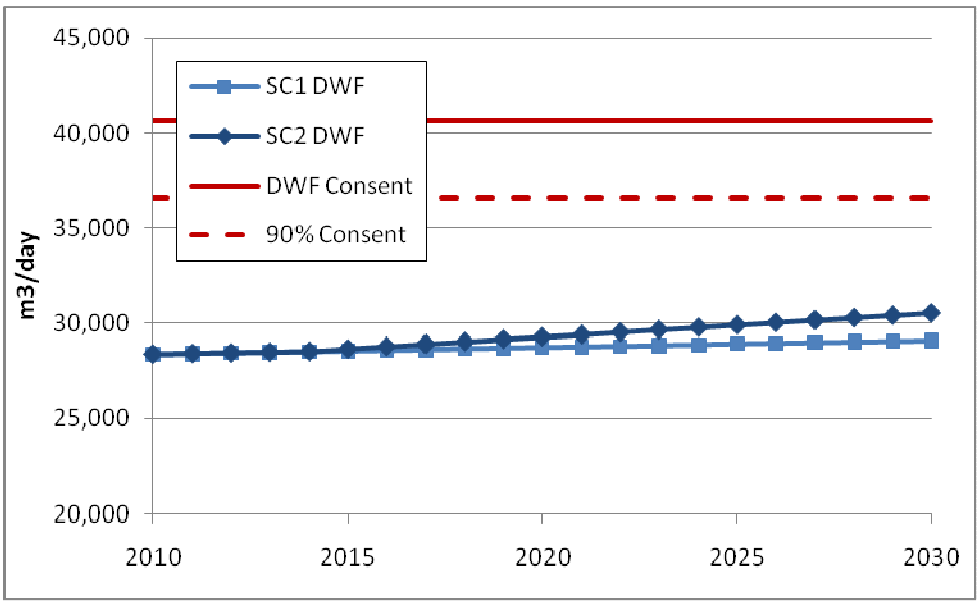

Figure 6-16 Estimated increase in DWF at Blackbirds WwTW

Figure 6-16 suggests that the potential increase in flows due to both growth scenarios would not require the theoretical DWF consent at **Blackbirds WwTW** to be increased. There may therefore be an opportunity for additional growth to be accommodated in the areas upstream of Blackbirds WwTW, and additional flow diverted to the WwTW by TWU.

According to TWU, land availability for any upgrades required at Blackbirds WwTW will be less constrained than at Maple Lodge WwTW.

It will be necessary for TWU to reassess plans to divert additional flows to Blackbirds WwTW following the confirmation of RSS targets and the rationalisation of the DWF consent issues with the EA.

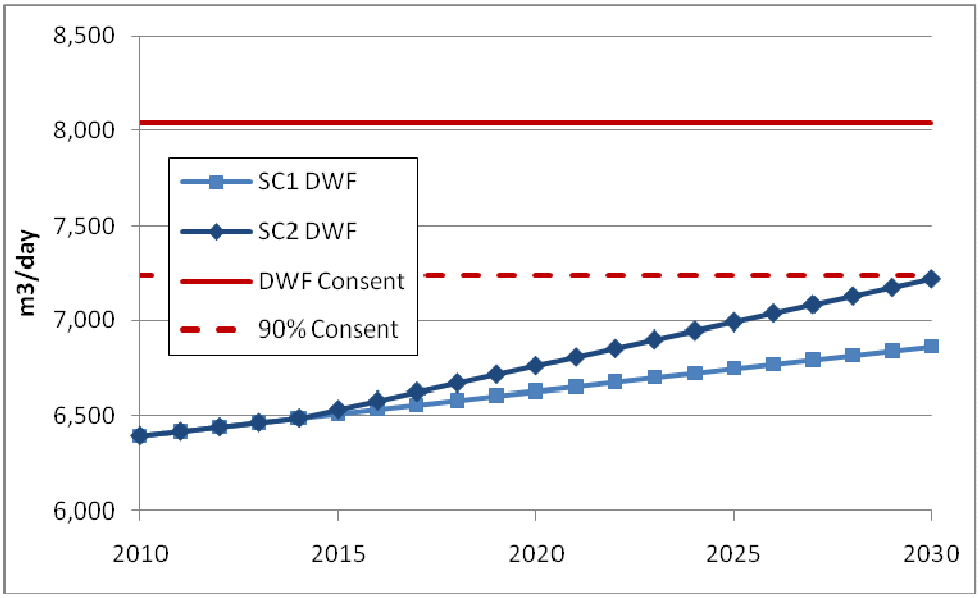

Figure 6-17 Estimated increase in DWF at Harpenden WwTW

Figure 6-17 suggests that neither growth scenarios will cause the theoretical DWF consent to be exceeded prior to 2031 at **Harpenden WwTW**. However, should Scenario 2 growth be realised,

TWU may wish to apply for an increased consent towards the end of the study period to allow additional headroom for seasonal variations in flow.

TWU indicate that suitable capacity upgrades could be accommodated on site to treat the increase in flows under Scenario 1. However, Scenario 2 may require rebuilding the WwTW to use a different process. This may be cost prohibitive given the relatively small scale of growth in the catchment.

However, if this is in fact required, it may be appropriate for SADC to allocate additional growth towards the end of the study period into this catchment, dependant on water level and quality issues in the River Lee. This would return treated water closer to source, and reduce the impact of the District's development on Maple Lodge WwTW.

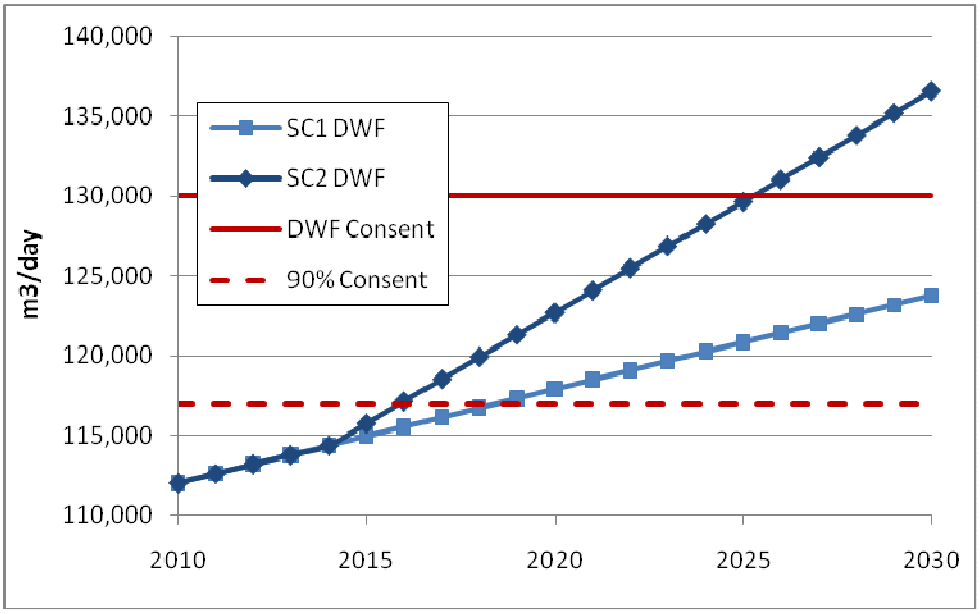

Figure 6-18 Estimated increase in DWF at Maple Lodge WwTW

Figure 6-18 suggests that the potential increase in flows from Scenario 2 will exceed the theoretical DWF consent at **Maple Lodge WwTW** by 2025, possibly requiring a new consent to be negotiated from 2016 onwards. Flows from Scenario 1 may not exceed the theoretical DWF consent within the study period; however there may be a need to negotiate a new consent from 2018.

There is a risk that any increase in consented volume would be accompanied by a tightening of physio-chemical standards. At present, Maple Lodge is operating at what can be considered Best Available Technology* (BAT) with regards to Amm. N and P.

Increasing flows to Blackbirds WwTW, by diverting additional flows from the trunk sewers, and perhaps allocating additional growth to the settlements upstream of this diversion (in SADC and WHBC), will lessen the impact of the development on Maple Lodge WwTW, and return treated water to the catchment closer to source.

Upgrades to the WwTW at Maple Lodge will be required under both growth scenarios - the land available for such upgrades is partially constrained due to the layout of the existing site.

* See Technical Glossary for definition of BAT and BATNEEC

BWW have voiced a concern regarding current water quality in the GUC downstream of the WwTW discharge, and the need to control potential increases in water levels.

A strategy for this catchment can only be developed once RSS targets are confirmed and the rationalisation of the DWF consent issues with the EA is complete.

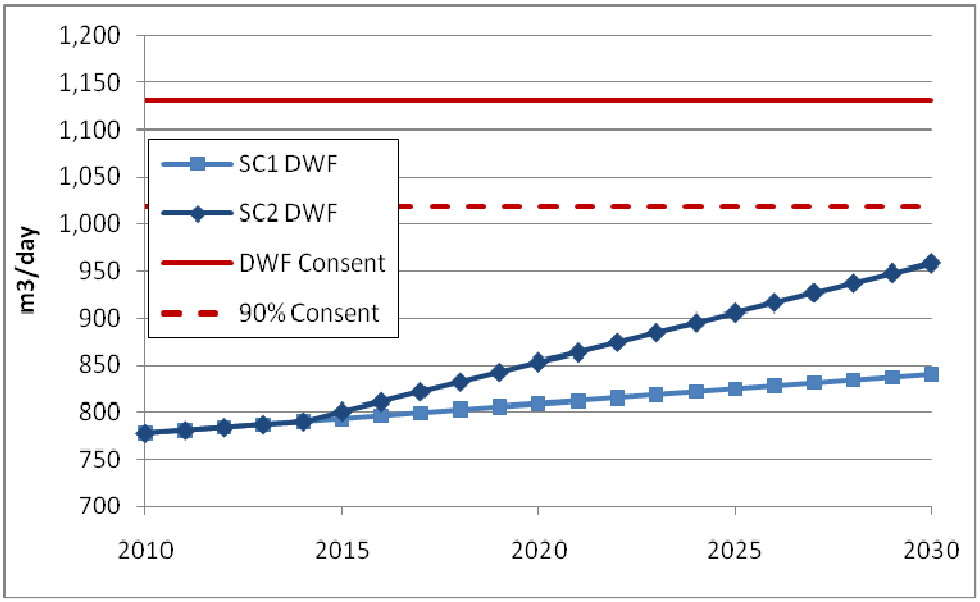

Figure 6-19 Estimated increase in DWF at Markyate WwTW

Figure 6-19 suggests that neither growth scenarios will cause the theoretical DWF consent to be exceeded prior to 2031 at **Markyate WwTW**. According to TWU, the Scenario 2 growth would require upgrades to the existing WwTW capacity, whilst Scenario 1 can possibly be accommodated by the existing assets.

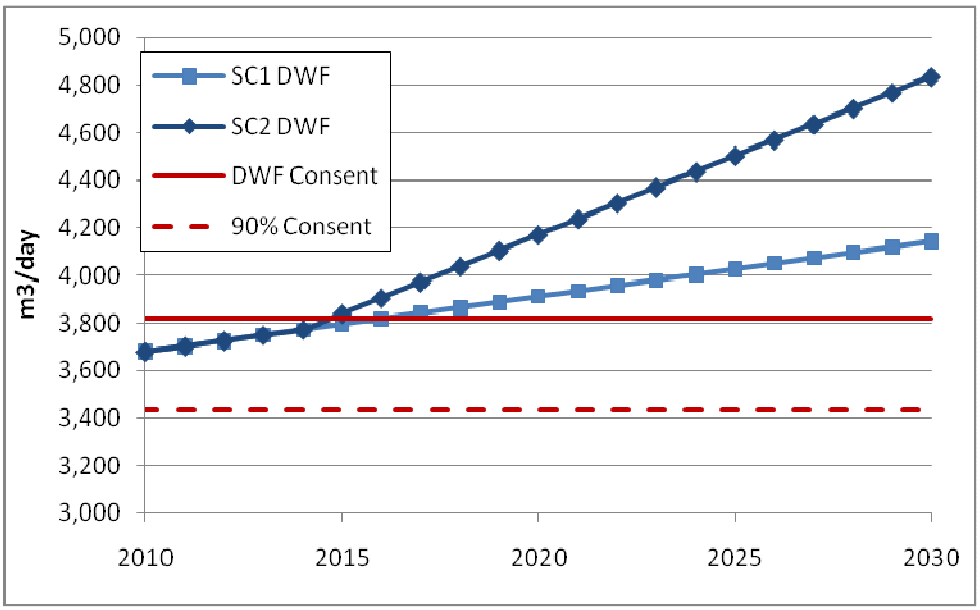

Figure 6-20 Estimated increase in DWF at Mill Green WwTW

Figure 6-20 suggests that **Mill Green WwTW** may currently be operating very close to its theoretical DWF consent limit, following the diversion of additional flows from the Rye Meads catchment in November 2009. This diversion alleviated network capacity issues along Boundary Lane/ Howlands, and decreased the number of properties connected to the Rye Meads

network. Theoretically, this will have increased the capacity available for WHBC growth in this area, although liaison would be required with TWU to assess how much growth can be accommodated without causing the recently resolved capacity issues to re-emerge, and ensure that any increase is not detrimental to the water environment in the Rye Meads catchment.

Any growth in the Mill Green catchment is likely to require the negotiation of an increased DWF consent. However, allocating additional WHBC growth in this catchment has the potential to benefit flow levels, and therefore biodiversity, in the River Lee by returning treated water closer to source, providing water quality can be managed appropriately.

TWU estimate that there is sufficient land currently available within the existing site boundary to upgrade the WwTW without the requirement to purchase adjacent land. Any process upgrades required due to the growth in the catchment would be unlikely to detriment the visual amenity of the area, as they will be contained within the area which is currently served by the existing landscaping and vegetation screens.

A strategy for this catchment can only be developed once RSS targets are confirmed and the rationalisation of the DWF consent issues with the EA is complete.

It would be valuable for TWU and the EA to discuss the potential physio-chemical standards that may be required along with an increased DWF consent, to test if WHBC allocating additional growth in this catchment can be beneficial to the local water environment, whilst reducing the pressures on the Maple Lodge WwTW.

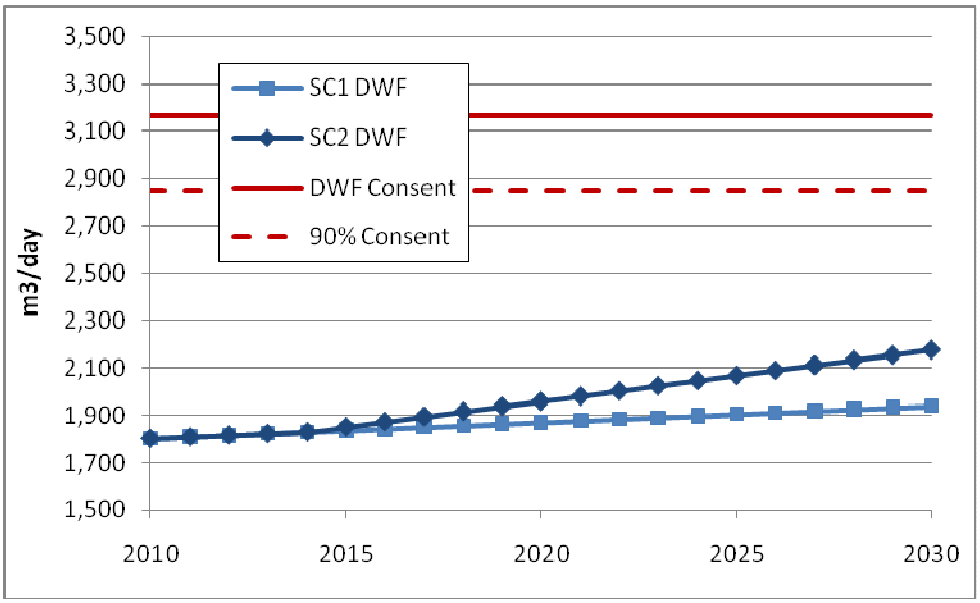

Figure 6-21 Estimated increase in DWF at Tring WwTW

Figure 6-21 suggests that neither growth scenarios will cause the theoretical DWF consent to be exceeded prior to 2031 at **Tring WwTW**. According to TWU, the Scenario 2 growth would require upgrades to the existing WwTW capacity, which may be expensive given the nature of the current process used on site. Scenario 1 can possibly be accommodated by the existing assets.

BWW have voiced a concern regarding current quality levels in the GUC downstream of the WwTW discharge.

6.4.3 Conclusion

According to the above results, Maple Lodge, Mill Green and Harpenden WwTW are likely to require an increase in DWF consent prior to 2031 due to the proposed development.

Should additional flow be diverted to Blackbirds WwTW from the Maple Lodge catchment following an investigation by TWU, then it is likely that Blackbirds WwTW will also require an increased DWF consent. It is estimated that the diversion of existing and new flows could be increased from 17% to approximately 22% before the Scenario 2 total DWF would breach the existing theoretical DWF consent, although this may require TWU to upgrade the pumped section of the network.

It is likely that any increase in the volume of flow consented would be accompanied by a tightening of the physio-chemical standards, as described in the following Section.

6.5 Water Quality and Ecology

Assuming surface water is adequately managed in line with PPS25 and the emerging FWMB, the major impact of the potential development sites on the water environment will be the variations in water **quality** and **quantity** discharged to receiving watercourses from the WwTW that serve the sites.

Where DWF consents from WwTW will increase (currently identified as an issue at Maple Lodge, Mill Green and Harpenden WwTW) it is likely that the physio-chemical limits included within these consents will be tightened by the EA, to ensure that the water quality of the receiving watercourses does not deteriorate. When assessing possible consent changes the EA will take account of any sensitive sites and species downstream of the discharge (which are numerous, as described in Section 5.5), as well as the current dilution available from the river flow, and the possible benefits of increased flows.

In some cases the physio-chemical limits required for some of the WwTW discharges may be tightened, to meet the WFD requirements, to limits that require the water companies to operate at BAT, or beyond in the future. As water companies primarily obtain funding from their customers through Ofwat, it may not be economically feasible for them to build and operate WwTW processes at this level, due to the increased costs (in both financial and energy/ carbon terms). Instead, it may be more feasible for water companies to plan to operate at Best Available Technology Not Entailing Excessive Cost* (BATNEEC), as there are less risks associated with releasing funds for achieving this. However, this will still require discussion and agreement with both the EA and Ofwat at a more strategic level than this WCS.

As described in Section 5.4, the majority of receiving watercourses already exhibit high phosphate levels, which cause them to be classed as not achieving good ecological status (or GEP) under the WFD. This is a key concern throughout the majority of the East of England, and will require ongoing cooperation between water companies, the EA and other parties such as Defra to overcome this issue at a national and regional level.

