Uttlesford District Council

Uttlesford District Water Cycle Study

Stage 2: Detailed Strategy

Detailed Strategy Report Final

Hyder Consulting (UK) Limited
2212959
Aston Cross Business Village
50 Rocky Lane
Aston
Birmingham B6 5RQ
United Kingdom
Tel: +44 (0)121 333 4466
Fax: +44 (0)121 333 4275
www.hyderconsulting.com

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Stage 2: Detailed Strategy

Detailed Strategy Report Final

Author	Aimee Hart / Tom Lester	
Checker	Heather Taylor	
Approver	Renuka Gunasekara	

Report No	6006-UA004462-BMR-02-Uttlesford WCS Detailed Final Report_Issue 211112_.Docx
Date	21 November 2012

Revisions

Revision	Date	Description	Prepared By	Approved By
A	12/10/12	Revised draft in response to Stakeholder comments	Heather Taylor	Renuka Gunasekara
B	19/10/12	Revised draft in response to Stakeholder comments	Heather Taylor	Renuka Gunasekara
C	26/10/12	Revised draft in response to Stakeholder comments	Aimee Hart	Heather Taylor
D	13/11/12	Final Report incorporating Stakeholder comments	Aimee Hart	Heather Taylor
E	21/11/12	Final Report incorporating Stakeholder comments and additional calculations for Great Dunmow	Aimee Hart	Renuka Gunasekara

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1 Executive Summary

This Stage 2 Detailed Water Cycle Study (WCS) has been commissioned by Uttlesford District Council (UDC) to provide evidence that the development proposed within the emerging Local Plan can be accommodated by the water and wastewater infrastructure, and wider water environment.

Baseline data, collected from the steering group members, has been assessed along with current and emerging legislation. The potential impact of the proposed development on water resources, the current water and wastewater infrastructure, and the water environment, has been analysed.

1.1 Water Resources and Supply Infrastructure

The District is partly underlain by a chalk aquifer of regional importance. However, the Environment Agency (EA) currently class the surface water and groundwater resources within the District as over-licensed or over-abstracted, meaning that there is no additional water available for supply. This highlights the importance of further developing policies to encourage the conservation of water in new and existing dwellings, and commercial properties.

Veolia Water Central (VWC) supply the District with water from a combination of groundwater and surface water abstractions, some of which are outside the District, allowing additional water to be transferred into the District to accommodate the supplied growth. However, the scale of growth proposed throughout the East of England, and increasing pressure on VWC from environmental constraints, means that **high levels of water efficiency** are still required. This is particularly important in existing dwellings, where reductions in consumption have the potential to offset the increased demand from new dwellings.

VWC are confident that the potential development sites **can be supplied** without the need for major infrastructure upgrades.

However, UDC need to consider including a development control policy, requiring developers to show how, through the installation of certain components and fittings, water use per person per day will be limited to a lower rate than the current statutory requirements. A policy such as this would:

- Achieve the nationwide aspirations of Defra and the EA regarding average domestic water consumption;
- Reduce the carbon intensity/ operational and environmental costs that water companies experience in moving the required additional water around the Region – allowing additional investment in resilience;
- Help provide a buffer against climate change, interruptions to supply and any future reductions required on existing abstractions to protect the sensitive water environment in the Region;
- Assist with reducing the volumes of wastewater generated by the District, which will help to mitigate the risks described below.

1.2 Flood Risk Management

Flood risk within the District can be exacerbated by development, unless the run-off of surface water is managed appropriately. The existing National Planning Policy Framework and Technical Guidance note provides the framework for managing and mitigating flood risk from new development.

The Strategic Flood Risk Assessment completed for the District in 2008 contains policy guidance that should be adhered to, in order to ensure any development does not occur in areas of flood risk or increase the flood risk of downstream properties.

This WCS has identified, at a high level, the types of Sustainable Drainage Systems (SuDS) appropriate at the proposed site locations, and reiterated the importance that these features have with regards to attenuating and disposing of surface water runoff.

Basins, ponds and wetlands are considered the most sustainable SuDS techniques because of their greater flood risk reduction, water quality and wildlife benefits but the land needed and potential safety considerations limit their use on some sites – infiltration techniques and underground storage may be suitable alternatives though source control measures should still be integrated within the SUDS management train.

There is a risk of flooding from Surface Water at 11 of the Uttlesford Local Policy Areas as identified by the EA Flood Map for Surface Water. In most cases this flooding relates to flood risk from ordinary watercourses that run through the allocated sites. Whilst the EA Surface Water flood map gives an indication of risk it will be important to fully understand the risk from these ordinary watercourses in order to inform site layouts, and ensure that a sequential approach to site layouts can be taken. The EA surface water flood map highlights opportunities for the development to reduce flood risk elsewhere, by placing SuDS elements in overland flow paths.

1.3 Wastewater Treatment and Sewer Network

Wastewater in the District is collected and treated by Thames Water Utilities (TWU) in the southwest and Anglian Water Services (AWS) in the northeast. The waste water capacity of each Waste Water Treatment Works (WwTW) and discharge consent constraints are summarised below along with sewer network capacity issues.

WwTW	Potential Capacity, Discharge Consent and Sewer Network Issues
Saffron Waldon	The development trajectory proposes that 880 new dwellings are constructed. The existing sewerage network is at capacity and it is understood extensive upgrades are required. The predicted total Dry Weather Flow (DWF) (following the proposed development) received by the Saffron Walden WwTW will not exceed its volumetric discharge consent. However, there is no process capacity available at the WwTW.
Great Dunmow	The development trajectory proposes that 1150 new dwellings are constructed. AWS predict that the completion of the existing allocations alone will exceed the current process capacity, and also require a new volumetric discharge consent to be negotiated with the EA. A new discharge consent could be difficult to achieve and may challenge the deliverability of the proposed quantum of development in the timeframes set out. At present there is no capacity at the WwTW for the connection of additional flows from the potential extension sites, however the required process capacity should be in place by 2016.

WwTW	Potential Capacity, Discharge Consent and Sewer Network Issues
	A portion of the current wastewater from Great Dunmow is currently treated at Felsted WwTW. If necessary AWS will continue this relationship and flows will only be passed forward that can be accommodated within the existing consent for Felsted WwTW. AWS will not apply for an increased discharge consent for Felsted to accommodate any additional flows from the Great Dunmow catchment. There is no capacity in the storm water network and upgrades are required for the foul system.
Takeley	TWU estimate that the pumping station can accommodate flows from an additional 1,000 dwellings in addition to the 574 existing dwellings, and that the gravity sewer from the Airport to Bishops Stortford WwTW has adequate capacity for such growth. However, the rising main (with an approximate length of 2.5 km), will require upsizing to accommodate future development. The development trajectory proposes that 203 new dwellings are constructed. Calculations indicate that the proposed growth will not result in the existing process capacity or volumetric consent being exceeded.
Great Easton	There are known network capacity issues at Great Easton WwTW, which is a potential issue and will need further discussion with AWS. The development trajectory for Thaxted (the main settlement served by Great Easton WwTW) proposes that 60 new dwellings are constructed. Calculations indicate that the predicted total DWF received by the Great Easton WwTW will not exceed its volumetric discharge consent. However, at present AWS have identified there are issues verifying the measured flows at the WwTW and as such there is considered to be no headroom at the works until such time as reliable verification is obtained. However, there is process capacity available at the WwTW.
Newport	The development trajectory proposes that 370 new dwellings are constructed. Calculations indicate that the proposed development in the catchment will result in the existing DWF consent limit almost being reached. AWS have indicated that, due to seasonal variations in existing DWF received at Newport WwTW, there is no capacity within the existing (or proposed higher) DWF consent, or in the process capacity of the WwTW, to accommodate the flows from any new dwellings. Any increase in dwellings at Newport will require the negotiation of a new increased DWF consent with the EA, and this potentially will lead to tightening of the quality levels required in this discharge. It is understood where development is proposed to the south of the village significant network upgrades are required.
Stansted Mountfitchet	Stansted Mountfitchet WwTW serves both Elsenham and Stansted Mountfitchet. The development trajectory proposed that 400 new dwellings are constructed at Elsenham and 60 at Stansted Mountfitchet. TWU estimate that the outfall sewer from Elsenham currently has the capacity to accept flows from a maximum of 500 new dwellings , although it is understood that the existing local network capacity here is less than this (around 20–30 dwellings max.). Calculations indicate that the proposed growth will not result in the existing volumetric consent being exceeded at Stansted Mountfitchet WwTW. TWU are concerned that the process capacity at Stansted Mountfitchet WwTW requires substantial upgrading to accommodate the additional loading from the increased population.
Great Chesterford	The development trajectory proposes that 100 new dwellings are constructed. The proposed development will require significant upgrades to the network or direct connection to WwTW. Calculations indicate the predicted total DWF received by

WwTW	Potential Capacity, Discharge Consent and Sewer Network Issues
	the Great Chesterford WwTW will not exceed its volumetric discharge consent. It is understood the existing WwTW will be able to accommodate the increased flows from the new developments, in line with their phasing and actual build rates, and providing that the flows remain within the current discharge consent limit.
Felsted	Felsted serves the village of Stebbing. There are 43 allocated dwellings within the catchment. AWS have identified that there are no significant process capacity issues at the WwTW. A portion of the flow from Great Dunmow is currently being transferred to Felsted. The volume of flow that is being transferred is not currently fully known. AWS have confirmed that the flows to Felsted combined with the transferred flows from Great Dunmow will not exceed the existing discharge consent for Felsted WwTW. It is understood that there is limited available capacity in the sewer network.

Table 1-1 Summary WwTW Process, Sewerage Infrastructure and Discharge Consent Capacity

Villages

The relatively low levels of growth proposed in Clavering, Henham, Radwinter and Stebbing will not require extensive upgrades to the WwTW processes. Hence, development is not considered to be completely constrained by WwTW capacity (both process capacity and sewerage network).

Summary

A summary of the WwTW capacity issues as reported by TWU and AWS for the key market towns is summarised in Table 1-2 below.

WwTW	Can the proposed development be accommodated within		
	Process Capacity	Consent	Sewerage Network
Saffron Waldon	No	Yes[1]	No[4]
Great Dunmow	No	No	No[4]
Takeley	Yes	Yes	No[4]
Great Easton	Yes	No[2]	No[4]
Newport	No	No	No[4]
Stansted Mountfitchet	No	Yes	No[4]
Great Chesterford	Yes	Yes	No[4]
Felsted	No	Yes[3]	No

Table 1-2 WwTW Capacity Summary

[1] A new consent is not required to accommodate development; however upgrades are required at the WwTW to improve the capacity.

[2] It is currently unable to verify the existing measured DWF at Great Easton and it should be assumed that no new development can be accommodated until flows can be verified sufficiently.

[3] An increase in consent is not required with the current allocated development within Stebbing. AWS services have confirmed that the future flow transferred from Great Dunmow will not exceed the existing discharge consent for Felsted WwTW.

[4] Network upgrades to the sewage network required to accommodate future development within the WwTW catchment.

1.4 WwTW Capacity Assessment – Flood Risk

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

- New developments connected to the existing sewerage network may exceed the capacity of certain parts of the existing network; and
- DWF leaving the WwTW, and hence discharges to local watercourses, will be increased following the connection of new dwellings to the network.

To assess the existing and future capacities of the WwTW and define a combined flood risk index, a high level assessment was used to investigate:

- Increase in peak flow;
- Sensitivity of the watercourse to changes in flood levels; and
- Potential impact of flooding.

The combined risk value for all eight WwTW sites (listed in Section 1.3) has been assessed as low, therefore the increased flow from each WwTW site is classified as having a low flood risk.

1.5 Water Quality Impacts and Options

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. The dilutive capacity of the watercourses to receive increased discharges from WwTW is therefore limited. Where discharges from WwTW increase, it is likely that the chemical constraints included within these consents will be tightened by the EA, to ensure that the water quality of the receiving watercourses does not deteriorate. Uttlesford District is located at the headwaters of four river catchments.

The results highlight the importance of AWS and TWU working to improve the concentrations of phosphate (SRP) in the effluent discharges of upstream WwTW in all of the catchments. The SRP concentration reductions that would be required to bring the downstream quality up to ‘good status’ is beyond what is currently generally considered to be reliably and economically achievable using conventional technology at Saffron Walden, Great Dunmow, Takeley and Stansted Mountfitchet.