The EA have previously indicated that they would not require P concentrations more stringent than BAT for consent revisions in the first period of the WFD (to 2015), however there is a risk that future iterations of the RBMPs may require more stringent standards.

During this WCS, the EA have provided copies of Water Level Management Plans for a number of SSSI in the study area. These plans set out any water level and quality requirements for the sites.

According to the WLMP[38], at Croxley Common Moor (on the River Gade) an increase in winter flooding would be beneficial to attract birds and aid seed disposal. However, some hollows in the site are seasonally wet, and increased water levels may alter the ecological interest of such features. Given the many interactions between the GUC and River Gade, it is unlikely that the increases in discharges from Tring and Berkhamsted WwTW would significantly impact on the water levels in the site. Water quality may be more of a concern, especially under Scenario 2, however this is difficult to assess without a current view on the DWF consent at these WwTW.

At Frogmore Meadows and Sarratt Bottom (on the River Chess) there is little seasonal variation in levels and winter flooding. Lower and wetter parts of the sites may be in hydrological continuity with the River Chess. According to the WLMP[39,40], it is preferable to maintain the current regime at these sites, in the absence of better historic information on seasonal flooding and water quality. However, given the negligible effect of the proposed growth at Bovingdon on the Chesham WwTW discharge, it is unlikely that the development will detriment these sites.

At Tewinbury (on the River Mimram), the primary concern of the WLMP[41] is the water levels and quality in surface water ditch to the south of the river, which drains industrial sites to the north of Welwyn Garden City. Providing that surface water management on any sites in this location adheres to PPS25, and the SuDS hierarchy as described in Section 5.6.3, then there should be no significant impact on the interest of the site.

6.6 Flood Risk

The connection of new sites to the existing sewerage network and WwTW can increase the risk of flooding in two ways:

- New development connected to the existing sewerage network may exceed the capacity of certain network capacity bottlenecks, causing surcharging of sewers, and the risk of properties and receiving watercourses being flooded with wastewater. This risk will be increased during storm events, as increased infiltration of surface water from the existing catchment area will also add to the flows in addition to any direct storm flows in combined systems; and
- DWF at WwTW will be increased following the connection of new dwellings to the network. Whilst some flows may be stored on site during peak flows, an increase to the volumetric flow rate of the discharge is likely. This may be within the existing volumetric discharge consent, as stipulated by the EA. However, discharges in excess of this, which will require an updated consent, may increase the fluvial flood risk to properties and environmental sites on the watercourse downstream of the discharge point.

Regarding sewerage network capacity and sewer flooding, priority sites for further assessment will be:

- All TRDC growth locations;
- All Watford growth locations;
- Locations in the upstream areas of the Maple Lodge network, i.e. south WHBC;
- Trunk sewers through St Albans and Hemel Hempstead; and
- Trunk sewers and pumping stations near Maple Lodge WwTW, given the potential growth throughout the catchment.

In addition, a number of potential growth locations have been identified at the smaller settlements in SADC and DBC that are located at the opposite periphery of the sewerage networks to their respective WwTW. These locations will require further assessment to ensure

that network capacity, and hence sewer flooding, does not become a constraint to development (unless new sewers are used to bypass the existing networks).

Ongoing discussions between LPAs and TWU, throughout the LDF process, will be required to ensure that adequate sewerage network upgrades can be implemented prior to the commencement of the development sites. Additional modelling information may become available to TWU to allow this risk to be better quantified in the further stages of the WCS.

Regarding an increase in fluvial flood risk, this risk is most apparent where WwTW will require an increased DWF consent in the future due to the growth. Presently, this applies to Maple Lodge, Mill Green and Harpenden WwTW, however, as stated throughout this report the current theoretical nature of the DWF consents leaves this subject to change.

Future WCS work should include additional consultation with the EA, and hydraulic assessment and modelling where deemed appropriate, to investigate the potential increase in flood risk on the affected receiving watercourses due to the increased WwTW discharges.

In addition, where expansions to WwTW are required to accommodate the increased flows from the growth sites, any future WCS work should include liaison with TWU to ensure that any existing floodplain surrounding the WwTW will not constrain such upgrades taking place.

7 Conclusion

7.1 Constraints Matrix

The following tables summarise the issues described through this report for each of the settlements where growth is proposed, for both growth scenarios.

As an indicative guide, the issues are displayed and discussed using the following convention:

	Major constraint to development, requiring extensive infrastructure improvements to allow development (possible showstopper at this stage but may be reclassified following further investigation).
	Major constraint to development, requiring extensive infrastructure improvements to allow development (Not considered as a showstopper at this stage but requires further investigation to confirm).
	Major or possible constraint to development, although infrastructure solutions and mitigation techniques can be identified and/ or judged as feasible.
	No constraint to development, or minor localised improvements required to allow development

Table 7-14 Key for constraints summary tables

For clarity, the settlements are displayed in separate tables for each LPA.

Growth Location	Potable Supply	WwTW and Sewerage Network Capacity	Flood Risk	Water Environment
Berkhamsted	**SC1:** Sites can be feasibly supplied via VWC trunk main system.	**SC1**: Some upgrades required to Berkhamsted WwTW. Planned increase in DWF consent should accommodate increased flows due to growth. Local network upgrades may be required.	**SC1/2:** The increased flows from either scenario will be within the proposed DWF consent from 2015 onwards. However, BWW must be consulted with regards to water level management on the GUC, and an assessment made of how any potential increases in downstream flood risk, due to the growth, can be mitigated.	**SC1/2:** BWW are concerned regarding downstream water quality on the GUC. A short term inconsistency remains regarding existing flows and current DWF consent. However, the predicted increase in flows due to either scenario will be within the proposed DWF consent from 2015 onwards, with TWU committed to providing the necessary capacity and achieving the required water quality.
	SC2: VWC may need to adjust plans for Northern WRZ, to ensure adequate water resources and associated water services infrastructure	**SC2:** Significant upgrades likely to be required to Berkhamsted WwTW. Planned increase in DWF consent should accommodate increased flows due to growth. New strategic sewer would likely be required linking the site to the southeast directly to the WwTW.		
Bovingdon	**SC1:** Sites can be feasibly supplied via VWC trunk main system.	**SC1/2:** Chesham WwTW can accommodate both scenarios within existing capacity and DWF consent. Some localised network improvements may be required. Capacity of sewage pumping station from Bovingdon requires checking. Sites to the south of town will be closer to this pumping station, therefore requiring less network upgrades.	**SC1/2:** As potential flow increases are negligible compared to the existing flows from Chesham WwTW, it is assumed that any downstream increase in flood risk will also be negligible for both scenarios.	**SC1/2:** As potential flow increases are negligible compared to the existing flows from Chesham WwTW, it is assumed that any downstream change in water quality will also be negligible for both scenarios.
	SC2: VWC may need to adjust plans for Northern WRZ, to ensure adequate water resources and associated water services infrastructure			
Hemel Hempstead	**SC1:** Sites can be feasibly supplied via VWC trunk main system.	**SC1/2:** Both scenarios will severely impact the trunk sewer network to Maple Lodge WwTW. TWU modelling required to assess the extent of network upgrades required. Sites to the south would be preferable as they minimise the distance of upgrades needed through the urban area. Maple Lodge WwTW will need upgrading given the growth in the catchment – there are spatial constraints that would need resolving at the WwTW	**SC1/2:** Both scenarios have the potential to significantly increase the risk of sewer flooding throughout the existing settlement, especially the potential growth sites to the northeast and northwest. TWU will need to assess the possibility of trunk main flooding further down the catchment. The total increase of flows throughout the catchment is likely to increase flood risk downstream of the Maple Lodge WwTW discharge.	**SC1/2:** The sensitive nature of the habitats downstream of the Maple Lodge WwTW may constrain growth, particularly Scenario 2 levels, as the existing Maple Lodge WwTW process is operating at BAT regarding nutrients. BWW are concerned regarding the water quality in the GUC downstream of the WwTW discharge.
	SC2: VWC may need to adjust plans for Northern WRZ, to ensure adequate water resources and associated water services infrastructure			

Kings Langley	**SC1:** Sites can be feasibly supplied via VWC trunk main system. **SC2:** VWC may need to adjust plans for Northern WRZ, to ensure adequate water resources and associated water services infrastructure	**SC1/2:** Impact on trunk sewer and Maple Lodge WwTW capacity is negligible for both growth scenarios. Any localised network upgrades should be assessed once site-specific details are confirmed.	**SC1/2:** Localised network issues may need to be resolved to ensure the risk of sewer flooding does not increase. The total increase of flows throughout the catchment is likely to increase flood risk downstream of the Maple Lodge WwTW discharge, although the contribution from this settlement is relatively small.	**SC1/2:** Whilst contributing relatively small growth levels to the catchment, there is a risk that the overall total growth in the catchment will be constrained by the sensitive habitats downstream of Maple Lodge WwTW.
Markyate	**SC1:** Sites can be feasibly supplied via VWC trunk main system. **SC2:** VWC may need to adjust plans for Northern WRZ, to ensure adequate water resources and associated water services infrastructure	**SC1:** Markyate WwTW can accommodate the growth. Sites to the southeast are preferable as they minimise the distance to the WwTW, and hence any sewer upgrades through the existing settlement. **SC2:** Markyate WwTW will require upgrading to accommodate the growth. Sites to the southeast are preferable as they minimise the distance to the WwTW, and hence any sewer upgrades through the existing settlement.	**SC1/2:** Localised network issues may need to be resolved to ensure the risk of sewer flooding does not increase. It is unlikely that the relatively small increases in discharge would cause a significant flood risk to the downstream area.	**SC1/2:** It appears that both growth scenarios could be accommodated under the existing DWF consent – reducing the risk that tighter physio-chemical standards would be imposed. However, the water quality in this stretch of the River Ver will be strongly linked to the WwTW discharge.
Tring	**SC1:** Minor local upgrades required **SC2:** TWU assessment required	**SC1/2:** Tring WwTW will require upgrades for both growth scenarios. Sites to the east, south and west may require substantial network upgrades through the existing settlement, or a new direct sewer to the WwTW.	**SC1/2:** Localised network issues may need to be resolved to ensure the risk of sewer flooding does not increase. BWW must be consulted with regards to water level management on the GUC.	**SC1/2:** It appears that both growth scenarios could be accommodated under the existing DWF consent – reducing the risk that tighter physio-chemical standards would be imposed. However, BWW are concerned regarding downstream water quality on the GUC.

Table 7-15 Summary of DBC growth area constraints

Growth Location	Potable Supply	WwTW and Sewerage Network Capacity	Flood Risk	Water Environment
Bricket Wood	**SC1:** Sites can be feasibly supplied via VWC trunk main system. **SC2:** VWC may require new strategic infrastructure	**SC1/2:** Impact on trunk sewer and Maple Lodge WwTW capacity is negligible for both growth scenarios. Any localised network upgrades should be assessed once site-specific details are confirmed. Sites to the south of the settlement are preferable due to proximity to trunk sewers.	**SC1/2:** Localised network issues may need to be resolved to ensure the risk of sewer flooding does not increase. The total increase of flows throughout the catchment is likely to increase flood risk downstream of the Maple Lodge WwTW discharge, although the contribution from this settlement is relatively small.	**SC1/2:** Whilst contributing relatively small growth levels to the catchment, there is a risk that the overall total growth in the catchment will be constrained by the sensitive habitats downstream of Maple Lodge WwTW.
Chiswell Green	**SC1:** Sites can be feasibly supplied via VWC trunk main system. **SC2:** VWC may require new strategic infrastructure	**SC1/2:** Impact on trunk sewer and Maple Lodge/Blackbirds WwTW capacity is negligible for both growth scenarios. Any localised network upgrades should be assessed once site-specific details are confirmed. Sites to the east of the settlement are preferable due to proximity to trunk sewers.	**SC1/2:** Localised network issues may need to be resolved to ensure the risk of sewer flooding does not increase. The total increase of flows throughout the catchment is likely to increase flood risk downstream of the Maple Lodge WwTW discharge, although the contribution from this settlement is relatively small.	**SC1/2:** Whilst contributing relatively small growth levels to the catchment, there is a risk that the overall total growth in the catchment will be constrained by the sensitive habitats downstream of Maple Lodge WwTW. There may be an option to divert additional flows from this settlement to Blackbirds WwTW, dependant on consent negotiations. This would return treated water closer to source.
Harpenden	**SC1:** Sites can be feasibly supplied via VWC trunk main system.	**SC1:** Upgrades to Harpenden WwTW would be required, but can likely be accommodated on current site. The network is at capacity at a number of locations, the proposed growth point would likely require extensive network upgrades through the town. Sites to the southeast are preferable as they minimise the impact on the network.	**SC1/2:** Localised network issues may need to be resolved to ensure the risk of sewer flooding does not increase – significant upgrades may be required through the existing settlement. The potential increase in water levels may increase downstream flood risk on the River Lee under either scenario.	**SC1:** Proposed growth may be able to be accommodated under existing consent. Until DWF discharge consents are finalised, and the impacts of increasing flow are assessed, there is potential for a future constraint to growth under either scenario.

	SC2: VWC may require new strategic infrastructure	**SC2:** There is a risk that the higher flows from this scenario would require a complete rebuild of the WwTW to switch to a more suitable form of treatment. This may be excessively costly given the relatively small proportion of the District being served. Network issues described above would be exacerbated by the increased flows.		**SC2:** This level of growth may require the negotiation of an increased DWF discharge consent. Tight physio-chemical standards may be required to protect/ enhance the water quality in the Upper Lee
How Wood	**SC1:** Sites can be feasibly supplied via VWC trunk main system. **SC2:** VWC may require new strategic infrastructure	**SC1/2:** Impact on trunk sewer and Maple Lodge/Blackbirds WwTW capacity is negligible for both growth scenarios. Any localised network upgrades should be assessed once site-specific details are confirmed. Sites to the east of the settlement are preferable due to proximity to trunk sewers.	**SC1/2:** Localised network issues may need to be resolved to ensure the risk of sewer flooding does not increase. The total increase of flows throughout the catchment is likely to increase flood risk downstream of the Maple Lodge WwTW discharge, although the contribution from this settlement is relatively small.	**SC1/2:** Whilst contributing relatively small growth levels to the catchment, there is a risk that the overall total growth in the catchment will be constrained by the sensitive habitats downstream of Maple Lodge WwTW. There may be an option to divert additional flows from this settlement to Blackbirds WwTW, dependant on consent negotiations. This would return treated water closer to source.
London Colney	**SC1:** Sites can be feasibly supplied via VWC trunk main system. **SC2:** VWC may require new strategic infrastructure	**SC1/2:** Both scenarios will significantly impact the trunk sewer network to Maple Lodge/ Blackbirds WwTW and WwTW capacity. TWU modelling required to assess the extent of network upgrades required. Sites to the southwest would be preferable as they minimise the distance of upgrades needed through the urban area. Maple Lodge WwTW/ Blackbirds will need upgrading given the growth in the catchment – there are spatial constraints that would need resolving at the WwTW	**SC1/2:** Localised network issues may need to be resolved to ensure the risk of sewer flooding does not increase. The total increase of flows throughout the catchment is likely to increase flood risk downstream of the Maple Lodge WwTW discharge, and growth levels here may increase the likelihood of sewer flooding along the trunk mains in the catchment	**SC1/2:** There is a risk that the overall total growth in the catchment will be constrained by the sensitive habitats downstream of Maple Lodge WwTW. There may be an option to divert additional flows from this settlement to Blackbirds WwTW, dependant on consent negotiations. This would return treated water closer to source.
Park Street/Frogmore	**SC1:** Sites can be feasibly supplied via VWC trunk main system.	**SC1/2:** Impact on trunk sewer and Maple Lodge/Blackbirds WwTW capacity is negligible for both growth scenarios. Any	**SC1/2:** Localised network issues may need to be resolved to ensure the risk of sewer flooding does not increase. The	**SC1/2:** Whilst contributing relatively small growth levels to the catchment, there is a risk that the overall total growth in the catchment will be

	SC2: VWC may require new strategic infrastructure	localised network upgrades should be assessed once site-specific details are confirmed.	total increase of flows throughout the catchment is likely to increase flood risk downstream of the Maple Lodge WwTW discharge, although the contribution from this settlement is relatively small.	constrained by the sensitive habitats downstream of Maple Lodge WwTW. There may be an option to divert additional flows from this settlement to Blackbirds WwTW, dependant on consent negotiations. This would return treated water closer to source.
Redbourn	**SC1:** Sites can be feasibly supplied via VWC trunk main system. **SC2:** VWC may require new strategic infrastructure	**SC1/2:** Impact on trunk sewer and Maple Lodge/Blackbirds WwTW capacity is negligible for both growth scenarios. Any localised network upgrades should be assessed once site-specific details are confirmed. Sites to the south of the settlement are preferable due to proximity to the trunk main.	**SC1/2:** Localised network issues may need to be resolved to ensure the risk of sewer flooding does not increase. The total increase of flows throughout the catchment is likely to increase flood risk downstream of the Maple Lodge WwTW discharge, although the contribution from this settlement is relatively small.	**SC1/2:** Whilst contributing relatively small growth levels to the catchment, there is a risk that the overall total growth in the catchment will be constrained by the sensitive habitats downstream of Maple Lodge WwTW. There may be an option to divert additional flows from this settlement to Blackbirds WwTW, dependant on consent negotiations. This would return treated water closer to source.
St Albans	**SC1:** Sites can be feasibly supplied via VWC trunk main system. **SC2:** VWC may require new strategic infrastructure	**SC1/2:** Both scenarios will severely impact the trunk sewer network to Maple Lodge/ Blackbirds WwTW and WwTW capacity. TWU modelling required to assess the extent of network upgrades required. Sites to the west would be preferable as they minimise the distance of sewer upgrades needed through the urban area. Maple Lodge/ Blackbirds WwTW will need upgrading given the growth in the catchment – there are spatial constraints that would need resolving at the WwTW	**SC1/2:** Both scenarios have the potential to significantly increase the risk of sewer flooding throughout the existing settlement, especially the potential growth sites to the north. TWU will need to assess the possibility of trunk main flooding further down the catchment. The total increase of flows throughout the catchment is likely to increase flood risk downstream of the Maple Lodge WwTW discharge.	**SC1/2:** The sensitive nature of the habitats downstream of the Maple Lodge WwTW may constrain growth, particularly Scenario 2 levels, as the existing Maple Lodge WwTW process is operating at BAT regarding nutrients. BWW are concerned regarding the water quality in the GUC downstream of the WwTW discharge. There may be an option to divert additional flows from this settlement to Blackbirds WwTW, dependant on consent negotiations. This would return treated water closer to source.
Wheathampstead	**SC1:** Sites can be feasibly supplied via VWC trunk main system.	**SC1/2:** Any localised network upgrades should be assessed once site-specific details are confirmed. Alternative sites to the	**SC1/2:** Localised network issues may need to be resolved to ensure the risk of sewer flooding does not increase –The	**SC1/2:** On its own, this level of growth would not require an increased DWF discharge consent. However, combined with flows at Harpenden,

	SC2: VWC may require new strategic infrastructure	north are preferable as they minimise the distance to the pumping station. Note that Harpenden WwTW can accommodate this level of growth with only minor upgrades. However, **when combined with the growth proposed at Harpenden, growth at Wheathampstead would further exacerbate the WwTW capacity issues.**	potential increase in flows, when combined with increased flows from Harpenden, may increase downstream flood risk on the River Lee under either scenario.	particularly under Scenario 2, a new consent may be required, with the associated tightening in physio-chemical standards.

Table 7-16 Summary of SADC growth area constraints

Growth Location	Potable Supply	WwTW and Sewerage Network Capacity	Flood Risk	Water Environment
Abbots Langley	**SC1:** Sites can be feasibly supplied via VWC trunk main system. **SC2:** VWC may need to adjust plans for Northern WRZ, to ensure adequate water resources and associated water services infrastructure	**SC1/2:** Both scenarios will impact the trunk sewer network to Maple Lodge WwTW and WwTW capacity. TWU modelling required to assess the extent of network upgrades required. Sites to the southwest would be preferable as they minimise the distance of upgrades needed through the urban area. Maple Lodge WwTW will need upgrading given the growth in the catchment – there are spatial constraints that would need resolving at the WwTW	**SC1/2:** Localised network issues may need to be resolved to ensure the risk of sewer flooding does not increase. The total increase of flows throughout the catchment is likely to increase flood risk downstream of the Maple Lodge WwTW discharge, and growth levels here may increase the likelihood of sewer flooding along the trunk mains in the catchment	**SC1/2:** There is a risk that the overall total growth in the catchment will be constrained by the sensitive habitats downstream of Maple Lodge WwTW.
Chorleywood	**SC1:** Sites can be feasibly supplied via VWC trunk main system.	**SC1/2:** Impact on trunk sewer and Maple Lodge WwTW capacity is negligible for both growth scenarios, although the combined	**SC1/2:** Localised network issues may need to be resolved to ensure the risk of sewer flooding does not increase. The	**SC1/2:** Whilst contributing relatively small growth levels to the catchment, there is a risk that the overall total growth in the catchment will be

	SC2: VWC may need to adjust plans for Northern WRZ, to ensure adequate water resources and associated water services infrastructure	impact of all the growth locations must be considered. Local sewer network has capacity issues – TWU modelling required to assess impact of scenarios. Sites to the east of the settlement are preferable due to proximity to trunk main.	total increase of flows throughout the catchment is likely to increase flood risk downstream of the Maple Lodge WwTW discharge, although the contribution from this settlement is relatively small.	constrained by the sensitive habitats downstream of Maple Lodge WwTW.
Croxley Green	**SC1:** Sites can be feasibly supplied via VWC trunk main system. **SC2:** VWC may need to adjust plans for Northern WRZ, to ensure adequate water resources and associated water services infrastructure	**SC1/2:** Both scenarios will impact the trunk sewer network to Maple Lodge WwTW and WwTW capacity. TWU modelling required to assess the extent of network upgrades required. Sites to the southwest and east would be preferable as they minimise the distance of upgrades needed through the urban area. Maple Lodge WwTW will need upgrading given the growth in the catchment – there are spatial constraints that would need resolving at the WwTW	**SC1/2:** Localised network issues may need to be resolved to ensure the risk of sewer flooding does not increase. The total increase of flows throughout the catchment is likely to increase flood risk downstream of the Maple Lodge WwTW discharge, and growth levels here may increase the likelihood of sewer flooding along the trunk mains in the catchment	**SC1/2:** There is a risk that the overall total growth in the catchment will be constrained by the sensitive habitats downstream of Maple Lodge WwTW.
Eastbury	**SC1:** Sites can be feasibly supplied via VWC trunk main system. **SC2:** VWC may require new strategic infrastructure	**SC1/2:** Impact on trunk sewer and Maple Lodge WwTW capacity is negligible for both growth scenarios although the combined impact of all the growth locations must be considered. Any localised network upgrades should be assessed once site-specific details are confirmed. Sites to the north of the settlement are preferable due to proximity to trunk main.	**SC1/2:** Localised network issues may need to be resolved to ensure the risk of sewer flooding does not increase. The total increase of flows throughout the catchment is likely to increase flood risk downstream of the Maple Lodge WwTW discharge, although the contribution from this settlement is relatively small.	**SC1/2:** Whilst contributing relatively small growth levels to the catchment, there is a risk that the overall total growth in the catchment will be constrained by the sensitive habitats downstream of Maple Lodge WwTW.
Rickmansworth	**SC1:** Sites can be feasibly supplied via VWC trunk main system.	**SC1/2:** Both scenarios will impact the trunk sewer network to Maple Lodge WwTW and WwTW capacity. TWU modelling required to	**SC1/2:** Localised network issues may need to be resolved to ensure the risk of sewer flooding does not increase. The	**SC1/2:** There is a risk that the overall total growth in the catchment will be constrained by the sensitive habitats downstream of Maple

	SC2: VWC may need to adjust plans for Northern WRZ, to ensure adequate water resources and associated water services infrastructure	assess the extent of network upgrades required. Sites to the south would be preferable as they minimise the distance of upgrades needed through the urban area. Maple Lodge WwTW will need upgrading given the growth in the catchment – there are spatial constraints that would need resolving at the WwTW	total increase of flows throughout the catchment is likely to increase flood risk downstream of the Maple Lodge WwTW discharge, and growth levels here may increase the likelihood of sewer flooding along the trunk mains in the catchment	Lodge WwTW.
South Oxhey	**SC1:** Sites can be feasibly supplied via VWC trunk main system. **SC2:** VWC may require new strategic infrastructure	**SC1/2:** Both scenarios will impact the trunk sewer network to Maple Lodge WwTW and WwTW capacity. TWU modelling required to assess the extent of network upgrades required. Sites to the north would be preferable as they minimise the distance of upgrades needed through the urban area. Maple Lodge WwTW will need upgrading given the growth in the catchment – there are spatial constraints that would need resolving at the WwTW	**SC1/2:** Localised network issues may need to be resolved to ensure the risk of sewer flooding does not increase. The total increase of flows throughout the catchment is likely to increase flood risk downstream of the Maple Lodge WwTW discharge, and growth levels here may increase the likelihood of sewer flooding along the trunk mains in the catchment	**SC1/2:** There is a risk that the overall total growth in the catchment will be constrained by the sensitive habitats downstream of Maple Lodge WwTW.

Table 7-17 Summary of TRDC growth area constraints

Growth Location	Potable Supply	WwTW and Sewerage Network Capacity	Flood Risk	Water Environment
Watford	**SC1:** Sites can be feasibly supplied via VWC trunk main system. **SC2:** VWC may require new strategic infrastructure	**SC1/2:** Both scenarios will severely impact the trunk sewer network to Maple Lodge WwTW and WwTW capacity. TWU modelling required to assess the extent of network upgrades required. Sites in the south of the Borough would be preferable as they minimise the distance of upgrades needed through the urban area. Central and northerly sites in the Borough have the potential to cause significant disruption if substantial network upgrades are required. Maple Lodge WwTW will need upgrading given the growth in the catchment – there are spatial constraints that would need resolving at the WwTW	**SC1/2:** Both scenarios have the potential to significantly increase the risk of sewer flooding throughout the existing settlement, especially the potential growth sites in the north of the Borough. TWU will need to assess the possibility of trunk main flooding further down the catchment. The total increase of flows throughout the catchment is likely to increase flood risk downstream of the Maple Lodge WwTW discharge.	**SC1/2:** The sensitive nature of the habitats downstream of the Maple Lodge WwTW may constrain growth, particularly Scenario 2 levels, as the existing Maple Lodge WwTW process is operating at BAT regarding nutrients. BWW are concerned regarding the water quality in the GUC downstream of the WwTW discharge.

Table 7-18 Summary of WBC growth area constraints

Growth Location	Potable Supply	WwTW and Sewerage Network Capacity	Flood Risk	Water Environment
Brookmans Park	**SC1:** Sites can be feasibly supplied via VWC trunk main system.	**SC1:** Impact on trunk sewer and Maple Lodge/ Blackbirds WwTW capacity is negligible. Any localised network upgrades should be assessed once site-specific details are confirmed. Sites to the west of the settlement are preferable due to proximity to trunk main.	**SC1**: Localised network issues may need to be resolved to ensure the risk of sewer flooding does not increase. The total increase of flows throughout the catchment is likely to increase flood risk downstream of the Maple Lodge WwTW discharge.	**SC1/2:** Whilst contributing relatively small growth levels to the catchment, there is a risk that the overall total growth in the catchment will be constrained by the sensitive habitats downstream of Maple Lodge WwTW. There may be an option to divert additional flows from this settlement to Blackbirds WwTW, dependant on consent negotiations. This would

	SC2: VWC may need to adjust plans for Northern WRZ, to ensure adequate water resources and associated water services infrastructure	**SC2:** Impact on the trunk sewer network could be significant as location is upstream of the majority of the Maple Lodge/ Blackbirds catchment. TWU modelling required to assess the extent of network upgrades required. Sites to the west would be preferable as they minimise the distance of upgrades needed through the urban area. Maple Lodge/ Blackbirds WwTW will need upgrading given the growth in the catchment – there are spatial constraints that would need resolving at the WwTW	**SC2:** This level of growth here may increase the likelihood of sewer flooding along the trunk mains in the catchment	return treated water closer to source.
Cuffley	**SC1:** Sites can be feasibly supplied via VWC trunk main system. **SC2:** VWC may need to adjust plans for Northern WRZ, to ensure adequate water resources and associated water services infrastructure	**SC1:** Impact on Deephams WwTW capacity is negligible. Local network upgrades may be required **SC2:** Impact on adjoining Deephams WwTW capacity is negligible. Local network upgrades may be required, and TWU will need to assess the capacity of the receiving trunk sewer and SPS	**SC1/2:** Localised network issues may need to be resolved to ensure the risk of sewer flooding does not increase. It is unlikely that the relatively small increases in discharge would cause a significant flood risk to the downstream area.	**SC1/2:** The planned process upgrades and increased discharge consent at Deephams WwTW from 2017 onwards should be able to accommodate the relatively small flow increases from this settlement without detriment to the water environment.
Digswell	**SC1:** Sites can be feasibly supplied via VWC trunk main system. **SC2:** VWC may need to adjust plans for Northern WRZ, to ensure adequate water resources and associated water services infrastructure	**SC1/2:** Impact on trunk sewer and adjoining Rye Meads WwTW capacity is negligible for both growth scenarios. Any localised network upgrades should be assessed once site-specific details are confirmed. Sites to the southeast of the settlement are preferable due to proximity to trunk main.	**SC1/2:** Localised network issues may need to be resolved to ensure the risk of sewer flooding does not increase. It is unlikely that the relatively small increases in discharge would cause a significant flood risk to the downstream area.	**SC1/2:** The EA and TWU will be investigating strategies to change the wastewater regime in other parts of the Rye Meads catchment. If found feasible, this may allow growth in WHBC areas to be accommodated without the need for an increased DWF consent, and the associated tightening in physio-chemical standards.

Hatfield	**SC1:** Sites can be feasibly supplied via VWC trunk main system. **SC2:** VWC may need to adjust plans for Northern WRZ, to ensure adequate water resources and associated water services infrastructure	**SC1:** Impact on the trunk sewer network could be significant as location is upstream of the majority of the Maple Lodge/ Blackbirds catchment. TWU modelling required to assess the extent of network upgrades required. Maple Lodge/ Blackbirds WwTW will need upgrading given the growth in the catchment – there are spatial constraints that would need resolving at the WwTW. Sites to the north are preferable as they could connect directly to Mill Green WwTW, partially dependant on the level of growth in Welwyn Garden City. According to TWU, the network in this area should be adequate for up to 1,000 new dwellings, and upgrades required at the WwTW would be minimal. Sites to the south are also preferable due to their proximity to the Blackbirds/ Maple Lodge trunk sewer network. The existing network in the settlement has very limited capacity for growth – sites to the west may require a new strategic sewer to either Mill Green WwTW or the Blackbirds/ Maple Lodge network. **SC2:** Above issues will be significantly exacerbated by the higher growth levels.	**SC1/2:** Both scenarios have the potential to significantly increase the risk of sewer flooding throughout the existing settlement, especially the potential growth sites to the west. TWU will need to assess the possibility of trunk main flooding further down the catchment. The total increase of flows throughout the catchment is likely to increase flood risk downstream of the Maple Lodge/ Blackbirds WwTW discharge, or Mill Green WwTW.	**SC1/2:** The sensitive nature of the habitats downstream of the Maple Lodge WwTW may constrain growth, particularly Scenario 2 levels, as the existing Maple Lodge WwTW process is operating at BAT regarding nutrients. BWW are concerned regarding the water quality in the GUC downstream of the WwTW discharge. There are options to divert additional flows from this settlement to Mill Green and Blackbirds WwTW, dependant on consent negotiations. This would return treated water closer to source, although the receiving watercourses are still sensitive.
Little Heath	**SC1:** Sites can be feasibly supplied via VWC trunk main system.	**SC1:** Impact on trunk sewer and Maple Lodge/ Blackbirds WwTW capacity is negligible for both growth scenarios, although combination of effect with	**SC1/2:** Localised network issues may need to be resolved to ensure the risk of sewer flooding does not	**SC1/2:** Whilst contributing relatively small growth levels to the catchment, there is a risk that the overall total growth in the catchment

	SC2: VWC may need to adjust plans for Northern WRZ, to ensure adequate water resources and associated water services infrastructure	other nearby growth locations should be considered. Any localised network upgrades should be assessed once site-specific details are confirmed. Sites to the north of the settlement are preferable due to proximity to trunk main.	increase. The total increase of flows throughout the catchment is likely to increase flood risk downstream of the Maple Lodge WwTW discharge, although the contribution from this settlement is relatively small.	will be constrained by the sensitive habitats downstream of Maple Lodge WwTW. There may be an option to divert additional flows from this settlement to Blackbirds WwTW, dependant on consent negotiations. This would return treated water closer to source.
Oaklands and Mardley Heath	**SC1:** Sites can be feasibly supplied via VWC trunk main system. **SC2:** VWC may need to adjust plans for Northern WRZ, to ensure adequate water resources and associated water services infrastructure	**SC1/2:** Impact on trunk sewer and adjoining Rye Meads WwTW capacity is negligible for both growth scenarios. Any localised network upgrades should be assessed once site-specific details are confirmed. Sites to the southwest of the settlement are preferable due to proximity to trunk main.	**SC1/2:** Localised network issues may need to be resolved to ensure the risk of sewer flooding does not increase. It is unlikely that the relatively small increases in discharge would cause a significant flood risk to the downstream area.	**SC1/2:** The EA and TWU will be investigating strategies to change the wastewater regime in other parts of the Rye Meads catchment. If found feasible, this may allow growth in WHBC areas to be accommodated without the need for an increased DWF consent, and the associated tightening in physio-chemical standards.
Welham Green	**SC1:** Sites can be feasibly supplied via VWC trunk main system.	**SC1:** Impact on trunk sewer and Maple Lodge/ Blackbirds WwTW capacity is negligible. Any localised network upgrades should be assessed once site-specific details are confirmed. Sites to the southwest of the settlement are preferable due to proximity to trunk main.	**SC1:** Localised network issues may need to be resolved to ensure the risk of sewer flooding does not increase. The total increase of flows throughout the catchment is likely to increase flood risk downstream of the Maple Lodge WwTW discharge, although the contribution from this settlement is relatively small.	**SC1/2:** Whilst contributing relatively small growth levels to the catchment, there is a risk that the overall total growth in the catchment will be constrained by the sensitive habitats downstream of Maple Lodge WwTW. There may be an option to divert additional flows from this settlement to Blackbirds WwTW, dependant on consent negotiations. This would return treated water closer to source.

	SC2: VWC may need to adjust plans for Northern WRZ, to ensure adequate water resources and associated water services infrastructure	**SC2:** Impact on the trunk sewer network could be significant as location is upstream of the majority of the Maple Lodge/ Blackbirds catchment. TWU modelling required to assess the extent of network upgrades required. Sites to the southwest would be preferable as they minimise the distance of upgrades needed through the urban area. Maple Lodge/ Blackbirds WwTW will need upgrading given the growth in the catchment – there are spatial constraints that would need resolving at the WwTW	**SC2:** This level of growth here may increase the likelihood of sewer flooding along the trunk mains in the catchment	
Welwyn	**SC1:** Sites can be feasibly supplied via VWC trunk main system. **SC2:** VWC may need to adjust plans for Northern WRZ, to ensure adequate water resources and associated water services infrastructure	**SC1/2:** Impact on trunk sewer and adjoining Rye Meads WwTW capacity is negligible for both growth scenarios. Any localised network upgrades should be assessed once site-specific details are confirmed. Sites to the southeast of the settlement are preferable due to proximity to trunk main.	**SC1/2:** Localised network issues may need to be resolved to ensure the risk of sewer flooding does not increase. It is unlikely that the relatively small increases in discharge would cause a significant flood risk to the downstream area.	**SC1/2:** The EA and TWU will be investigating strategies to change the wastewater regime in other parts of the Rye Meads catchment. If found feasible this may allow growth in WHBC areas to be accommodated without the need for an increased DWF consent, and the associated tightening in physio-chemical standards.
Welwyn Garden City	**SC1:** Sites can be feasibly supplied via VWC trunk main system. **SC2:** VWC may need to adjust plans for Northern WRZ, to ensure adequate water resources and associated water services infrastructure	**SC1/2:** Impact on trunk sewer and adjoining Rye Meads WwTW capacity is negligible for both growth scenarios, although there is significant growth in this catchment from other locations. Recent TWU upgrades to the sewer network to the east should allow adequate capacity for sites in this area. WHBC may want to allocate additional SC2 growth to this area to exploit available capacity – further work with TWU required. In addition, whilst not a growth point originally identified by WHBC, sites to the southwest would be able to connect to Mill Green WwTW via the network in the north of Hatfield.	**SC1/2:** TWU will need to assess the possibility of trunk main flooding further down the Maple Lodge/ Blackbirds catchment. The total increase of flows throughout the catchment is likely to increase flood risk downstream of the Maple Lodge/ Blackbirds WwTW discharge, or Mill Green WwTW.	**SC1/2:** The EA and TWU will be investigating strategies to change the wastewater regime in other parts of the Rye Meads catchment. If found feasible this may allow growth in WHBC areas to be accommodated without the need for an increased DWF consent, and the associated tightening in physio-chemical standards. There may be an option to divert additional flows from this settlement to Mill Green WwTW, dependant on consent negotiations. This would return treated water closer to source.