With the exception of Great Dunmow, given the small difference between the current DWF consent, and the worst case DWF predicted by 2028; the River Quality Planning (RQP) modelling for the increased DWF at all WwTW produces results similar to the current consented condition. It can therefore be concluded that the increase in DWF from the proposed growth in the study area will not make achieving the requirements of the Water Framework Directive (WFD) any more difficult than the current consented position. At Great Dunmow WwTW, discharging the treated DWF is more constrained by WFD water quality requirements than is currently the case. The level of constraint depends on whether future upgrades take place and the volume of any future flow transfers to Felsted WwTW.

The capacity of the WwTW is a key constraint in Great Dunmow. AWS predict that development could exceed the current process capacity, and require a new volumetric discharge consent to be negotiated with the EA, to avoid negative impacts on water quality. A new discharge consent is also required at Newport and potentially at Great Easton subject on-going discussion between AWS and the EA.

High level water quality modelling calculations have been undertaken to determine the indicative WwTW discharge consent standards required to protect the water environment. The results highlight the importance of AWS working to improve the concentrations of SRP in the effluent discharges upstream WwTW in all eight WwTW catchments.

The SRP concentration required to bring the downstream quality 'up to good status' is within the levels that could be currently achieved by enhanced operation of conventional processes at Great Easton, Newport and Great Chesterford.

1.6 Water Efficiency Options

In order to achieve the Code for Sustainable Homes (CSH) Level 5/6 target (80 litres/per/day) in the study area; it is necessary to consider the use of Rainwater Harvesting (RWH) or Grey Water Recycling (GWR) to augment the incoming potable water supply, in addition to water efficiency measures.

It has been calculated that a typical three bedroom house would be able to capture an average of 89 l per day of rainwater from its roof, equating to a supply of 31 l/p/d for non-potable use (with an assumed occupancy of 3, or 36 l/p/d with an assumed occupancy of 2.43). This suggests that under average conditions, a domestic level RWH system (with a storage capacity of 3,000 l) would be capable of meeting the non-potable demand for a house, allowing CSH Level 5/6 efficiency (80 litres/per/day) to be met, despite the predicted decreases in summer rainfall due to climate change.

The Building Research Establishment (BRE) tool calculates that a typical house built to CSH Level 3/4 water efficiency (105 litres/per/day) would provide approximately 67 l/p/d of greywater. Allowing for a 50% collection and recycling rate, this would still provide more than the 30 l/p/d non-potable requirement.

It must therefore be considered that some degree of RWH or GWR will be required in order for the proposed development to comply with the standards set by the CSH. This could potentially be at either a domestic, neighbourhood or District level.

2 Introduction

Uttlesford District Council (UDC) is currently in the process of preparing its Local Plan and associated development documents. The Local Plan will comprise statutory (and optional) documents that translate national planning policy to a local level strategy.

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 growth to 2028 and beyond, whilst preserving and enhancing the water environment. The WCS will form a key part of the evidence base for the UDC Core Strategy, which will be submitted in late 2012.

UDC appointed Hyder Consulting (UK) in March 2012 to complete a Detailed WCS Strategy for the Uttlesford District. This District wide study will provide the context for the more detailed studies which will be required for the strategic sites.

The purpose of this Detailed WCS report is to build on the work and update the conclusions of the Outline WCS Study completed for the District in 2008, hereafter referred to throughout this report as 'the Outline Study'.

UDC has now decided upon a final development option for their Core Strategy. Therefore, this WCS is intended to inform UDC of the possible constraints and opportunities to the strategic sites.

The purpose of this Stage 2 Detailed WCS is to:

- Provide a robust evidence base to support the growth proposals and strategy policies set out by UDC in their Local Plan Submission document;
- Confirm whether the supply of potable water to the strategic sites by Veolia Water Central (VWC) can be achieved, taking into account water resources and the existing supply network;
- Confirm with the statutory sewerage undertakers, Anglian Water Services (AWS) and Thames Water Utilities Limited (TWU), that the network of sewers in the District can accommodate the increase in flows from the proposed strategic sites and confirm the upgrades required to overcome any sewerage capacity constraints;
- Liaise with AWS and TWU to identify the wastewater treatment works (WwTW) which will be affected by the proposed development, and confirm the upgrades required to accommodate this increase in flows;
- Work in partnership with the Environment Agency (EA) and Natural England (NE) to determine the potential impacts of the increase in flows from the WwTW on the receiving watercourses and wider water environment;
- Provide UDC with guidance on their Phasing strategy to minimise the impact of the proposed growth on the existing water infrastructure; and

- Update the conclusions of the Outline Study to take account of newly available data and legislation (see below).

The key elements of the Outline Study that will be updated in this Stage 2 Detailed WCS are listed below.

- UDC has provided the quantum and development locations, anticipated phasing and completion dates which allows site specific constraint analysis;
- UDC has provided the representation received from key stakeholders on Site Allocations and Development Management Policies put forward as part of the Local Plan;
- VWC published its Final Water Resource Management Plan (WRMP) in 2010, setting out strategies for managing water resources and supplying potable water- this was only available in draft form when the Outline Study was completed;
- The EA has published Catchment Flood Management Plans (CFMPs) which describe flood risk within the catchments, and strategies for managing this over 50- 100 years. The CFMPs underwent a period of consultation in 2006/07, and the final results of the North Essex and Thames CFMP were published in December 2009 with the Great Ouse CFMP being published in January 2011.
- The EA has published River Basin Management Plans which describe the current quality of surface and ground water in the District, and set out the measures necessary to comply with the targets of the Water Framework Directive (WFD);
- In March 2012, Planning Policy Statements (PPS) and Planning Policy Guidance Notes (PPG) were superseded by the National Planning Policy Framework (NPPF). This national planning document provides guidance to Local Authorities on planning policy and therefore this WCS must consider these policies;
- The EA has provided updated water quality, rainfall and flow data; and
- AWS and TWU have provided the latest population and Dry Weather Flow (DWF) estimates, consented flow limits and WwTW and sewerage capacity data.