Woolmer Green	**SC1:** Sites can be feasibly supplied via VWC trunk main system. **SC2:** VWC may need to adjust plans for Northern WRZ, to ensure adequate water resources and associated water services infrastructure	**SC1/2:** Impact on trunk sewer and adjoining Rye Meads WwTW capacity is negligible for both growth scenarios. Any localised network upgrades should be assessed once site-specific details are confirmed. Sites to the south of the settlement are preferable due to proximity to trunk main.	**SC1/2:** Localised network issues may need to be resolved to ensure the risk of sewer flooding does not increase. It is unlikely that the relatively small increases in discharge would cause a significant flood risk to the downstream area.	**SC1/2:** The EA and TWU will be investigating strategies to change the wastewater regime in other parts of the Rye Meads catchment. If found feasible this may allow growth in WHBC areas to be accommodated without the need for an increased DWF consent, and the associated tightening in physio-chemical standards.

Table 7-19 Summary of WHBC growth area constraints

8 Recommendations and Further Work

LPAs should look to include the availability of water and wastewater infrastructure as a planning condition, so that planning permission is not granted until developers have consulted with VWC and TWU regarding network capacity and possible strategic solutions. Additional contributions towards the costs of such infrastructure may be collected through local planning obligations and the forthcoming Community Infrastructure Levy, although this will depend on national and local implementation guidelines – there is a current lack of clarity regarding the use of such funds for water and wastewater infrastructure.

It is anticipated that major extensions to the strategic potable water supply or sewerage network, such as those highlighted in the above Sections, will take around five years to plan and complete. Any localised network upgrades can be commenced by water companies once planning permission for the development has been approved, and the developer requisition received.

Indicative guidance from the water companies suggests the following planning and construction timeframes for wastewater infrastructure:

- Network improvements – up to three years;
- Significant new network, and upgraded process capability at WwTW – up to five years; and
- Major upgrade of WwTW, or construction of new WwTW – up to ten years.

Therefore, development phasing and planned development trajectories to meet RSS targets should clearly allow for the lead in time involved in investigating, planning and constructing the required key infrastructure. The emerging LDFs within the study area should factor in these requirements.

Further guidance and further work recommendations, relevant to specific aspects of the water cycle, are included in the Sections below, which clearly highlight the need for immediate progression to the next stages of WCS for several LPAs to avoid unnecessary delays and possible objections to their emerging LDFs.

8.1 Potable Water

LPAs should look to implement policies through their LDF process to set a maximum PCC for all new dwellings. In order to assist with achieving the aspirational targets of the EA, Defra, Regional Assembly and County, this maximum PCC should go beyond the proposed changes to the Building Regulations, and encourage developers to aspire to 80 l/p/d (CSH Levels 5/6). However, it must be noted that spatial, technical and financial considerations may make this target currently infeasible for some developments.

Therefore, it is recommended that a target PCC of 105 l/p/d (CSH Levels 3/4) be implemented as a minimum. To enforce this, developers would have to provide initial calculations and estimated fitting details to the LPAs during planning applications, and details on completion, similar to the provisions proposed in the upcoming Building Regulations changes (see Section 3.1.3). Preference should be given, at the discretion of the LPAs, to developments proposing to achieve greater efficiencies with rainwater harvesting or grey water recycling, through either favourable planning obligations, or a reduction in any applicable local ‘roof tax’ contributions that the LPAs may introduce.

Achieving the required reductions in PCC across the study area will require multiple stakeholder engagement. The consumer awareness required, particularly to encourage the installation of

water efficient fittings into existing dwellings and adoption of water saving practices, will need to be generated by VWC, TWU and the LPAs working in cooperation with the local community. Particular emphasis will also need to be placed on encouraging occupants of new dwellings to retain their water efficient fittings, as there is a risk that occupants may revert to higher usage fittings, due to consumer preference.

Comprehensive advice regarding water efficiency in new buildings, retrofitting existing homes with water efficient devices, the types of products available and how water efficient policies can be supported through the planning system, is available from the Waterwise website; www.waterwise.org.uk, which includes dedicated advice for the East of England, and their associated site www.water-efficient-buildings.org.uk.

8.1.1 Cost Implications

A study undertaken by the EA in 2007[42] assessed the cost implications of reducing PCC rates in line with the recommendations from the Code for Sustainable Homes. It highlighted that the costs of water saving measures only marginally increased through reducing consumption from the baseline of 150 l/p/d to 100 l/p/d. Further reductions to 80 l/p/d entail the installation of rainwater and grey water harvesting techniques, which significantly increased the overall expenditure. Also, these figures are based on the cost of installing the technologies at time of construction, rather than retrofitting to existing properties, which would be significantly more expensive.

The table below set out the broad costs per dwelling for each of the consumption rates that were assessed. The total costs and the difference between the consumption rate and the baseline were considered. The table also shows the reduced costs per dwelling that can be achieved through potential VAT exclusion schemes, and through bulk purchasing discounts available to developers.

Scenario/Target level (litres/head/day)	Cost £ (inc VAT)	Extra over baseline	Cost £ (exc VAT)	Cost £ (exc VAT + 20% discount)
Baseline (150)	£508	£0	£432	£346
130	£677	£169	£576	£461
120	£697	£189	£593	£475
100	£792	£284	£674	£539
80	£3,737	£3,229	£3,180	£2,544

Figure 8-22 Extract from EA report[42] (2007) estimating cost of achieving reduced PCC

The report also highlighted that over time, the capital cost of the fittings used to make such water savings is likely to reduce (as shown in Figure 8-23) due to the natural product life cycle and pricing strategies.

Scenario/Target level (litres/head/day)	Current cost of compliance (retail inc VAT)	Extra over baseline	2016 cost of compliance	
			Upper bound (best case)	Lower bound (worst case)
Baseline (150)	£508	£0	£406	£508
130	£677	£169	£406*	£615
120	£697	£189	£406*	£627
100	£792	£284	£406*	£687
80	£3,737	£3,229	£884	£2,543
*Upper bound meets discounted baseline				

Figure 8-23 Extract from EA report[42] (2007) estimating cost reductions by 2016

The EA report predicts that in as little as 10 years, the costs of fitting devices (which will decrease the average household consumption rates to 100 l/p/d) are likely to reduce to be the same as the current baseline case of 150 l/p/d. This shows that the cost of the water saving devices that can be installed into **new** properties are only slightly more expensive at present and are likely to significantly reduce in price in the coming years as the technology evolves and the uptake increases.

Also, these figures do not take into account the potential savings to customers due to reduced water bills. This additional benefit further reduces the long-term costs of introducing water efficiency measures.

8.2 Wastewater and Sewerage

8.2.1 Dacorum BC

The potential growth at Hemel Hempstead (and Kings Langley) is a large proportion of the total growth within the Maple Lodge catchment, under either scenario. Wastewater from this settlement is sewered out of the Borough to be treated and discharged at least 17 km from its source, whilst locally the watercourses suffer from low flows. The current sewerage regime does however allow for the majority of the sewerage network serving these areas to operate by gravity alone (reducing the energy demand and operational burden associated with pumping wastewater), and utilises the greater dilutive capacity available from the River Colne at Maple Lodge WwTW.

There is currently uncertainty regarding the DWF consent at Maple Lodge, although it is understood that at present the WwTW is operating at BAT with regards to nutrient levels. The levels of growth within the catchment may require an increased DWF consent by 2016. In order to protect water quality and comply with the WFD, the EA may impose a tightening of physio-chemical standards to accompany such a DWF consent increase. TWU may have to implement unconventional (hence expensive and potentially carbon intensive) processes at the WwTW to achieves these standards, along with majorly increasing the hydraulic capacity on site. However, this may take up to ten years to plan, design and construct subject to financial and technical feasibility of the required upgrades. In addition, the potential growth locations around Hemel Hempstead may require extensive upgrades to the sewerage network throughout the existing settlement. Such upgrades would be disruptive, expensive and require three to five years to plan, design and construct.

Should TWU decide to divert additional flows from other areas of the catchment to Blackbirds WwTW, this could potentially release capacity at Maple Lodge WwTW to accommodate the

growth in Dacorum. However, similar constraints regarding water quality, capacity, cost and timing will apply at Blackbirds WwTW as well.

As DBC have not yet submitted their Core Strategy, they may wish to consider undertaking additional WCS work (in the form of an Outline WCS) immediately, alongside other LDF studies, to test the potential impact of allocating additional growth to Bovingdon, Berkhamsted, Markyate and Tring compared to the Maple Lodge catchment.

Such a WCS should include:

- Confirmation of growth targets for the Borough following the RSS review (and revision due to legal challenge);
- Confirmation of the current DWF consent for Maple Lodge (and Blackbirds), Chesham, Berkhamsted, Markyate and Tring WwTW;
- Confirmation of how the proposed increase in DWF consent from 2015 onwards at Berkhamsted WwTW was arrived at, and if this includes an allowance for any growth within the catchment;
- DBC to devise a range of different growth options (and phasing) for testing, perhaps driven by other planning considerations (transport, education etc);
- Liaison with the EA, BWW and NE to assess the potential impacts on water levels/ flood risk and water quality/ ecology downstream of the WwTW, for each of the growth options;
- Advice from TWU as to what additional capacity can be provided at each WwTW together with further details (including timescale and cost implications) of both sewerage and WwTW strategic upgrades;
- Advice from the EA as to whether it would be preferable to significantly increase the discharge into the River Ver from Markyate WwTW; and
- Increased certainty, through liaison with surrounding LPA and TWU, of the potential increases in wastewater received by Maple Lodge WwTW.

The benefits of completing such a study in the near future would be that:

- The outcomes of the study could be used by DBC to refine the allocation of their growth targets (in either their Preferred Options Consultation or Submission stage);
- DBC will have more certainty as to how TWU can accommodate the increases in wastewater, and the potential impacts on the water environment; and
- The study would serve as evidence that the Council had considered the impact of the development on existing water infrastructure and the water environment, and considered the future infrastructure requirement, as required under PPS1, 12, and 23.

It may also be appropriate for any Outline WCS work undertaken by DBC to assess the possibility of more localised treatment of wastewater, for example a new WwTW serving Hemel Hempstead. However, the impact on water quality due to the limited dilution available in the watercourses higher in the Colne catchment, and potential increases in downstream flood risk, will need careful consideration.

Further Detailed WCS work could be undertaken to support the Site Allocation stage of the LDF, particularly regarding the provision of sewerage capacity in and around Hemel Hempstead and Kings Langley.

8.2.2 St Albans C & DC

The potential growth at St Albans (and Redbourn, London Colney, Chiswell Green, How Wood and Part Street/ Frogmore) is a large proportion of the total growth within the Maple Lodge/ Blackbirds catchment, under either scenario. Wastewater from this area is sewered out of the District to be treated and discharged at approximately 25 km from its source, whilst locally the watercourses suffer from low flows.

There is currently uncertainty regarding the DWF consent at Maple Lodge, although it is understood that at present the WwTW is operating at BAT with regards to nutrient levels. The levels of growth within the catchment may require an increased DWF consent by 2016. In order to protect water quality and comply with the WFD, the EA may impose a tightening of physio-chemical standards to accompany such a DWF consent increase. TWU may have to implement unconventional (hence expensive and potentially carbon intensive) processes at the WwTW to achieves these standards, along with majorly increasing the hydraulic capacity on site. However, this may take up to ten years to plan, design and construct subject to financial and technical feasibility of the required upgrades. In addition, the potential growth locations around St Albans may require extensive upgrades to the sewerage network throughout the existing settlement. Such upgrades would be disruptive, expensive and require three to five years to plan, design and construct.

TWU may decide to divert additional flows from this area of the catchment to Blackbirds WwTW, which could potentially release capacity at Maple Lodge WwTW to help accommodate the growth in DBC and TRDC and WBC. However, similar constraints regarding water quality, capacity, cost and timing will apply at Blackbirds WwTW as well.

As SADC have not yet submitted their Core Strategy, they may wish to consider undertaking additional WCS work (in the form of an Outline WCS) immediately, alongside other LDF studies, to test the potential impact of allocating additional growth to Harpenden and Wheathampstead, compared to the Maple Lodge catchment.

Such a WCS should include:

- Confirmation of growth targets for the District following the RSS review (and revision due to legal challenge);
- Confirmation of the DWF consent for Maple Lodge (and Blackbirds) and Harpenden WwTW;
- SADC to devise a range of different growth options (and phasing) for testing, perhaps driven by other planning considerations (transport, education etc);
- Liaison with the EA, BWW and NE to assess the potential impacts on water levels/ flood risk and water quality/ ecology downstream of the WwTW, for each of the growth options;
- Advice from TWU as to what additional capacity can be provided at each WwTW together with further details (including timescale and cost implications) of both sewerage and WwTW strategic upgrades;
- Advice from the EA as to whether it would be preferable to significantly increase the discharges into the River Lee at Harpenden WwTW and the River Colne from Blackbirds WwTW; and
- Increased certainty, through liaison with surrounding LPA and TWU, of the potential increases in wastewater received by Maple Lodge WwTW.

The benefits of completing such a study in the near future would be that:

- The outcomes of the study could be used by SADC to refine the allocation of their growth targets (in either their Preferred Options Consultation or Submission stage);
- SADC will have more certainty as to how TWU can accommodate the increases in wastewater, and the potential impacts on the water environment; and
- The study would serve as evidence that the Council had considered the impact of the development on existing water infrastructure and the water environment, and considered the future infrastructure requirement, as required under PPS1, 12, and 23.

Further Detailed WCS work could be undertaken to support the Site Allocation stage of the LDF, particularly regarding the provision of sewerage capacity in and around St Albans.

8.2.3 Three Rivers DC

The location of TRDC, entirely within the Maple Lodge WwTW catchment, means that there is little scope at present for allocating growth to a different WwTW catchment. The proximity of the majority of potential growth locations in the District to Maple Lodge WwTW means that a solution involving a new WwTW, perhaps on the River Chess, is unlikely to be favoured by the EA and TWU.

Unfortunately, the capacity of Maple Lodge WwTW to accommodate the increase in wastewater from the TRDC development will be severely constrained by the wastewater strategy employed higher in the catchment (i.e. how much growth from DBC, SADC, WBC and WHBC is allocated in the Maple Lodge catchment, and how much of this is diverted to Blackbirds WwTW).

This is outside of TRDC direct control. However, TRDC can contribute to any studies regarding the wider catchment by ensuring they liaise with TWU once development targets, locations and phasing are confirmed. This will ensure that TWU will incorporate the growth in TRDC into any strategies involving the wider catchment.

Until DWF consents are finalised, and TWU have assessed the upgrades required to accommodate the growth in the catchment (whilst meeting any tightened physio-chemical standards), it is impossible to comment on the likely constraint this will have on development. However, TRDC should consider that any possible upgrades to the WwTW may take up to ten years to plan, design and construct, and should therefore ensure that suitable flexibility is written into policies regarding phasing of dwellings.

Providing TWU have access to suitable network models, TRDC may wish to complete further WCS work (e.g. combined outline and detailed study) immediately to accompany the Site Allocation stage of their LDF, to identify the upgrades required to the strategic sewers in the area. This may allow TRDC to develop a phasing plan in conjunction with TWU (and perhaps in partnership with WBC), to ensure that adequate sewerage infrastructure is phased and implemented alongside the development sites, rather than constructed piecemeal.

This, combined with an understanding that TRDC are contributing to future studies into the Maple Lodge WwTW catchment (e.g. WCSs within other LPAs, which this WCS recommends should commence shortly), should be sufficient for TRDC to show that they have considered the impact of the development on existing water infrastructure and the water environment, and considered future infrastructure requirements, as required under PPS1, 12, and 23.

8.2.4 Watford BC

The location of WBC, entirely within the Maple Lodge WwTW catchment and its proximity to the works, means that there is little scope at present for allocating growth to a different WwTW catchment. The proximity of the majority of potential growth locations in the Borough to Maple Lodge WwTW means that a solution involving a new WwTW, perhaps on the River Bulbourne or Colne, is unlikely to be favoured by the EA and TWU.

Unfortunately, the capacity of Maple Lodge WwTW to accommodate the increase in wastewater from the WBC development will be severely constrained by the wastewater strategy employed higher in the catchment (i.e. how much growth from DBC, SADC, and WHBC is allocated in the Maple Lodge catchment, and how much of this is diverted to Blackbirds WwTW). The increase in flows from TRDC growth once targets are finalised will also affect the capacity of the Maple Lodge catchment.

This is outside of WBC direct control. However, WBC can contribute to any studies regarding the wider catchment by ensuring they liaise with TWU once development targets, locations and phasing are confirmed. This will ensure that TWU will incorporate the growth in WBC into any strategies involving the wider catchment.

Until DWF consents are finalised, and TWU have assessed the upgrades required to accommodate the growth in the catchment (whilst meeting any tightened physio-chemical standards), it is impossible to comment on the likely constraint this will have on development. However, WBC should consider that any possible upgrades to the WwTW may take up to ten years to plan, design and construct, and should therefore ensure that suitable flexibility is written into policies regarding phasing of dwellings.

Providing TWU have access to suitable network models, WBC may wish to complete further WCS work (e.g. combined outline and detailed study) immediately to help steer their Pre-Submission Core Strategy, or accompany the Site Allocation stage of their LDF, to identify the upgrades required to the strategic sewers in the area. This may allow WBC to develop a phasing plan in conjunction with TWU (and perhaps in partnership with TRDC), to ensure that adequate sewerage infrastructure is phased and implemented alongside the development sites, rather than constructed piecemeal.

This, combined with an understanding that WBC are contributing to future studies into the Maple Lodge WwTW catchment (e.g. WCSs within other LPAs, which this WCS recommends should commence shortly), should be sufficient for WBC to show that they have considered the impact of the development on existing water infrastructure and the water environment, as required under PPS1, 12, and 23.

8.2.5 Welwyn Hatfield BC

The WCS completed for the Rye Meads WwTW catchment[43] in 2009 considered growth levels of approximately 5,000 to 10,000 new dwellings in the WHBC area connected to the Rye Meads network. Whilst there remains concern regarding the Rye Meads WwTW capacity (given the considerable growth proposed in the catchment), the EA, TWU and LPAs concerned are aware of the further studies required to finalise a strategy to accommodate this growth. The advice given to WHBC in this document should still be considered when setting development policies.

Additional consultation will be required with the EA and TWU to establish how much of the proposed growth can be accommodated at Mill Green WwTW. As this is the most local of the WwTW, concentrating development in this catchment may minimise the network infrastructure

expenditure required, and offer considerable benefits to flow levels in the River Lee, providing that water quality can be protected.

Until existing DWF consents are confirmed, and the future water quality/ level issues explored with the EA and TWU, a strategy for the interaction between the Rye Meads, Mill Green and Maple Lodge WwTW cannot be developed.