The key aspects to be tested as part of this Detailed WCS are to:

- Assess the solutions and phasing of the required supply and sewerage infrastructure, particularly the sewers in and around Saffron Walden and Stansted Mountfitchet;
- Liaise with the Sewerage Undertakers and the Environment Agency to better understand the implications of achieving the water quality targets and flood risk requirements for additional WwTW discharges, and the treatment capacity upgrades required to accommodate the Council's preferred development options;
- Recommend SuDS and biodiversity enhancement opportunities now the preferred development option is identified; and

- Discuss the responsibilities of the various stakeholders, with regards to removing the constraints that could delay the proposed growth.

2.1 Stakeholder Consultation

Stakeholder engagement is key to informing and providing an evidence base for the WCS in terms of the water resource, wastewater treatment capacity and water environmental capacity constraints. The following Stakeholders have been engaged throughout the WCS process from Outline to Detailed Stages:

- EA (Water Resources and Water Environment);
- NE (Wider Environment);
- AWS (Sewerage and Wastewater);
- TWU (Sewerage and Wastewater); and
- Veolia Water Central (Water Resources & Supply);

Consultations have been undertaken through Stakeholder workshops and representation provided to UDC. A data register of information received from Stakeholders can be seen in Appendix A.

2.2 Study area

Uttlesford District is located in the northwest of the County of Essex, in the East of England. The District is predominantly rural in nature, although it includes the market towns of Great Dunmow and Saffron Walden, and the key service centres of Elsenham, Great Chesterford, Newport, Stansted Mountfitchet, Takeley, and Thaxted. The District also contains a large number of smaller villages.

In respect to the water environment, Uttlesford District is located at the headwaters of four river catchments:

- The Cam and Ely Ouse;
- The Combined Essex rivers (Rivers Cam, Chelmer, Ter and Pant, and Stebbing Brook);
- The Roding, Beam and Ingrebourne; and
- The Upper Lee (River Stort and Pincey Brook).

Figure 2-1 below 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 6.

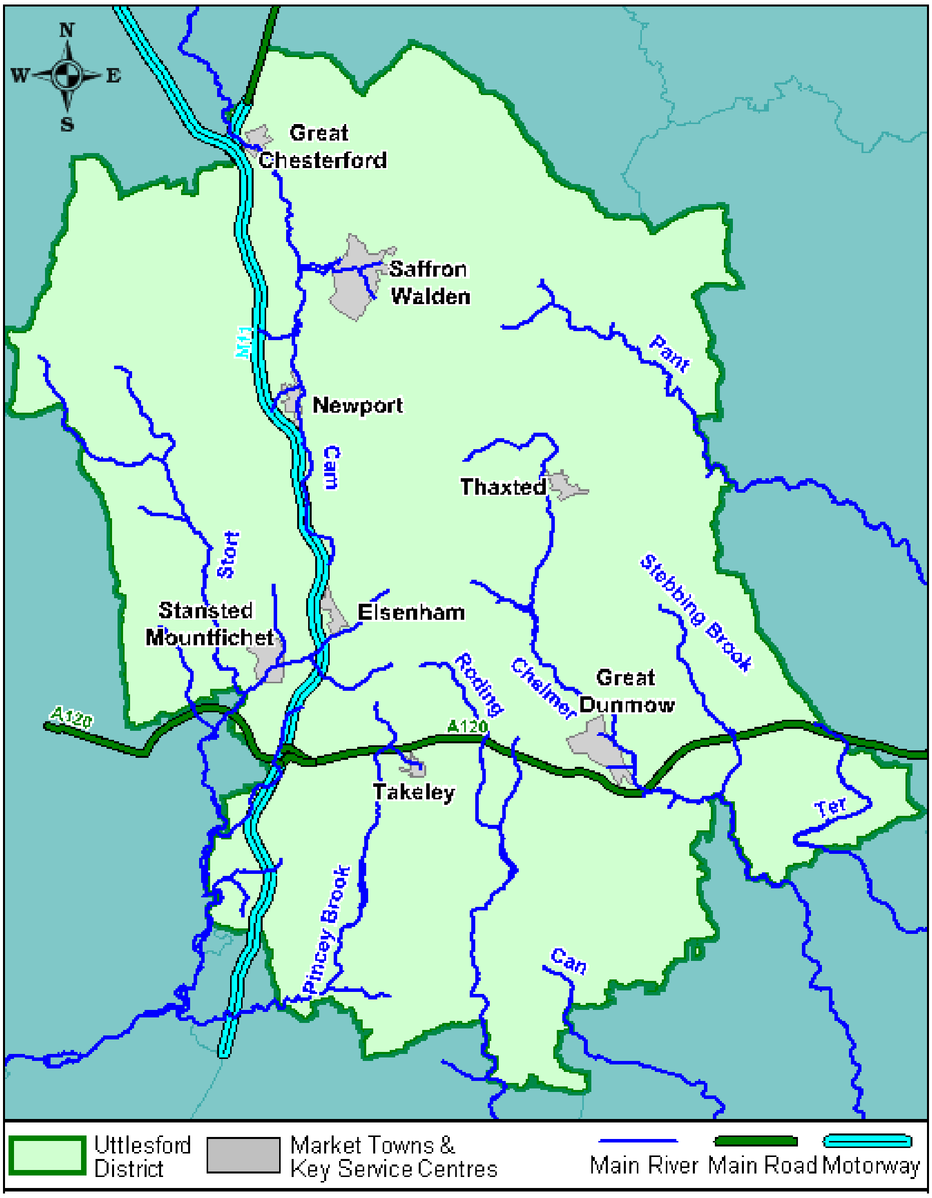

Figure 2-1 River catchments in the District

As set out in the Outline Study, the northern half of the District is underlain by the chalk aquifer (a major store of the UK's groundwater resources). However, the majority of the chalk in the District is overlain by a layer of clay. More information regarding water resources is included in Sections 6.1 and 6.1.2.

Potable water is supplied to the District by VWC. Uttlesford District lies completely within VWC's Northern Water Resource Zone (WRZ). This WRZ 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 WRZ. More information regarding potable water supply is included in Section 6.4.

The companies responsible for collecting and treating wastewater within the District are AWS and TWU. More information is included in Section 8.1.

Sources of flood risk within the District were identified in the Uttlesford District Strategic Flood Risk Assessment (SFRA)[1]. Key messages from this report, and other relevant flood risk policies, are highlighted and built upon in Section 7.1.

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.

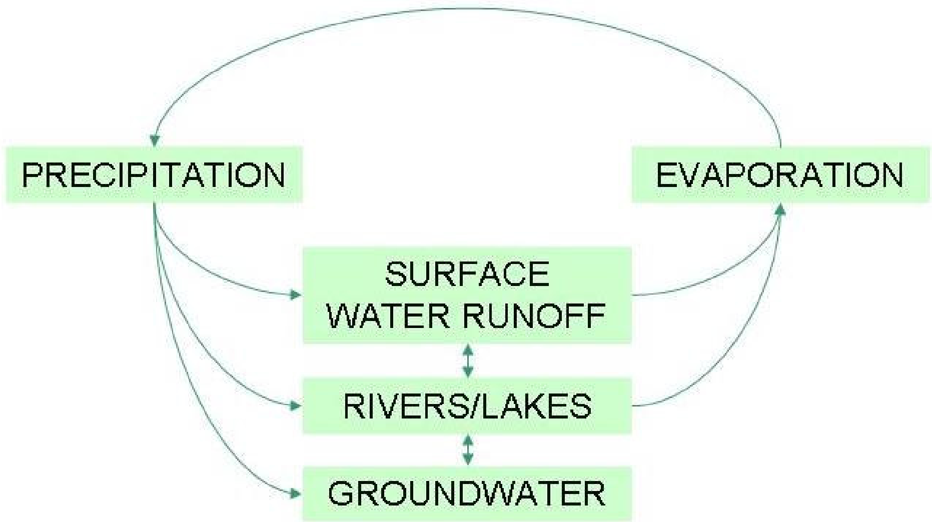

Figure 2-2 The natural Water Cycle

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. 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 paved and other surfaces in this development 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.

The wastewater from the developments 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. This consent will set out the maximum volume of treated wastewater that can be discharged, and the quality standards that this discharge must meet. Typically, the consent will set limits on the concentrations of the following physiochemical determinands: Ammoniacal Nitrogen (Amm. N), Biochemical Oxygen Demand (BOD) and suspended solids in the discharge. In addition, the consent can stipulate a Phosphorous (SRP) concentration, along with limits on the concentrations of other chemicals (such as Iron) used in the Phosphorous stripping process.

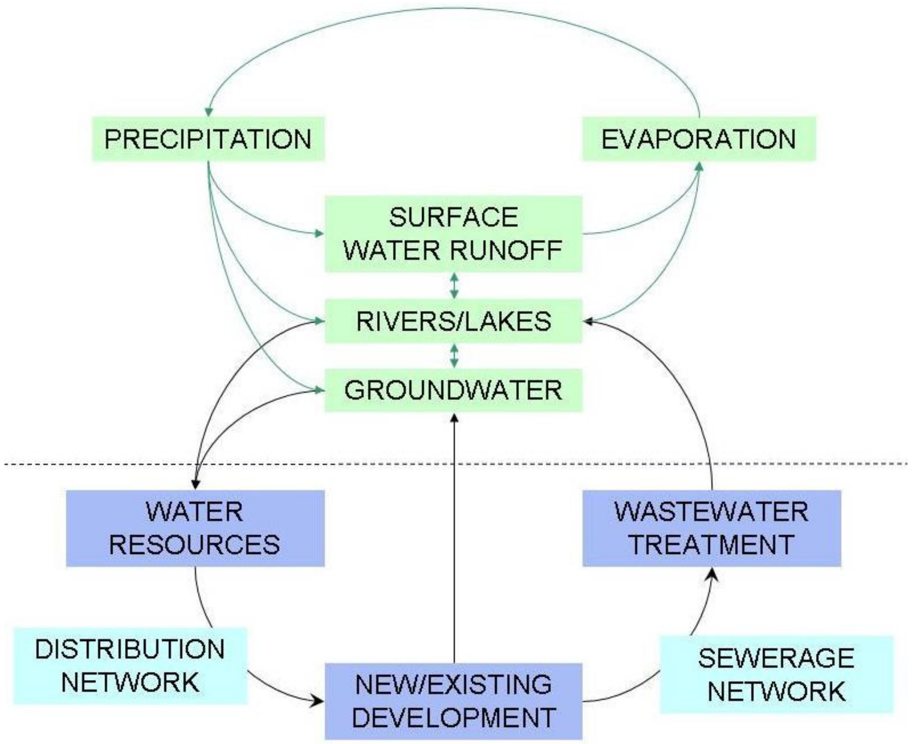

Figure 2-3 The wider Water Cycle

2.4 Current funding

Water companies primarily receive funding through their customer bills. Amongst other duties, Ofwat regulate how much these bills can increase, and what the funds are spent on. Asset Management Periods (AMP) are five yearly cycles that look at the improvement and upgrade works required for water company assets. The current AMP 5 period is 2010-2015 and the water companies will be soon in the process of preparing their programme and capital expenditure plan for the next period, AMP 6 (2015-2020).

The next price review is due to be carried out by Ofwat in 2014, this will set the amount that water companies can charge for water and wastewater services for AMP 6, in order to fund the operation, maintenance and upgrade of assets. The Price Review (PR) methodology is due to be consulted on in autumn 2012

Figure 2-4 illustrates AMP5 and the AMP 6 process to 2020 that dictates the constraints on capital project planning and funding that could influence the phasing of the planned development. Therefore it is essential that the future infrastructure requirements are accurately factored into the water companies' AMP proposals to accommodate the proposed growth in the District.