As WHBC have not yet consulted on their emerging Core Strategy stage, they may wish to consider undertaking additional WCS work (in the form of an Outline WCS) alongside other LDF studies to test the potential impact of allocating additional growth to the Rye Meads, Mill Green and Maple Lodge catchments.

Such a WCS should include:

- Confirmation of growth targets for the Borough following the RSS review (and revision due to legal challenge);
- Confirmation of the DWF consent for Maple Lodge (and Blackbirds) and Mill Green WwTW;
- Update on any work undertaken regarding wastewater strategy in the Rye Meads catchment;
- WHBC to devise a range of different growth options (and phasing) for testing, perhaps driven by other planning considerations (transport, education etc);
- Liaison with the EA, BWW and NE to assess the potential impacts on water levels/ flood risk and water quality/ ecology downstream of the WwTW, for each of the growth options (with reference to a potential Appropriate Assessment for the Lee Valley SPA) ;
- Advice from TWU as to what additional capacity can be provided at each WwTW together with further details (including timescale and cost implications) of both sewerage and WwTW strategic upgrades;
- Advice from the EA as to whether it would be preferable to significantly increase the discharge into the River Lee from Mill Green WwTW; and
- Increased certainty, through liaison with surrounding LPA and TWU, of the potential increases in wastewater received by Maple Lodge WwTW.

The benefits of completing such a study in the near future would be that:

- The outcomes of the study could be used by WHBC to refine the allocation of their growth targets (in either their Preferred Options Consultation or Submission stage);
- WHBC will have more certainty as to how TWU can accommodate the increases in wastewater, and the potential impacts on the water environment; and
- The study would serve as evidence that the Council had considered the impact of the development on existing water infrastructure and the water environment, and considered the future infrastructure requirement, as required under PPS1, 12, and 23.

Due to the criticality of the Hatfield growth (a significant amount of growth, upstream of the majority of the catchment) WHBC may wish to include an assessment of the strategic sewerage network in the area into the Outline WCS. This will require input from TWU in the form of output from sewerage models.

8.3 Flood Risk

The LPAs should continue to refer to their recent SFRAs when shaping development policies and documents, and when determining planning permissions.

Site specific flood risk considerations should take account of current flood risk from all sources, potential increases in flood risk due to development, and potential the impacts of climate change on future flood risk.

Following review of the above policies and reports (including other recent relevant documents), the following strategic objectives can be highlighted with regards to flood risk management in the study area:

- LPAs should require developers to build resilience into a sites design (e.g. flood-proofing, raised floor levels) where applicable;
- New developments should be designed to preserve and improve the conveyance and storage of fluvial and surface floodwater;
- Suitable SuDS should be included on all new developments of appropriate size and ground condition, with priority given to schemes proposing SuDS solutions that maximise environmental benefits (see Section 5.6.3);
- Surface water run-off rate post development should be managed (through the use of SuDS) to be the same, or less, as the corresponding greenfield run-off rate prior to development;
- Foul water should be separated from surface water runoff for both greenfield development and brownfield development/ refurbishment to reduce storm flows in foul sewers;
- The potential increase in flood risk, due to increased effluent discharges from expanded WwTW, should be assessed and managed accordingly by the EA and TWU;
- Existing undeveloped river corridors, particularly the greenfield functional floodplain, should be preserved from further development to help attenuate flood waters;
- The LPAs and developers should work in partnership with the EA to look at opportunities for river restoration/ enhancement as part of developments, and to make space for water to accommodate climate change impacts;
- LPAs should work in partnership with developers, the EA, water companies and HCC to determine the most appropriate flood risk solutions required to meet their obligations as prescribed by the emerging Flood and Water Management Bill; and
- Surface Water Management Plans being undertaken for WBC and SADC should consider the possible impacts of increased river flows (downstream of the WwTW experiencing growth) which may prevent the normal operation of outfalls from the surface water network (issues already exist) at times of peak flow. For example, increased flows from Berkhamsted and Blackbirds WwTW may increase flows in the Rivers Gade and Colne and therefore reduce the effectiveness of existing outfalls from the surface water drainage networks.

8.4 Developer Guidance

The following checklist (Table 8-20) should be used to guide policy development by the LPAs, and is also provided as outline guidance for developers, to enable developments to be planned whilst taking account of best practice, and conforming to the strategy and aspirations discussed throughout this WCS. This guidance will need further development in line with future outline and

detailed WCS findings, and emerging guidance for County Councils and LPAs regarding the Floods and Water Management Act.

Meeting the “actively encouraged” requirements will minimise the negative impacts of any development on the water infrastructure within the study area, and the wider water environment.

Topic	Strategic Requirement/ Aspiration	Minimum Requirement	Actively Encouraged
Flood Risk	*Has the development been approved following an assessment under PPS25, utilising the sequential and exception tests, in accordance with local SFRA, SWMP and a site specific FRA where appropriate?*	ⓘ	
	Does the FRA for the development site propose measures to provide betterment regarding downstream flood risk, particularly from surface water runoff?		✔
SUDS	*Has the developer provided details of how surface water runoff will be separated from foul drainage systems and limited to the rate prior to development (the equivalent greenfield rate for brownfield sites), or better, in line with CIRIA and EA guidance, CFMP and SFRA?*	ⓘ	
	Can the developer demonstrate that any planned SUDS are appropriate for the site geology, taking into account Groundwater Vulnerability and SPZ, as detailed in the SFRA? - Previous land use should be considered, and localised permeability tests will also be required, potentially as part of the site FRA.	ⓘ	
	Has the developer consulted with the LPAs and County Council regarding who will be responsible for maintenance of any SUDS features, and how this will be funded?	ⓘ	
	Is the developer proposing to integrate biodiversity features such as wetlands and green corridors into any proposed SUDS, as recommended in this WCS?		✔
Demand Management	*Has the developer provided evidence of how calculated whole building performance will equate to a PCC of 105 l/p/d or less, as required by emerging LPA policy and recommended in this WCS?*	ⓘ	
	Has the developer provided details of any rainwater harvesting/ grey water reuse systems to achieve PCC between 80-105 l/p/d?		✔
	Has the developer provided details of any schemes/ measures (such as smart meters with internal displays) to raise the occupiers'/ community's awareness of the importance of water efficiency, and encourage water efficient measures to be retained into the future?		✔
Potable Supply	*Has the developer liaised with VWC (or TWU) to ascertain if supply can be provided in a timely manner, and agreed appropriate funding mechanisms?*	ⓘ	
Sewerage	*Has the developer provided evidence (following liaison with TWU) that network capacity can be provided in a timely manner, the receiving WwTW has adequate capacity to receive the flows, and that appropriate funding mechanisms are in place?*	ⓘ	
	Is the initial development located in keeping with the conclusions of this WCS – i.e. in proximity to the existing trunk sewer network, hence reducing the impact on the existing sewers through the urban areas, and allowing time for more complex network solutions to be assessed by TWU?		✔

Topic	Strategic Requirement/ Aspiration	Minimum Requirement	Actively Encouraged
Conservation	*Has the developer completed all relevant ecological surveys and impact assessments, and complied with all relevant planning conditions, as directed by UK/ EC law, PPS9 and the latest LPA policies?*	ⓘ	
	Has the developer provided details of integrated site specific solutions to enhance biodiversity in the water environment?		✔

Table 8-20 Developer Guidance Checklist

9 Additional data requirements

The following data is required in the future to ensure that further WCS work undertaken by the LPAs fully reflects the concerns of all stakeholders, and allows a sustainable integrated strategy to be developed across the study area:

- Confirmation of LPA dwelling targets, allocation and phasing;
- Confirmation of DWF consents and any changes in physio-chemical standards at all WwTW where growth has been proposed;
- Water quality modelling from the EA, to provide indicative consent standards for the various discharge options that should be considered as part of the next stages of the WCS;
- Output from TWU sewerage models to allow a range of growth numbers and locations to be assessed against existing strategic sewer capacity, and to develop appropriate strategic sewer upgrades;
- Indication from the EA as to whether future WFD requirements may tighten the physio-chemical standards required at the WwTW;
- Indication from the EA as to likely trade-off between additional flows from more localised WwTW discharges, against water quality concerns, given the sensitive chalk stream habitats in the study area;
- Input from BWW as to the magnitude of current concerns regarding water quality and levels, and views on the likely implications of the potential increases in discharge;
- Baseflow data and river cross-section data, or access to suitable river hydraulic models, from the EA to assess the impacts of increased WwTW discharges on downstream water levels and flood risk;
- WwTW upgrade proposals from TWU for the significantly impacted locations for the current or future growth scenarios; and
- Additional information from the LPAs and the EA on flood and surface water risk from the ongoing SWMPs and future assessments (including those resulting from the enactment of the Flood and Water Management Bill).

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Glossary of Terms

Acronym	Term
Amm. N	Ammoniacal Nitrogen (re Discharge Consent)
AMP	Asset Management Period
AMR	Annual Monitoring Report
AWS	Anglian Water Services
BAP/ (L)BAP	(Local) Biodiversity Action Plan
BAT	Best Available Technology
BATNEEC	Best Available Technology Not Entailing Excessive Cost
BOD	Biochemical Oxygen Demand
BWW	British Waterways
CAMS	Catchment Abstraction Management Strategies
CFMP	Catchment Flood Management Plans
CSH	Code for Sustainable Homes
DBC	Dacorum Borough Council
DEFRA	Department for Environment, Food and Rural Affairs
DPD	Development Plan Documents
DWF	Dry Weather Flow
DYAA	Dry Year Annual Average
DYCP	Dry Year Critical Period
EA	Environment Agency
GEP	Good Ecological Potential
GUC	Grand Union Canal
HMWB	Heavily Modified Water Body
HOF	Hands Off Flow
LDD	Local Development Documents
LDF	Local Development Framework
NE	Natural England
OFWAT	The Water Services Regulation Authority
P	Phosphorous (re Discharge Consent)
PCC	Per Capita Consumption
PE	Population Equivalent
PPS	Planning Policy Statement
PR09/ 14	Price Review 2009/ 2014
RBMP	River Basement Management Plan
RSAP	Restoring Sustainable Abstraction Programme
RSS	Regional Spatial Strategy
SADC	St Albans City and District Council
SFRA	Strategic Flood Risk Assessment
SPD	Supplementary Planning Document
SSSI	Site of Special Scientific Interest
SUDS	Sustainable Drainage Systems
TRDC	Three Rivers District Council
TWU	Thames Water Utilities
UKTAG	United Kingdom Technical Advisory Group
UWWTD	Urban Waste Water Treatment Directive
WAFU	Water Available for Use
WBC	Watford Borough Council
WFD	Water Framework Directive
WHBC	Welwyn Hatfield Borough Council
WRZ	Water Resource Zone
WwTW	Wastewater Treatment Works

Technical Glossary

- **Asset Management Period (AMP)** - A period of five years in which water companies implement planned upgrades and improvements to their asset base. For example, AMP4 is 2005-2010 and AMP5 is 2010-2015.
- **Aquifer** – a layer of permeable rock, which acts as a store of groundwater. Water is stored within fissures, or within the rock matrix itself.
- **Best Available Technology (BAT) –** in this context refers to the most advanced methods (that have been proven in the industry) that a water company can utilise to obtain the best result from a process.
- **Best Available Technology Not Entailing Excessive Cost (BATNEEC) –** similar to the above, but taking account of the whole life cycle costs. BATNEEC is often applied by water companies because they pass on costs to customers through the Price Review process, and this funding regime requires that the optimum balance between benefits and costs is therefore achieved.
- **Biochemical Oxygen Demand –** a measure of the oxygen demand that results from bacteria breaking down organic carbon compounds in water. High levels of BOD can use up oxygen in a watercourse, to the detriment of the ecology.
- **Catchment Abstraction Management Strategies (CAMS)** - the production of a strategy by the EA to assess and improve the amount of water that is available on a catchment scale. The first cycle of CAMS have recently been produced and are currently being reviewed.
- **Code for Sustainable Homes (CSH)** - released in 2007 and aims to make newly built homes more efficient in the future. The code gives a star rating (between 1 and 6) for a home based on nine different categories including water, waste and energy. In May 2008 the government announced a timetable to ensure the implementation of the CSH through the tightening up of building regulations. At present all new homes are required to be assessed for a CSH star rating.
- **Deployable Output –** the amount of water that can be abstracted from a source (or bulk supply) as constrained by environment, license, pumping plant and well/aquifer properties, raw water mains, transfer, treatment and water quality.
- **Discharge Consent –** a consent issued and reviewed by the EA which permits an organisation or individual to discharge sewage or trade effluent into surface water, groundwater or the sea. Volume and quality levels are set to protect water quality, the environment and human health. Regarding water quality, the determinands controlled under a discharge consent are:
  - Suspended Solids;
  - Biochemical Oxygen Demand; and
  - Ammoniacal Nitrogen (Amm. N) and Phosphorous (P), where the UWWTD conditions apply.
- **Draft Water Resource Management Plan (WRMP)** - Currently in their draft stages awaiting approval by OFWAT later this year, the Water Resource Management Plans are studies undertaken by every water company in England to determine the availability of water resources for the next 25 years. WRMPs can be found on most water company websites.
- **Dry Weather Flow (DWF)** – an estimation of the flow of wastewater to a WwTW during a period of dry weather. This is based on the 20th percentile of daily flow through the works over a rolling three year period.
- **Dry Year Annual Average (DYAA) –** the average demand during a year of rainfall below long-term average (characterised with high summer temperatures and high demand).
- **Dry Year Critical Period (DYCP) –** the demand over a period of time during which the customer experiences the greatest risk of loss of potable water supply, during a year of rainfall below long-term average (characterised with high summer temperatures and high demand).
- **Eutrophication –** higher than natural levels of nutrients in a watercourse, which may lead to the excessive build up of plant life (especially algae). Excessive algal blooms remove valuable oxygen from the watercourse, block filters at water treatment works, affect the taste and smell of water, and can be toxic to other wildlife.
- **Fluvial** – term referring to rivers or streams.

- **Hands Off Flow (HOF)** – the minimum river flow that must be achieved at a monitoring point to allow abstraction to take place at any associated upstream abstraction points.
- **Local Development Framework (LDF)** – A folder of development documents outlining the spatial planning strategy for each local authority. The LDF will contain a number of statutory Local Development Documents (LDDs), such as a Statement of Community Involvement, Annual Monitoring Reports, Core Strategy, Local Development Scheme as well as a number of optional Supplementary Planning Documents.
- **National Nature Reserve (NNR) –** are areas of national importance, protected because they are amongst the best examples of a particular habitat in the country. Details of NNR can be found at http://www.natureonthemap.org.uk/.
- **Per Capita Consumption (PCC) –** the volume of water used by one person over a day, expressed in units of litres per person per day (l/p/d).
- **Planning Policy Statement (PPS)** - set out the Government's national policies on different aspect of planning. The policies in these statements apply throughout England and focus on procedural policy and the process of preparing local development documents.
- **Population Equivalent (PE) –** a method of measuring the loading on a WwTW, and is based on a notional population comprising; resident population, a percentage of transient population, cessed liquor input expressed in population, and trade effluent expressed in population**.**
- **Potable Water –** water that is fit for drinking, being free of harmful chemicals and pathogens. Raw water can be potable in some instances, although it usually requires treatment of some kind to bring it up to this level.
- **Price Review –** the process with which Ofwat reviews water company business plans and subsequently sets limits on the prices the companies can charge their customers for the following AMP. The business plan submissions are often referred to as the Price Review submission, e.g. business plan submitted in 2009 for AMP5 (2010–2015) is referred to as the PR09 submission.
- **Raw Water -** water taken from the environment, which is subsequently treated or purified to produce potable water.
- **Regional Spatial Strategy (RSS)** - a broad development strategy for a region for a 15 to 20 year period prepared by the Regional Planning Body. The Regional Spatial Strategy for the East of England is currently under review. Once issued, it will establish the broad development strategy for the region, and provide a framework within which local development documents and local transport plans can be prepared for the period to 2031.
- **Riparian Landowner** – the owner of land adjacent to a watercourse.
- **River Basin Management Plans (RBMP)** – documents produced by each of the EA regions to catalogue the water quality of all watercourses and set out actions to ensure they achieve the ecological targets stipulated in the WFD.
- **Site of Special Scientific Interest (SSSI) -** 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). A map showing all SSSI sites can be found at http://www.natureonthemap.org.uk/**.**
- **Strategic Flood Risk Assessment (SFRA)** – document required by PPS25 that informs the planning process of flood risk and provides information on future risk over a wide spatial area. It is also used as a planning tool to examine the sustainability of the proposed development allocations.
- **Surface Water Management Plans (SWMP)** – a document that assists in the assessment of flood risk, to ensure that increased levels of development, and climate change, do not have an adverse impact on flooding from surface water sources within the catchment. SWMP were introduced following the severe flooding in 2007, as means for Local Authorities to take the lead in reducing flood risk.
- **Sustainable Drainage Systems (SUDS)** – a combination of physical structures and management techniques designed to drain, attenuate, and in some cases treat, runoff from urban (and in some cases rural) areas.
- **Target Headroom -** the threshold of minimum acceptable headroom, which would trigger the need for water management options to increase water available for use or decrease demand.