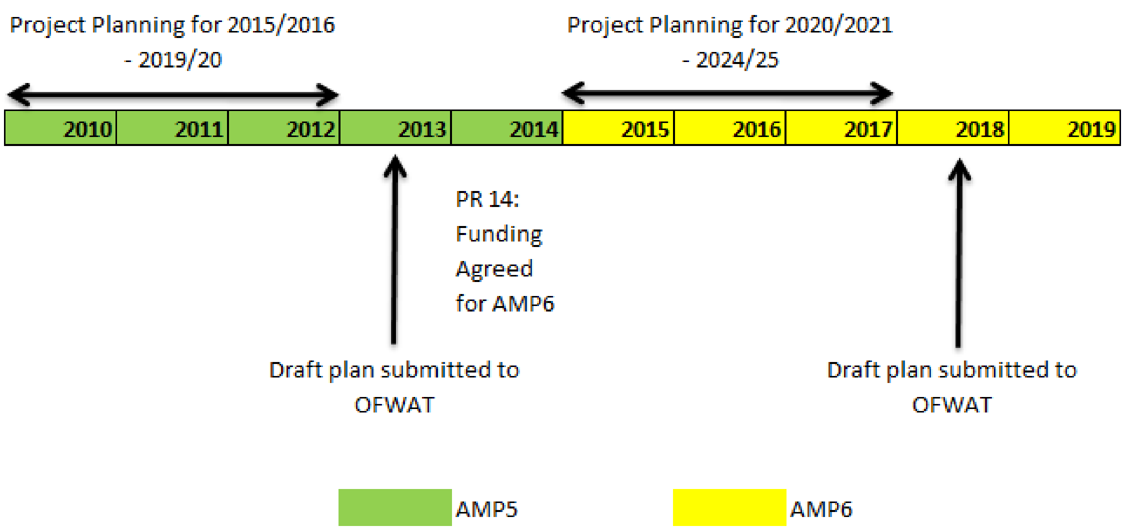

Figure 2-4 Water Company Capital Funding Cycle

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

Prior to each PR process, the EA publishes its National Environment Program, which is a list of environmental improvement schemes. This guides the water companies on areas where they need to undertake, or investigate, an improvement to the way in which their business interacts with an aspect of the water cycle. The EA expects that the water companies will progress with such projects, without exception, and Ofwat will therefore take these requirements into account when approving funds.

Under the recent Water White Paper[2], customers will have to meet the cost of financing new infrastructure, so it is essential that the regulatory regime incentivises companies to select low cost options and to only invest in measures that are needed to deliver secure and sustainable supplies.

Getting access to water and sewage infrastructure is essential for development to proceed. A recommendation from the paper is for developers to receive higher standards of service and

Water Companies to increase the transparency of infrastructure and requisition charges. Market codes and charging schemes are being introduced to increase transparency and negotiations around bulk supply and sewerage service arrangements for new building developments. This will be of particular value for developers of Greenfield sites.

Wastewater treatment improvements are generally agreed by Ofwat and funded through customer bills as above. However, the prime source of funding for sewerage network improvements is by developers through the requisition process described below.

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 on the planning system (through appropriate planning conditions) to ensure that development does not lead to an unacceptable risk of flooding or pollution of watercourses. The situation, with regards to the connection of surface water drainage to public sewers, should be improved by the implementation of the Flood and Water Management Act 2010. Where new infrastructure is required to serve development, developers can requisition infrastructure in accordance with S41 and S98 of the Water Industry Act 1991. 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.

For infrastructure serving more than one development site, the Water Industry Act assumes that the first developer will pay the majority if the costs. In most cases, however, it will be preferable to share costs equitably between developers. Such an agreement will require facilitating by UDC.

3 Policy context

The following sections introduce the changes to national policies that were previously not discussed in the Outline Study. Key extracts from these policies relating to new national planning policies and mitigating the impacts on the water environment from new development are summarised below.

3.1 National

3.1.1 National Planning Policy Framework

The National Planning Policy Framework (NPPF) was published in March 2012 and represents an effort by the Government to achieve a reduction in the complexity of the planning system. It replaces the majority of the former Planning Policy Guidance documents (PPGs) and Planning Policy Statements (PPSs). A technical guidance document on flood risk and minerals was also issued in support of the NPPF as an interim measure pending a wider review of guidance.

The NPPF relies on the fact that specific details of the requirements previously obtained from national planning policy will be set out in local plans. These plans will be founded on a locally developed evidence base, including relevant technical studies, such as this Water Cycle Study. By emphasising the importance of local plans local communities will feel empowered to decide the look and feel of the local area.

Local authorities should ensure that planning documents consider these policies, and they can use some of the policies contained within NPPF to make decisions on individual planning applications.

The key themes in NPPF that are most relevant to this WCS are:

- Delivering Sustainable Development and Climate Change;
- Housing;
- Biodiversity and Geological Conservation;
- Planning and Pollution Control; and
- Development and Flood Risk.

Relevant topics that consistently occur within the above mentioned NPPF 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.

3.1.2 Flood and Water Management Act 2010

The Flood and Water Management Act passed into statute in April 2010. It sets out a number of changes to the way that new development and water infrastructure will interact, including the proposed future mechanism for utilising SuDS where practical. SuDS assist in reducing the rates (and potentially volumes) of surface water arising from new developments and therefore reduce the impacts on the existing water cycle. This is important in ensuring that existing flood risks do not increase as a consequence of new developments, and can reduce (or even eliminate) the need to use existing sewerage systems to convey surface water. This reduces unnecessary expenditure in the uprating of existing sewers and WwTW, reduces the probability of untreated discharges of wastewater during flood events, and can delay the requirement to consent increased flows from WwTW.

The Act establishes a SuDS Approving Body (the “SAB”) at county or unitary local authority levels, which will have responsibility for the approval of proposed drainage systems in new developments and redevelopments. This approval must be given before the developer can commence construction. It is recommended that Essex County Council (ECC) are consulted in line with their duties under the Act.

In order to be approved, the proposed drainage system would have to meet new national standards for sustainable drainage published in draft). The National Standards sets out the criteria by which the form of drainage appropriate to any particular site or development can be determined, as well as requirements for the design, construction, operation and maintenance of SuDS.

Where planning permission is required applications for drainage approval and planning permission can be lodged jointly with the planning authority but the SAB will determine the outcome of the drainage application.

The Act also makes the right to connect surface water drainage from new development to the public sewerage system conditional on the surface water drainage system being approved by the SAB. Before determining an application the SAB must consult, amongst others, any sewerage undertaker with whose public sewer the new drainage system will connect to and, if the drainage system directly or indirectly involves the discharge of water into a watercourse, the EA or Land Drainage Authority.

The right to connect newly built foul sewers to the public network remains, but an adoption agreement must be in place with the relevant sewerage undertaker. The sewerage undertaker will be obliged to adopt and maintain new foul sewers which connect to the public system, and those (very few) surface water sewers with no SuDS alternative which connect to the public system, where this has been approved by the SAB.