- **UK Biodiversity Action Plan (BAP) –** the Government's response to the Convention on Biological Diversity 1992. It describes the UK's biological resources, both species and habitats, and details a plan to protect them. UK BAP habitats are often encompassed within the other sites listed above, however smaller pockets of UK BAP habitat may also exist outside these sites.
- **Water Available for Use (WAFU) –** the amount of water remaining after allowable outages and planning allowances are deducted from deployable output in a WRZ.
- **Water Framework Directive (WFD) 2000** - A European Union directive (2000/60/EC) which commits member states to make all water bodies of good qualitative and quantitative status by 2015. The WFD could have significant implications on water quality and abstraction. Important dates for the WFD are:
    - 2008 Draft River Basin Management Plans for each river basin district completed;
    - 2009 Final River Basin Management Plans completed;
    - 2012 Programs of measures for improvements to be fully operational; and
    - 2015 Achieve the first set of water body objectives.
- **Water Resource Zone (WRZ) –** are areas based on the existing potable water supply network and represent the largest area in which water resources can be shared.
- **Wastewater -** is any water that has been adversely affected in quality by anthropogenic influence. It comprises liquid waste discharged by domestic residences, commercial properties, industry, and/or agriculture.
- **Water Treatment Works (WTW)** – a facility that treats abstracted raw water to bring it up to potable standards.
- **Wastewater Treatment Works (WwTW)** – a facility that treats wastewater through a combination of physical, biological and chemical processes.
- **Winterbourne –** describes a river or stream which only flows during the winter season, when groundwater levels are high enough

Appendix A

Report Figures

Figures

The following figures, referred to throughout the report, are included in this Appendix:

- Figure A-1: CAMS
- Figure A-2: Growth Points
- Figure A-3: WRZ
- Figure A-4: VWC Supply Schematic
- Figure A-5: WwTW Catchments
- Figure A-6: Trunk Sewers

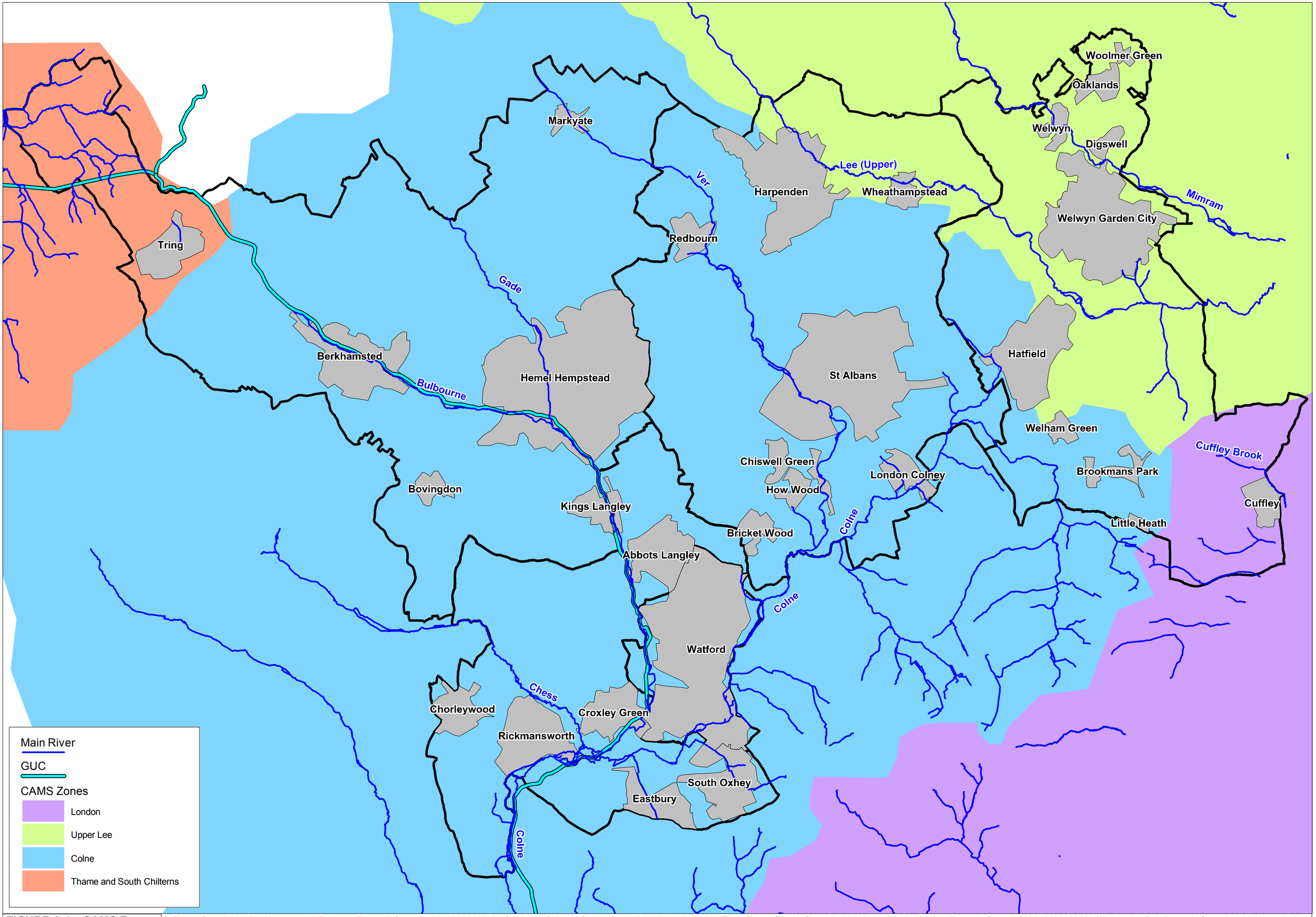


FIGURE A-1 CAMS Zones

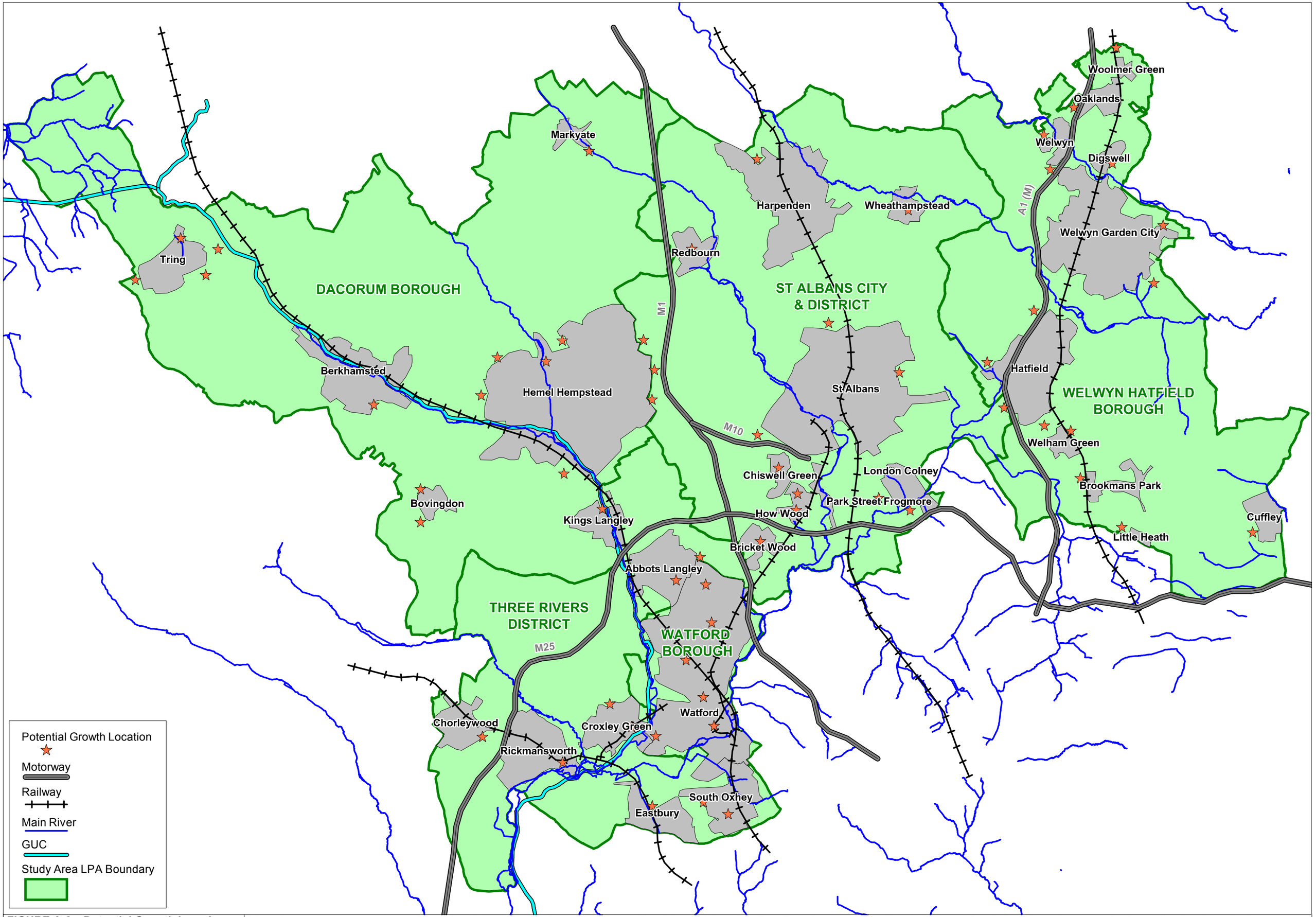


FIGURE A-2 Potential Growth Locations

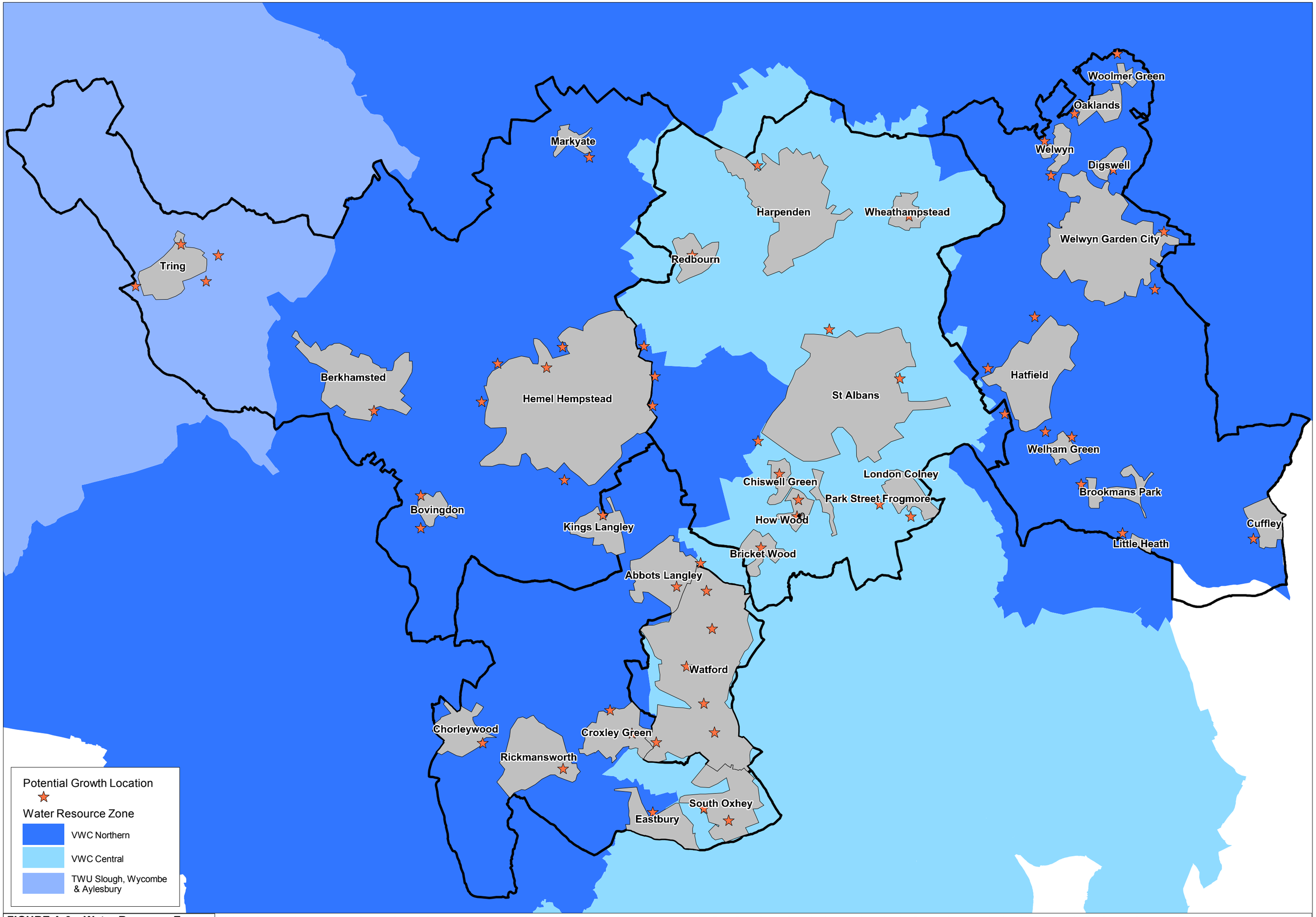


FIGURE A-3 Water Resource Zones

Anglian Water Import

Berkhamsted

Hemel Hempstead

Harpenden

Welwyn Garden City

Hatfield

St Albans

Watford

Rickmansworth

Water Treatment Works

Water Treatment Works

Water Treatment Works

Reservoir

Strategic Transfers between areas

Pumping Mains

Extent of study area in Central Water Resources Zone

Extent of study area in Northern Water Resources Zone

FIGURE A-4 VWC Supply Schematic

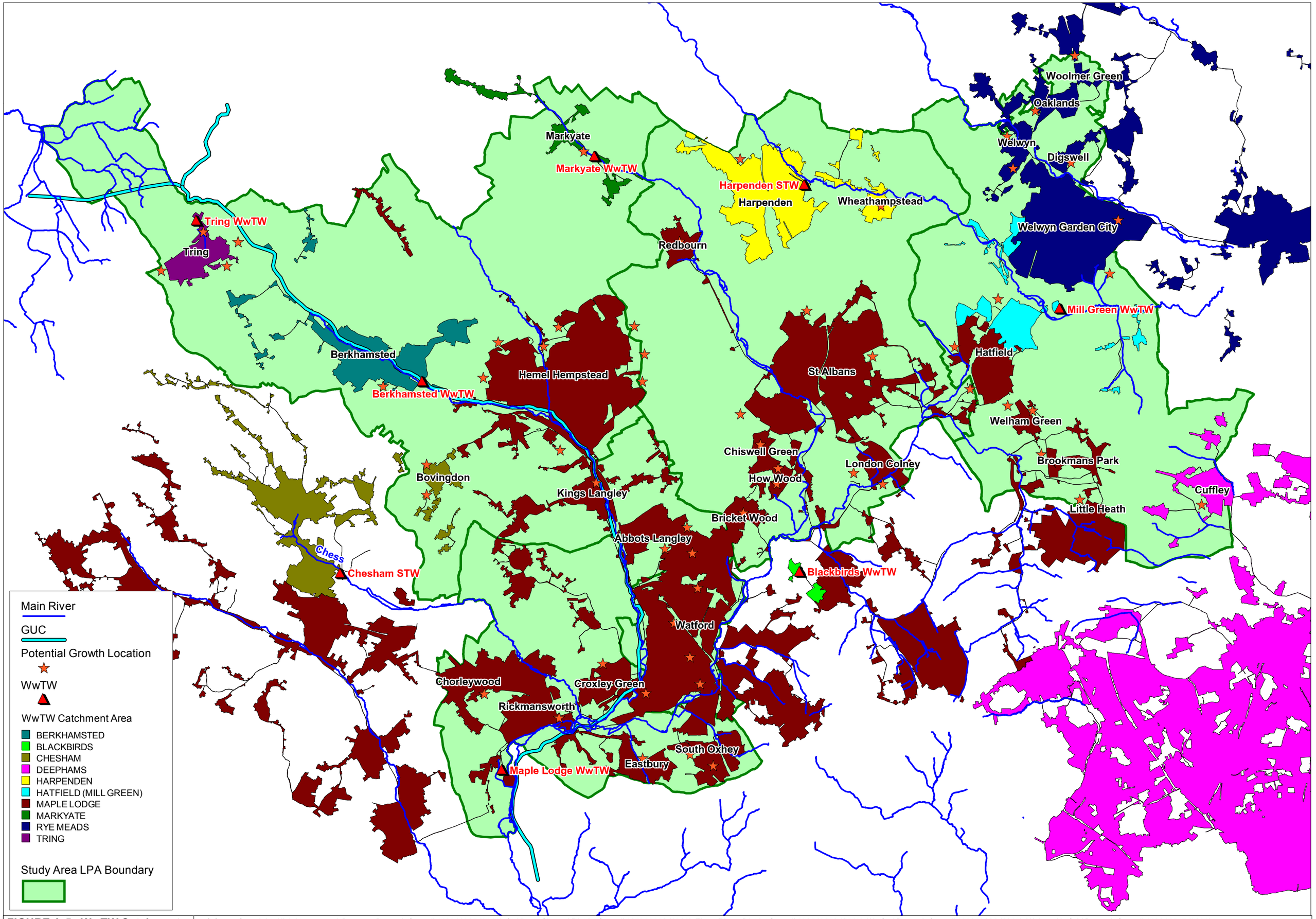


FIGURE A-5 WwTW Catchments

Thame
Long Marston Brook
Tring Bourne
Tring WwTW
Tring
Bulbourne
Berkhamsted
Berkhamsted WwTW
Gade
Markyate
Ver
Markyate WwTW
Mimram
Lee (Upper)
Harpenden WwTW
Harpenden
Wheathampstead
Redbourn
Ver
Woolmer Green
Oaklands
Welwyn
Digswell
Welwyn Garden City
Mill Green WwTW
Hatfield
Hemel Hempstead
St Albans
Chiswell Green
How Wood
London Colney
Colne
Mimmshall Brook
Cuffley Brook
Cuffley
Little Heath
Northaw Brook
Bovingdon
Kings Langley
Bricket Wood
Abbots Langley
Chess
Chesham WwTW
Blackbirds WwTW
Misbourne
Colne
Chorleywood
Croxley Green
Rickmansworth
South Oxhey
Eastbury
Maple Lodge WwTW
Colne

Main River
GUC
Potential Growth Location
WwTW
Trunk Sewer
Study Area LPA Boundary

FIGURE A-6 Trunk Sewers

Appendix B

	Project Title				Project Code			Background only - may not feed report directly	
	Dacorum, Watford et al WCS - Scoping				WX54733			Critical Developer Information	
	INCOMING DOCUMENT/DRAWING REGISTER							Critical Environmental/ Conservation Information	
								Critical Water resources/ supply information	
								Critical Sewage information	
								Critical Flood Risk information	