3.2 Local policy

3.2.1 Uttlesford District Draft Local Plan

The vision for the Draft Local Plan is to achieve a sustainable balance between water supplies and demand. Policies are being developed through the Local Plan to make sure development:

- Addresses issues of water supply and wastewater disposal;
- Reduces the consumption of energy and water, minimizes the production of pollution and waste and incorporates facilities for recycling water and waste;
- Reduces flood risk – UDC will seek to allocate development beyond the floodplain. Flood Risk Assessments will be required for appropriate sites and management sought. Development will be directed to areas of lowest flood risk in accordance with the sequential approach in NPPF;
- All new buildings and extensions, and the development of car parking and hard standing, will incorporate SuDS to limit, where possible, water run-off-rates and volumes to the original Greenfield discharge. Only where there is a significant risk of pollution to the water environment, inappropriate soil conditions and/or engineering difficulties, should alternative methods of drainage be considered with adequate assessment and justification provided; a consideration should still be given to pre and post runoff rates. If this is not possible it will be necessary to demonstrate why it is not achievable;
- Development proposals adjoining the main rivers, ordinary watercourses and culverts should be set back to provide a suitable buffer in accordance with the relevant EA requirements. Developments should not compromise the ability of organisations responsible for maintaining watercourses from accessing and undertaking works;
- The Council will seek to restore/deculvert rivers through the determination of planning applications when and where the opportunity arises;
- Details of proposed SuDS and how they will be maintained will be required as part of any planning application and will need to be agreed by the Council. For smaller developments, SuDS could comprise green roof or rainwater harvesting techniques; and
- Examples of the type of system that can be provided for large-scale developments are reed beds and other wetland habitats that collect, store, and improve water quality along with providing a habitat for wildlife.

4 Methodology & Assumptions

4.1 Development

The Outline Study was completed in time to accompany the *'further consultation on the preferred options'* which ran from 15 February 2010 to 9 April 2010. Option 4 was presented which comprised a new settlement of 3,000 dwellings at Elsenham with the remaining 1,000 dwellings distributed around the existing urban areas and rural villages.

However, the public response favoured a more balanced spread of development across the existing market towns and key villages, and a driver to reduce the overall total number of new dwellings proposed for the District.

In tandem with the response from the public consultation in 2010, the Government announced its intention to revoke the Regional Spatial Strategy (RSS) targets that all previous work). UDC was therefore tasked with locally determining a housing target. UDC has therefore revisited their Local Plan preparation accounting for residents' views which came to light during previous consultations.

In January- March 2012, UDC undertook a further consultation on their Site Allocations Development Plan Document and Development Management Policies to understand what residents would be prepared to see developed, and the development control policies they should use to assist the process.

Following the above process, a number of sites have been brought forward to be analysed as part of this Detailed WCS. UDC's Local Plan identifies approximately 3,300 new homes to be delivered between 2013- 2028. In addition there are approximately 2,756 dwellings that are either under construction or that have approved planning applications. Consultation with both TWU and AWS confirm that these have been accounted for within their infrastructure planning.

4.1.1 Residential

UDC provided site location and expected period of development details for the residential development sites which form its 15 year supply of housing. This is information which is contained within the Council's Strategic Housing Land Availability Assessment (SHLAA), which is part of the Local Plan evidence base and is published on the Councils website.

In addition to this data, UDC provided details of any completions up until 2012/2013, which were then subtracted from the total dwellings numbers remaining at the above sites, so as to allow an accurate comparison with current data.

This allowed the creation of an up to date estimate of the proposed housing trajectory from 2013 to 2028 for the District, which could then be apportioned to the various catchments within the District (see Appendix B) to analyse the potential impact of the proposed growth.

The capacity of the existing water infrastructure to accept the demands from the proposed development, including any impacts due to future climate change and tightened legislation/

environmental standards, has been assessed through consultation with the water companies in the WCS Steering Group. This allows for an understanding of the limitations of the current system, and also those improvements being planned by the water companies to accommodate the proposed development, mitigate possible impacts of climate change, and maintain or improve current levels of service. High-level information was also available from the water company business plans and Final Water Resource Management Plans (FWRMP).

4.1.2 Occupancy Rates

To assess the impact of the proposed development within the District on the water infrastructure, an estimate of the predicted population and dwellings amounts, and hence occupancy rate, is required.

It was agreed at the Stakeholder meeting on the 20 June 2012 that an Occupancy Rate of **2.43** should be adopted as a constant occupancy rate for calculations in the detailed WCS based on UDC supplied data. This occupancy rate will ensure a conservative estimate of the impacts on the water infrastructure and wider water environment.

4.1.3 Non- Residential Sites

Following discussions with water and sewerage companies, it has been assumed that the overall demand for water and wastewater service from businesses are unlikely to have significant impacts on the WCS and they are not expected to be assessed within the detailed study. In order to verify the significance of such sites key information such as scale, location, type and phasing will be required. This information was not fully available at the time of this assessment.

Any local water or wastewater infrastructure improvements required to service these developments will be delivered via financial agreements between the developer and the statutory undertaker. High level guidance as to the local constraints which are known to affect these sites has been provided by the stakeholders.

4.2 Water Resources and Supply

Three potable water demand scenarios, dependant on Per Capita Consumption (PCC) rate projections, were developed to assess the potential impact of the proposed development:

Scenario	PCC of Existing Dwellings	PCC of New Dwellings
Best Case	PCC reduces to DEFRA aspirational target of 130 l/p/d	CSH Level 3 present – 2016 CSH Level 6 post 2016
Business Plan Case	Reducing in line with VWC predictions	CSH Level 3 present – 2016 CSH Level 6 post 2016
Worst Case	166 l/p/d – remains constant in line with VWC 2008/09 figures	PCC required by 2009 changes to Building Regulations is achieved (125 l/p/d)

Table 4-1 Development Impact Scenarios for Potable Water Demand

The PCC values, which form the business plan scenario (and the starting point of the two other scenarios), are based on the VWC predicted PCC rates for metered and un-metered customers, and weighted to take account of the predicted changes in meter penetration rates, as predicted in their 2010 FWRMP[3]. This produces a prediction of average PCC rates for the existing population, as illustrated in Figure 4-1.