Incoming Date	Originator	Originator's Doc. Ref	Originator's Organisation	Document Title/ Description	Format of incoming info	Water Cycle Study Aspect	Receivers Initials	Scanned	Location of data
8-Jan-10	Dacorum Web		DBC	DBC, WBC, SADC and TRDC Level 1 SFRA 2007	PDF	E) SW & Flood Risk	DV	N/A	B-IncomingData
8-Jan-10	WHBC Website		WHBC	WHBC Level 1 SFRA 2009	PDF	E) SW & Flood Risk	DV	N/A	B-IncomingData
11-Jan-10	EoE website			EoE RSS Review Consultation Document	PDF	A) Develop Scenarios	DV	N/A	B-IncomingData
11-Jan-10	EoE Website			London Arc West Sub Area Profile	PDF	A) Develop Scenarios	DV	N/A	B-IncomingData
11-Jan-10	GO East Website			Background to RSS challenge	Word	A) Develop Scenarios	DV	N/A	B-IncomingData
11-Jan-10	GO East Website			RSS Legal Challenge Outcome	PDF	A) Develop Scenarios	DV	N/A	B-IncomingData
11-Jan-10	Wel Hat Website		WHBC	Sustainability Appraisal 2008	PDF	A) Develop Scenarios	DV	N/A	B-IncomingData
11-Jan-10	Three Rivers Web		TRDC	CS Preferred Options Nov 2009	PDF	A) Develop Scenarios	DV	N/A	B-IncomingData
11-Jan-10	Three Rivers Web		TRDC	Appendix to above showing site details	PDF	A) Develop Scenarios	DV	N/A	B-IncomingData
11-Jan-10	Three Rivers Web		TRDC	Draft Sustainability Report Feb 09	PDF	A) Develop Scenarios	DV	N/A	B-IncomingData
11-Jan-10	Watford Web		WBC	Sustainability Appraisal Enviro Report 2008	PDF	A) Develop Scenarios	DV	N/A	B-IncomingData
11-Jan-10	Watford Web		WBC	CS Preferred Options 2008	PDF	A) Develop Scenarios	DV	N/A	B-IncomingData
11-Jan-10	Dacorum Web		DBC	Sustainability Appraisal 2009	PDF	A) Develop Scenarios	DV	N/A	B-IncomingData
11-Jan-10	Hyder			Plan of Maple Lodge WwTW (2006)	PDF	D) FW Sewerage & Treatment	DV	N/A	B-IncomingData
11-Jan-10	Wel Hat Website		WHBC	SFRA Flood Defence Map	PDF	E) SW & Flood Risk	DV	N/A	B-IncomingData
11-Jan-10	Wel Hat Website		WHBC	SFRA Overland Flow Risk Map	PDF	E) SW & Flood Risk	DV	N/A	B-IncomingData
8-Jan-10	Dacorum Web		DBC	Historical Flood Events SFRA Map	PDF	E) SW & Flood Risk	DV	N/A	B-IncomingData
8-Jan-10	Dacorum Web		DBC	Major Defences and Schemes SFRA Map	PDF	E) SW & Flood Risk	DV	N/A	B-IncomingData
8-Jan-10	VWC		VWC	WRMP Jan 2009	PDF	B) Water Resource & Supply	DV	N/A	B-IncomingData
14-Jan-10	PK		WBC	SHLAA sites and Info for WBC, TRDC and DBC	Various	A) Develop Scenarios	DV	N/A	B-IncomingData
19-Jan-10	NB		DBC	Housing location information (from climate change study)	Word	A) Develop Scenarios	DV	N/A	B-IncomingData
19-Jan-10	NB		DBC	GIS of Submitted and indicative and SHLAA sites	GIS Files	A) Develop Scenarios	DV	N/A	B-IncomingData
19-Jan-10	NB		DBC	GIS of Local Wildlife sites	GIS Files	F) Conservation & Env	DV	N/A	B-IncomingData
19-Jan-10	NB		DBC	GIS of Surface Water Susceptibility	GIS Files	E) SW & Flood Risk	DV	N/A	B-IncomingData
20-Jan-10	PK		WBC	Herts CC guidance on FWMB	Word	E) SW & Flood Risk	DV	N/A	B-IncomingData
20-Jan-10	PK		WBC	Outcomes of WBC SWMP meeting Dec 09	Email	E) SW & Flood Risk	DV	N/A	B-IncomingData
14-Jan-10	JB		TRDC	GIS of Surface Water Susceptibility	GIS Files	E) SW & Flood Risk	DV	N/A	B-IncomingData
14-Jan-10	JB		TRDC	GIS of District Boundary and Preferred Sites	GIS Files	A) Develop Scenarios	DV	N/A	B-IncomingData
14-Jan-10	JB		TRDC	GIS of LNR, Local Wildlife Sites	GIS Files	F) Conservation & Env	DV	N/A	B-IncomingData
14-Jan-10	JB		TRDC	GIS of ordinary watercourses	GIS Files	B) Water Resource & Supply	DV	N/A	B-IncomingData
14-Jan-10	JB		TRDC	TRDC Draft LDS Jan 10	PDF	A) Develop Scenarios	DV	N/A	B-IncomingData
14-Jan-10	JB		TRDC	TRDC AMR Trajectory 08/09	Excel	A) Develop Scenarios	DV	N/A	B-IncomingData
14-Jan-10	JB		TRDC	TRDC Background OS 1:10,000	Excel	A) Develop Scenarios	DV	N/A	B-IncomingData
21-Jan-10	NB		DBC	DBC Core Strategy Trajectory 09	Excel	A) Develop Scenarios	DV	N/A	B-IncomingData
21-Jan-10	NB		DBC	DBC Local Plan Trajectory	Excel	A) Develop Scenarios	DV	N/A	B-IncomingData
21-Jan-10	NB		DBC	DBC Core Strategy Trajectory old RSS	Excel	A) Develop Scenarios	DV	N/A	B-IncomingData
21-Jan-10	NB		DBC	DBC Hemel Hempstead Emerging CS info 09	Excel	A) Develop Scenarios	DV	N/A	B-IncomingData
26-Jan-10	NB		DBC	TL00 1:50 k tif file	Picture	Z) General	RG	N/A	SharePoint - incoming data
21-Jan-10	FW		DBC	Email confirming DBC growth profile	Email	A) Develop Scenarios	DV		B-IncomingData
27-Jan-10	JY		WHBC	TL20 1:50k file and 1:10k TL20 and 00	Picture	Z) General	DV	N/A	CD in project file
22-Jan-10	LG		WHBC	GIS files of district boundary, wildlife sites, growth points	GIS Files	A) Develop Scenarios	RG	N/A	B-IncomingData - converted to .tab in E-OurDrawings
22-Jan-10	LG		WHBC	Wel Hat growth locations map	PDF	A) Develop Scenarios	RG	N/A	B-IncomingData
22-Jan-10	LG		WHBC	Welwyn Hatfield Growth description document	Word	A) Develop Scenarios	RG	N/A	B-IncomingData
22-Jan-10	LG		WHBC	Welwyn Hatfield Housing Trajectory 08/09	Excel	A) Develop Scenarios	RG	N/A	B-IncomingData
22-Jan-10	LG		WHBC	Details of Wel Hat wildlife sites	GIS Files	F) Conservation & Env	RG	N/A	B-IncomingData
28-Jan-10	SB		HCC	1:50 k mapping (bw and colour) for whole study area under Three Rivers license, and all District boundaries	Picture	Z) General	DV	N/A	CD in project file
27-Jan-10	LB		DBC	Maps of DBC SHLAA sites that have planning permission or comp - Berkhampstead	Picture	A) Develop Scenarios	DV	N/A	B-IncomingData
27-Jan-10	LB		DBC	Maps of DBC SHLAA sites that have planning permission or comp - Bovingdon	Picture	A) Develop Scenarios	DV	N/A	B-IncomingData
27-Jan-10	LB		DBC	Maps of DBC SHLAA sites that have planning permission or comp - Hemel Hempstead	Picture	A) Develop Scenarios	DV	N/A	B-IncomingData
27-Jan-10	LB		DBC	Maps of DBC SHLAA sites that have planning permission or comp. - Kings Langley	Picture	A) Develop Scenarios	DV	N/A	B-IncomingData
27-Jan-10	LB		DBC	Maps of DBC SHLAA sites that have planning permission or comp. - Kings Langley	Picture	A) Develop Scenarios	DV	N/A	B-IncomingData
27-Jan-10	LB		DBC	Maps of DBC SHLAA sites that have planning permission or comp. - Tring and Aldbury	Picture	A) Develop Scenarios	DV	N/A	B-IncomingData
28-Jan-10	AP		HCC	Confirmation of biodiversity data available	Word	F) Conservation & Env	DV	N/A	B-IncomingData
28-Jan-10	AP		HCC	Biodiversity GIS from HBRC	GIS Files	F) Conservation & Env	DV	N/A	B-IncomingData
29-Jan-10	FW		DBC	Latest data on DBC completions and allocations - used in calcs	Excel	A) Develop Scenarios	DV	N/A	B-IncomingData
29-Jan-10	KB		DBC	3 x CD ok DBC 1:50 and 1:10 map files	Picture	Z) General	RG	N/A	CD in project file
1-Feb-10	JY		WHBC	WHBC Surface Water Susceptibility mapping	GIS Files	E) SW & Flood Risk	DV	N/A	B-IncomingData
1-Feb-10	CM		TRDC	TRDC final development spreadsheet **(superseded by IN083)**	Excel	A) Develop Scenarios	DV	N/A	B-IncomingData
2-Feb-10	LB		DBC	Additional GIS site data	GIS Files	A) Develop Scenarios	DV	N/A	B-IncomingData
2-Feb-10	PK		WBC	Links to WBC 2009 AMR and SHLAA report	Email	A) Develop Scenarios	DV	N/A	B-IncomingData
3-Feb-10	NG		VWC	AMP5 NEP schemes	Word	B) Water Resource & Supply	DV	N/A	B-IncomingData
3-Feb-10	PK		WBC	WBC final development spreadsheet **(superseded by IN067)**	Excel	A) Develop Scenarios	DV	N/A	B-IncomingData
3-Feb-10	PK		WBC	Watford Junction development details	Email	A) Develop Scenarios	DV	N/A	B-IncomingData
5-Feb-10	NM		TWU	TWU GIS response	GIS Files	D) FW Sewerage & Treatment	DV	N/A	B-IncomingData
9-Feb-10	AD		WHBC	WHBC final development spreadsheet	Excel	A) Develop Scenarios	DV	N/A	B-IncomingData
9-Feb-10	NM		TWU	TWU response to calculation queries	Email	D) FW Sewerage & Treatment	DV	N/A	B-IncomingData
9-Feb-10	PK		WBC	RevisedWBC final development spreadsheet **(superseded by IN089)**	Excel	A) Develop Scenarios	DV	N/A	B-IncomingData
9-Feb-10	MK		SADC	St Albans District boundary	GIS Files	Z) General	DV	N/A	B-IncomingData
9-Feb-10	MK		SADC	St Albans Final Development spreadsheet	Excel	A) Develop Scenarios	DV	N/A	B-IncomingData
9-Feb-10	MK		SADC	Supporting data and assumptions for above spreadsheet	Excel	A) Develop Scenarios	DV	N/A	B-IncomingData
10-Feb-10	NM		TWU	TWU WwTW catchment infiltration, occupancy and pcc rates	Excel	D) FW Sewerage & Treatment	DV	N/A	B-IncomingData
11-Feb-10	AD		WHBC	Wel Hat Scenario 3 development	Excel	A) Develop Scenarios	DV	N/A	B-IncomingData
10-Feb-10	PP		EA	FZ2 & 3, Historic and Areas Benefitting GIS	GIS Files	E) SW & Flood Risk	DV	N/A	B-IncomingData
10-Feb-10	PP		EA	GWV and SPZ GIS	GIS Files	B) Water Resource & Supply	DV	N/A	B-IncomingData
10-Feb-10	PP		EA	Pollution Events GIS	GIS Files	Z) General	DV	N/A	B-IncomingData
10-Feb-10	PP		EA	Rivers, RBMP and monitoring points GIS	GIS Files	C) Water Quality	DV	N/A	B-IncomingData
10-Feb-10	MK		SADC	SHLAA site details	Word	A) Develop Scenarios	DV	N/A	B-IncomingData
10-Feb-10	MK		SADC	Areas of search and SHLAA details/GIS	Various	A) Develop Scenarios	DV	N/A	B-IncomingData
10-Feb-10	MK		SADC	SHLAA consultation details/GIS	Various	A) Develop Scenarios	DV	N/A	B-IncomingData
10-Feb-10	MK		SADC	SADC surface water susceptibility	GIS Files	E) SW & Flood Risk	DV	N/A	B-IncomingData
10-Feb-10	MK		SADC	SADC wildlife site details/GIS	Various	E) SW & Flood Risk	DV	N/A	B-IncomingData
10-Feb-10	MK		SADC	SADC Housing Monitoring Report 09	Various	A) Develop Scenarios	DV	N/A	B-IncomingData
15-Feb-10	CM		TRDC	TRDC final development spreadsheet v2	Excel	A) Develop Scenarios	DV	N/A	B-IncomingData
18-Feb-10	PP		EA	WLMP for sites in the area	PDF	F) Conservation & Env	DV	N/A	B-IncomingData
18-Feb-10	RR		TWU	Details of WwTW flows	Excel	D) FW Sewerage & Treatment	DV	N/A	B-IncomingData
17-Feb-10	PK		WBC	Details of Watford development sites	Word	A) Develop Scenarios	DV	N/A	B-IncomingData
19-Feb-10	PK		WBC	Flood zone mapping	GIS Files	E) SW & Flood Risk	DV	N/A	B-IncomingData
19-Feb-10	PK		WBC	Flood zone mapping with climate change	GIS Files	E) SW & Flood Risk	DV	N/A	B-IncomingData
19-Feb-10	PK		WBC	FINAL RevisedWBC final development spreadsheet	Excel	A) Develop Scenarios	DV	N/A	B-IncomingData
23-Feb-10	NG		VWC	Schematic of study area supply network	Picture	B) Water Resource & Supply	DV	N/A	B-IncomingData
23-Feb-10	NG		VWC	PCC rates for metered and unmetered customers	Excel	B) Water Resource & Supply	DV	N/A	B-IncomingData
23-Feb-10	NG		VWC	PCC rates for customers weighted by meter penetration	Excel	B) Water Resource & Supply	DV	N/A	B-IncomingData
24-Feb-10	RR		TWU	TWU NEP studies for AMP5	Excel	D) FW Sewerage & Treatment	DV	N/A	B-IncomingData
24-Feb-10	RR		TWU	Capacity notes and catchment plans for WwTW	Various	D) FW Sewerage & Treatment	DV	N/A	B-IncomingData
24-Feb-10	NG		VWC	Desciption of supply in the area	Word	B) Water Resource & Supply	DV	N/A	B-IncomingData
24-Feb-10	PP		EA	Upper Lee FRM	Pdf	E) SW & Flood Risk	DV	N/A	B-IncomingData
3-Mar-10	PP		EA	Flood defences GIS	GIS Files	E) SW & Flood Risk	DV	N/A	B-IncomingData
3-Mar-10	NM		TWU	Description of Tring Supply	Email	B) Water Resource & Supply	DV	N/A	B-IncomingData
4-Mar-10	PP		EA	Restoring Sustainable Abstraction reports	PDF	B) Water Resource & Supply	DV	N/A	CD in project file
16-Mar-10	RR		TWU	Review of WwTW and network capapcity given growth scenarios	Word	D) FW Sewerage & Treatment	DV	N/A	B-IncomingData
22-Mar-10	EL		EA	RBMP Water Quality Map	Picture	C) Water Quality	DV	N/A	B-IncomingData

Appendix C

Planning Policy Context

National Policy

National policy for development and planning is set by the Government. The planning system has changed significantly in recent years due to the Governments planning reform. This reform has included the introduction of the 'Planning for a Sustainable Future: White Paper' and the 'Planning and Compulsory Purchase Act' which has lead to the need for local authorities to develop unified Local Development Frameworks. The planning reform has also lead to the revision of a number of planning policy documents. Extracts from the most relevant Planning Policy Statement (PPS) documents is set out below. This is not an exhaustive list but include the key areas where Local Authorities are required to contribute to the protection of the water environment.

Planning Policy Statement (PPS)

PPS 1: Delivering Sustainable Development[i]

PPS1 sets out the overarching planning policies on the delivery of sustainable development through the planning system. Regional planning authorities and local authorities should promote… *the sustainable use of water resources; and the use of sustainable drainage systems in the management of run-off.*

Development plan policies should take account of environmental issues such as:

- the protection of groundwater from contamination;
- the conservation and enhancement of wildlife species and habitats and the promotion of biodiversity; and
- the potential impact of the environment on proposed developments.

The Government is committed to promoting a strong, stable, and productive economy that aims to bring jobs and prosperity for all. Planning authorities should…ensure that infrastructure and services are provided to support new and existing economic development and housing.

In preparing development plans, planning authorities should seek to…*address, on the basis of sound science, the causes and impacts of climate change, the management of pollution and natural hazards, the safeguarding of natural resources, and the minimisation of impacts from the management and use of resources.*

PPS Planning and Climate Change: Supplement to PPS1[ii]

This PPS on climate change supplements PPS1 by setting out how planning should contribute to reducing emissions and stabilising climate change and take into account the unavoidable consequences. In deciding which areas and sites are suitable, and for what type and intensity of development, planning authorities should assess their consistency with the policies in this PPS. In doing so, planning authorities should take into account:

- the capacity of existing and potential infrastructure (including for water supply, sewage and sewerage, waste management and community infrastructure such as schools and

[i] Planning Policy Statement 1: Delivering Sustainable Development, Office of the Deputy Prime Minister. 2005

[ii] Planning Policy Statement: Planning and Climate Change. Supplement to Planning Policy Statement 1, Office of the Deputy Prime Minister. December 2007

hospitals) to service the site or area in ways consistent with cutting carbon dioxide emissions and successfully adapting to likely changes in the local climate;

- the effect of development on biodiversity and its capacity to adapt to likely changes in the climate;
- the contribution to be made from existing and new opportunities for open space and green infrastructure to urban cooling, sustainable drainage systems, and conserving and enhancing biodiversity; and
- known physical and environmental constraints on the development of land such as sea level rises, flood risk and stability, and take a precautionary approach to increases in risk that could arise as a result of likely changes to the climate.

In their consideration of the environmental performance of proposed development, taking particular account of the climate the development is likely to experience over its expected lifetime, planning authorities should expect new development to…*give priority to the use of sustainable drainage systems, paying attention to the potential contribution to be gained from water harvesting from impermeable surfaces, and encourage layouts that accommodate waste water recycling.*

PPS 3: Housing[iii]

PPS3 sets out the national planning policy framework for delivering the Government's housing objectives. Local Planning Authorities should encourage applicants to bring forward sustainable and environmentally friendly new housing developments, including affordable housing developments, and in doing so should reflect the approach set out in the forthcoming PPS on climate change, including on the Code for Sustainable Homes.

PPS 9: Biodiversity and Geological Conservation[iv]

PPS9 sets out planning policies on protection of biodiversity and geological conservation through the planning system. Regional planning bodies and local planning authorities should adhere to the following key principles to ensure that the potential impacts of planning decisions on biodiversity and geological conservation are fully considered.

Development plan policies and planning decisions should be based upon up-to-date information about the environmental characteristics of their areas. These characteristics should include the relevant biodiversity and geological resources of the area. In reviewing environmental characteristics local authorities should assess the potential to sustain and enhance those resources.

Plan policies and planning decisions should aim to maintain, and enhance, restore or add to biodiversity and geological conservation interests. In taking decisions, local planning authorities should ensure that appropriate weight is attached to designated sites of international, national and local importance; protected species; and to biodiversity and geological interests within the wider environment.

Plan policies on the form and location of development should take a strategic approach to the conservation, enhancement and restoration of biodiversity and geology, and recognise the

[iii] Planning Policy Statement 3: Housing, Office of the Deputy Prime Minister. November 2006

[iv] Planning Policy Statement 9: Biodiversity and Geological Conservation, Office of the Deputy Prime Minister. August 2005

contributions that sites, areas and features, both individually and in combination, make to conserving these resources.

Plan policies should promote opportunities for the incorporation of beneficial biodiversity and geological features within the design of development.

Development proposals where the principal objective is to conserve or enhance biodiversity and geological conservation interests should be permitted.

The aim of planning decisions should be to prevent harm to biodiversity and geological conservation interests. Where granting planning permission would result in significant harm to those interests, local planning authorities will need to be satisfied that the development cannot reasonably be located on any alternative sites that would result in less or no harm. In the absence of any such alternatives, local planning authorities should ensure that, before planning permission is granted, adequate mitigation measures are put in place. Where a planning decision would result in significant harm to biodiversity and geological interests which cannot be prevented or adequately mitigated against, appropriate compensation measures should be sought. If that significant harm cannot be prevented, adequately mitigated against, or compensated for, then planning permission should be refused.

Local development frameworks should indicate the location of designated sites of importance for biodiversity and geodiversity, making clear distinctions between the hierarchy of international, national, regional and locally designated sites. They should also identify any areas or sites for the restoration or creation of new priority habitats, which contribute to regional targets, and support this restoration or creation through appropriate policies.

PPS 12: Local Spatial Planning[v]

PPS 12 sets out government policy on local development frameworks. The core strategy should be supported by evidence of what physical, social and green infrastructure is needed to enable the amount of development proposed for the area, taking account of its type and distribution. This evidence should cover who will provide the infrastructure and when it will be provided. The core strategy should draw on and in parallel influence any strategies and investment plans of the local authority and other organisations.

Good infrastructure planning considers the infrastructure required to support development, costs, sources of funding, timescales for delivery and gaps in funding. This allows for the identified infrastructure to be prioritised in discussions with key local partners. This has been a major theme highlighted and considered via HM Treasury's CSR07 Policy Review on Supporting Housing Growth. The infrastructure planning process should identify, as far as possible:

- infrastructure needs and costs;
- phasing of development;
- funding sources; and
- responsibilities for delivery.

The need for infrastructure to support housing growth and the associated need for an infrastructure delivery planning process has been highlighted further in the Government's recent Housing Green Paper. The outcome of the infrastructure planning process should inform the core strategy and should be part of a robust evidence base. It will greatly assist the overall

[v] Planning Policy Statement 12: Local Spatial Planning, Office of the Deputy Prime Minister. 2008

planning process for all participants if the agencies responsible for infrastructure delivery and the local authority producing the core strategy were to align their planning processes. Local authorities should undertake timely, effective and conclusive discussion with key infrastructure providers when preparing a core strategy. Key infrastructure stakeholders are encouraged to engage in such discussions and to reflect the core strategy within their own future planning. However the Government recognises that the budgeting processes of different agencies may mean that less information may be available when the core strategy is being prepared than would be ideal. It is important therefore that the core strategy makes proper provision for such uncertainty and does not place undue reliance on critical elements of infrastructure whose funding is unknown. The test should be whether there is a reasonable prospect of provision. Contingency planning – showing how the objectives will be achieved under different scenarios – may be necessary in circumstances where provision is uncertain.

PPS 23: Planning and Pollution Control[vi]

The following matters (not in any order of importance) should be considered in the preparation of development plan documents and may also be material in the consideration of individual planning applications where pollution considerations arise:

- the potential sensitivity of the area to adverse effects from pollution, in particular reflected in landscape, the quality of soil, air, and ground and surface waters, nature conservation (including Sites of Special Scientific Interest (SSSIs), National Parks, Areas of Outstanding Natural Beauty (AONBs), Special Areas of Conservation (SACs), Special Protection Areas (SPAs),Wetland of International Importance (RAMSAR sites), agricultural land quality, water supply (Source Protection Zones), archaeological designations and the need to protect natural resources;
- the possible adverse impacts on water quality and the impact of any possible discharge of effluent or leachates which may pose a threat to surface or underground water resources directly or indirectly through surrounding soils;
- the need to make suitable provision for the drainage of surface water; and
- the provision of sewerage and sewage treatment and the availability of existing sewage infrastructure.

PPS 25: Development and Flood Risk[vii]

RPBs and LPAs should adhere to the following principles in preparing planning strategies:

- LPAs should prepare Local Development Documents (LDDs) that set out policies for the allocation of sites and the control of development which avoid flood risk to people and property where possible and manage it elsewhere, reflecting the approach to managing flood risk in this PPS and in the RSS for their region;
- where climate change is expected to increase flood risk so that some existing development may not be sustainable in the long-term, LPAs should consider whether there are opportunities in the preparation of LDDs to facilitate the relocation of development, including housing to more sustainable locations at less risk from flooding;

In addition, LPAs should in determining planning applications:

[vi] Planning Policy Statement 23: Pollution Control, Office of the Deputy Prime Minister. 2004

[vii] Planning Policy Statement 25: Development and Flood Risk, CLG, 2006

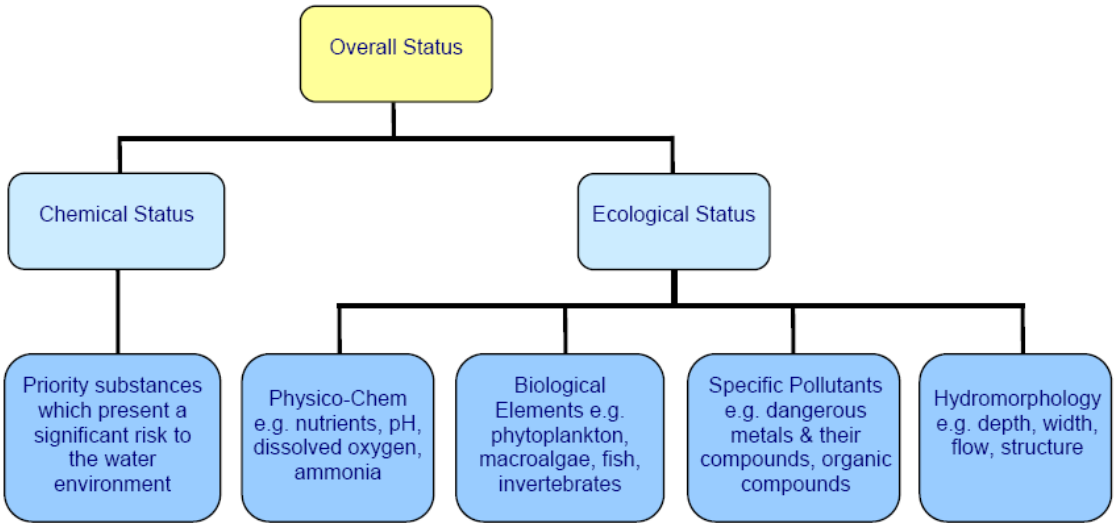
- give priority to the use of SUDS; and
- ensure that all new development in flood risk areas is appropriately flood resilient and resistant, including safe access and escape routes where required, and that any residual risk can be safely managed.

Appendix D

Water Framework Directive

Water Framework Directive

The new methodology of assessing the status of a watercourse, and contributing factors, is shown in the Figure below.



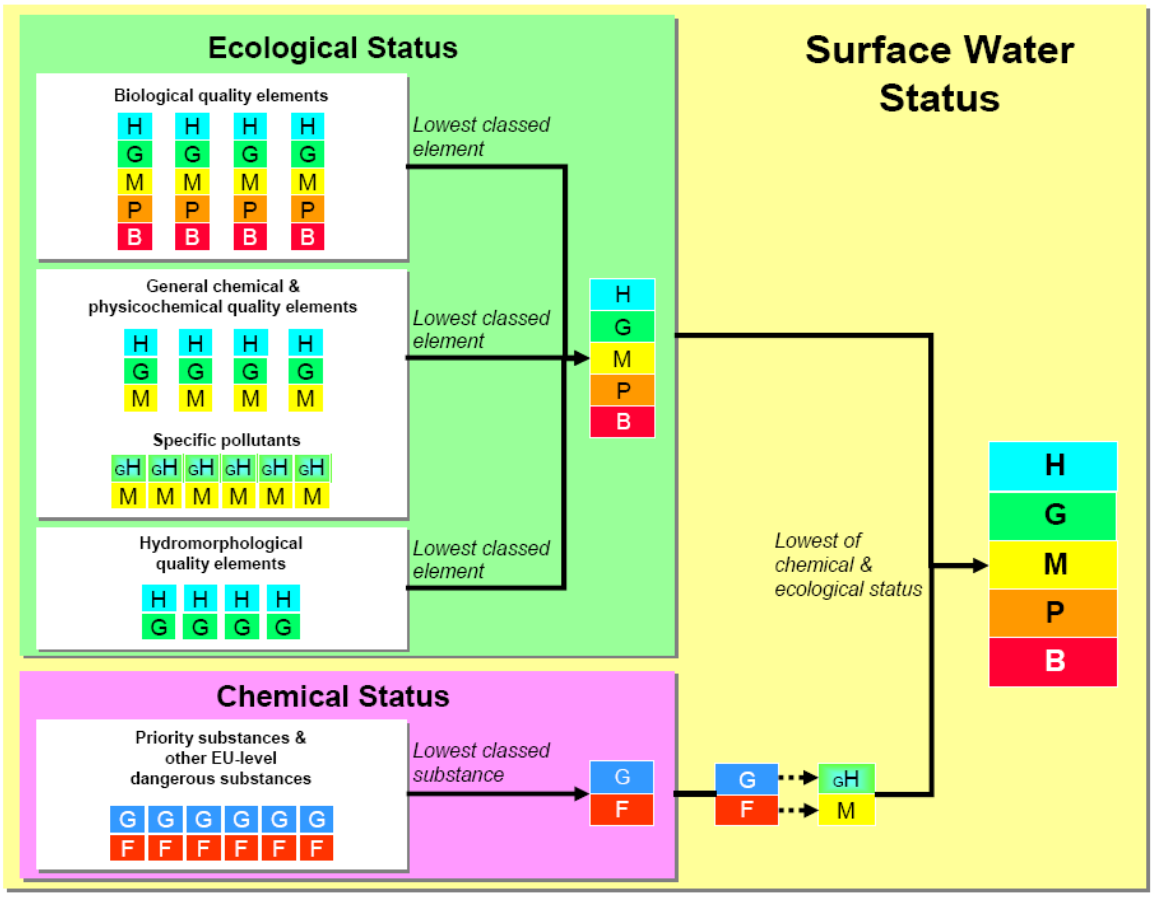
Components of WFD surface water status

Environment Agency Draft River Basin Management Plan, Thames River Basin District December 2008

Surface water status, and ecological status, is assessed on a scale from high to bad, shown in the Table below. Concentrations of individual priority substances and other chemicals deemed dangerous by the EU are classed as either good, or failing to meet good.

Ecological Status	Chemical Status Grades
High	Good
Good	
Moderate	Fail
Poor	
Bad	

Details of the classification components that make up surface water status under the WFD are displayed below.



WFD classification

UKTAG Recommendations on Surface Water Classification Schemes for the purposes of the Water Framework Directive, 2007

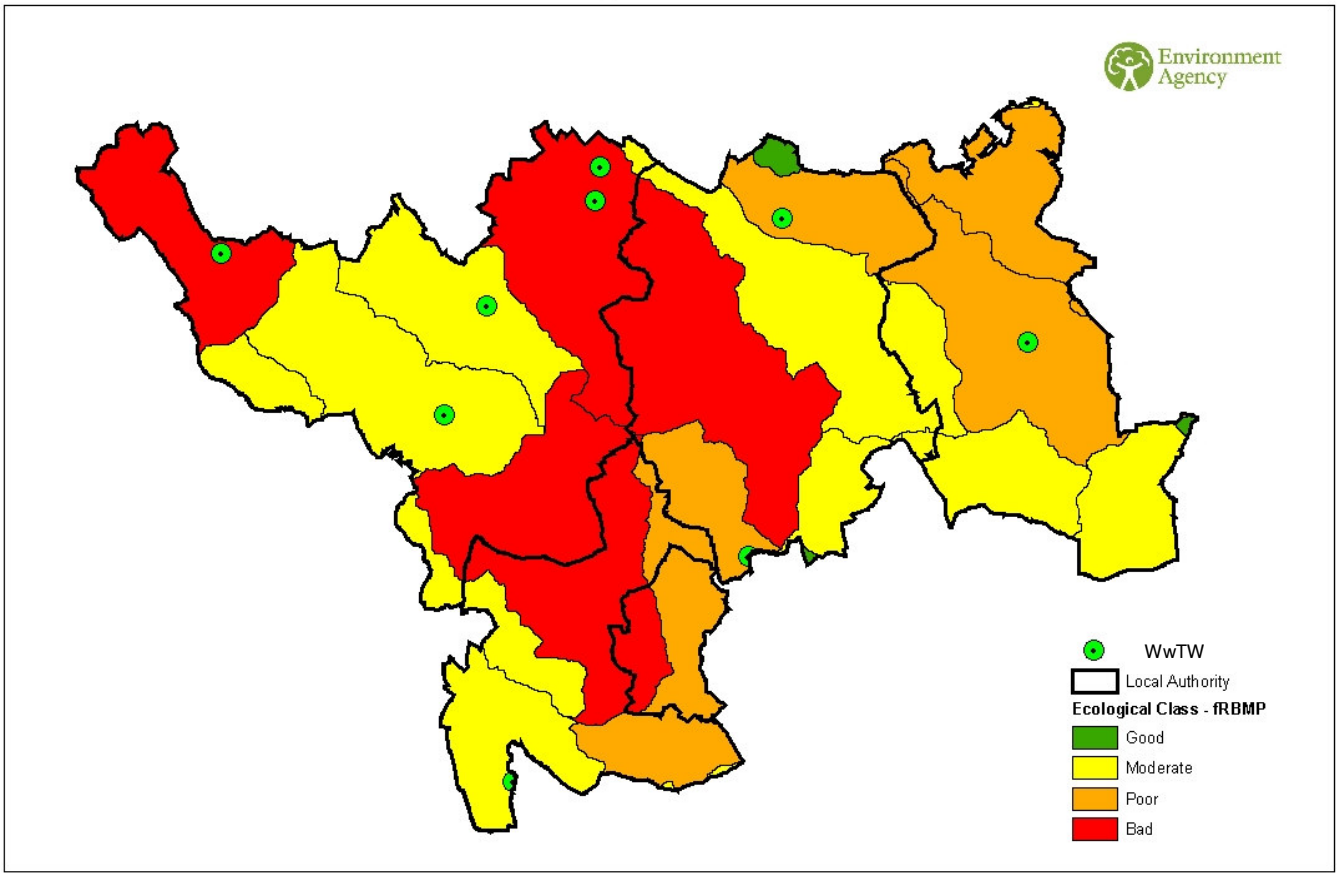
Key dates for the implementation of the WFD and RBMPs are:

- 2008: Draft River Basin Management Plans for each river basin district completed;
- 2009: Final River Basin Management Plans completed following consultation;
- 2012: Programs of measures for improvements to be fully operational;
- 2015: Achieve the first set of water body objectives, publish second RBMP;
- 2021: Achieve the second set of water body objectives, publish third RBMP;
- 2027: Achieve the third set of water body objectives, final deadline for achieving objectives.

However, if it is determined that the solutions required to bring a watercourse up to good status by 2015 are either technically infeasible or disproportionately costly, lower objectives can be set for the short term, with 2027 being the latest date at which the objectives should be met. Under the WFD, there is also a provision for good status to not be met for reasons of overriding public interest.

As part of the WCS consultation process, the EA have supplied a figure (included below) illustrating the current status of the watercourses in the study area.

Water Framework Directive Ecological Status fRBMP



Further details on the WFD are available from the EA RBMP, Defra and http://www.wfduk.org/.

Extracts from the RBMP relevant to the watercourses and WwTW in the study area are included in the tables below.

River Basin District: Thames

Catchment: Colne

River *(WwTW)*	Reach (with unique reference code)	Current Ecological Status (or EP in the case of HMWB)	Current Chemical Status	Barriers to Good status (or GEP for HMWB)	Proposed Date for Achieving Good status (or GEP)
Bulbourne *(Berkhamsted)*	Source…Gade GB106039029890 (HMWB – Flood Protection, Land Drainage, Navigation, Recreation, Urbanisation, Wider Environment)	Moderate	Good	Invertebrates: Bad Phosphate: Poor Mitigation Measures: Moderate	2027
Chess *(Chesham)*	Source…Colne GB106039029870	Moderate	N/A	Fish: Moderate Phosphate: Poor Quantity and dynamics of flow do not support good status	2027; Fish to be Good by 2015
Colne *(Blackbirds)*	Confluence with Ver…Gade GB106039029840	Poor	Good	Fish: Moderate Invertebrates: Poor Phosphate: Poor Quantity and dynamics of flow do not support good status	2027
Colne and GUC *(Maple Lodge)*	Confluence with Chess…Ash GB106039023090 (HMWB – flood protection and navigation)	Moderate	Fail	Fish: Moderate Invertebrates: Moderate Phosphate: Poor Mitigation Measures: Moderate Quantity and dynamics of flow do not support good status	2027
Ver *(Markyate)*	Source…Colne GB106039029920	Bad	N/A	Fish: Poor Invertebrates: Bad Quantity and dynamics of flow, and morphology, do not support good status	2027

Catchment: London

River	Reach (with unique reference code)	Current Ecological Status (or EP in the case of HMWB)	Current Chemical Status	Barriers to Good status (or GEP for HMWB)	Proposed Date for Achieving Good status (or GEP)
Salmons Brook *(Deephams)*	Source…Pymmes Brook GB106038027960 (HMWB - Flood Protection, Navigation, Urbanisation)	Poor	Good	Fish: Moderate Invertebrates: Moderate Macrophytes: Moderate Phytobenthos: Poor Dissolved oxygen: Poor Phosphate: Poor Mitigation Measures: Moderate	2027

Catchment: Thame

River	Reach (with unique reference code)	Current Ecological Status (or EP in the case of HMWB)	Current Chemical Status	Barriers to Good status (or GEP for HMWB)	Proposed Date for Achieving Good status (or GEP)
Thame *(Tring)*	Upstream of Aylesbury GB106039030410	Bad	N/A	Invertebrates: Bad	2027

Catchment: Upper Lee

River *(WwTW)*	Reach (with unique reference code)	Current Ecological Status (or EP in the case of HMWB)	Current Chemical Status	Barriers to Good status (or GEP for HMWB)	Proposed Date for Achieving Good status (or GEP)
Lee *(Harpenden Mill Green)*	Luton Hoo Lakes…Hertford GB106038033392 (HMWB)	Poor	Fail	Phytobenthos: Poor Phosphate: Poor	2027

Above from Environment Agency River Basin Management Plan, Thames River Basin District, Annex B: Water body status objectives for the Thames River Basin District, December 2009