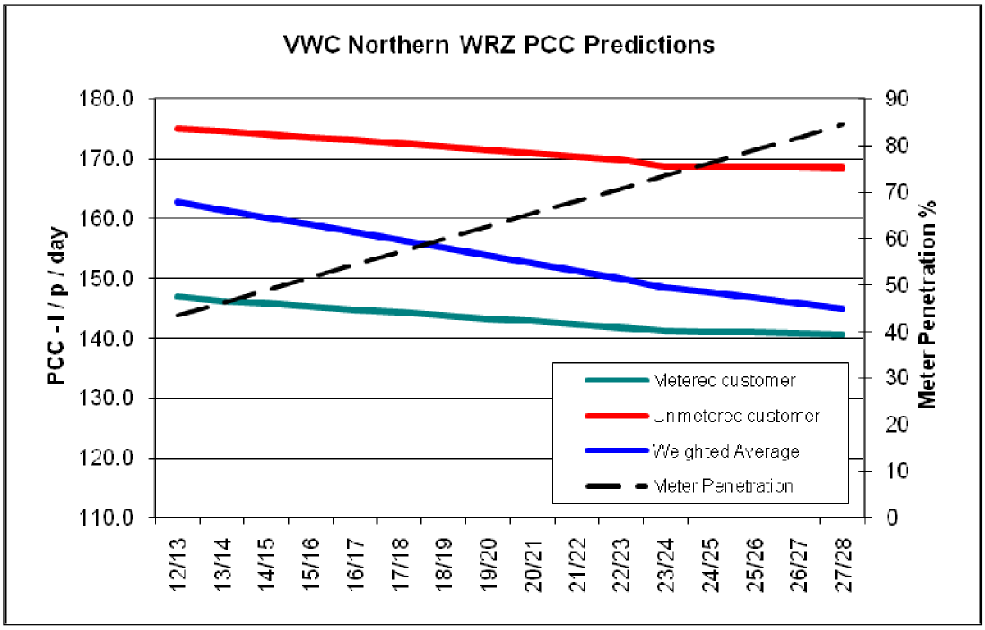

Figure 4-1 Average PCC predictions for existing population, weighted by meter penetration, as per now VWC FWRMP 2010

Using the scenarios above, the change in potable water demand (for domestic properties) due to the proposed development has been assessed using the following equation:

Total District Demand Change in demand from existing dwellings + new dwelling demand

Where demand from new and existing dwellings is calculated from:

number of dwellings x occupancy rate x PCC

The development of new employment sites will require modification and upgrades to the existing network. Where new sites are proposed, any constraints that potentially restrict the provision of potable water or wastewater services have been highlighted. However, employment sites have not been included in the overall volumetric assessment of potable water demand and increased wastewater flows, due to the inherent difficultly in predicting the demand from different land uses. Water companies have advocated the exclusion of employment sites from the Detailed WCS.

TWU and AWS are under no obligation to accept trade effluent to their wastewater systems. When doing so, they can request improvements to some process streams, depending on the chemical consistency 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.

4.3 Wastewater Treatment

The potential impact of the proposed growth in the District has been estimated by calculating the increase in foul water arriving at each of the WwTW from the proposed growth. The calculations are completed in terms of 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 NPPF and the Flood and Water Management Act.

Changes in Dry Weather Flow (DWF) received by the WwTW have been assessed using the following equation:

Total DWF Existing DWF + DWF from new dwellings

Where DWF is calculated from:

(*number of dwellings x occupancy rate x PCC) + allowance for infiltration*

The existing present day DWF has been calculated using population numbers for each WwTW catchment (as shown in Table 4-2). The population numbers were provided by Anglian Water and Thames Water. The population numbers provided constitute the *number of dwellings x occupancy rate* element of the above equation.

WwTW	Existing Population
Saffron Waldon	18,125
Great Dunmow	9,439
Takeley	1,850
Great Easton	3,649
Newport	3,127
Stansted Mountfitchet	9,900
Great Chesterford	3,467

WwTW	Existing Population
Felsted	6,469

Table 4-2 Existing Population Figures used in DWF calculations

The future post growth DWF has been calculated by taking the number of proposed dwellings within each WwTW catchment and multiplying this figure by the occupancy rate of 2.43. The future DWF figure was added to the present day DWF to give a total post growth DWF.

WwTW	Increase in Dwellings	Occupancy rate	Increase in Population	Total future Population
Saffron Waldon	880	2.43	2138	20,263
Great Dunmow	1150	2.43	2794	12,234
Takeley	200	2.43	486[1]	2,336[1]
Great Easton	60	2.43	145	3,795
Newport	370	2.43	899	4,026
Stansted Mountfitchet	490	2.43	1190	11,091
Great Chesterford	100	2.43	243	3,710
Felsted	43	2.43	104	6,573

Table 4-3 Post Growth Figures used in DWF calculations

[1] The additional population is not drained to Takeley WwTW. It is passed to Bishops Stortford WwTW. The final population of Takeley WwTW will remain around the 1,850 (allowing for infill). The impact of the additional population on Bishops Stortford STW is negligible (less than 1%).

The allowance for infiltration, which accounts for water entering the sewerage network from incorrect or illegal connections, and through defects in the existing assets, is estimated to be an additional 25% of the DWF from dwellings, based on guidelines from water companies and previous experience undertaking neighbouring WCS.

Similarly, PCC rates used in the calculations correspond to current values used by AWS for planning purposes (144 l/s), and are assumed to remain constant at this level to 2028 in existing properties. This produced the most conservative estimate of the flow increases at the WwTW.

The changes in demand for water supply (and sewerage and wastewater treatment services) that emerge from the above scenarios have been compared with water company plans, and used as a tool to aid consultation with the water companies.

The calculated DWF was compared with the measured DWF at each WwTW. As the measured flows cannot be sufficiently verified at Great Easton there is uncertainty in the recorded DWF at the WwTW at present. Therefore the calculated DWF has been used in the assessment as a baseline to calculate the future DWF post development, Refer to Section 8.3 and Appendix E for further details regarding the DWF calculations undertaken as part of the WCS.

4.4 Water Quality

The capacity of the water environment, most notably the capacity of the receiving watercourses to receive greater discharges from WwTW, has been assessed through a review of the EA River Basin Management Plan (RBMP). These plans describe the current water quality of the receiving watercourses, and the proposed remedial actions for the future to meet the requirements of the Water Framework Directive (WFD).

High level water quality modelling calculations have been undertaken to determine the indicative WwTW discharge consent standards required to protect the water environment, given the rise in volumetric discharge rates anticipated from the proposed development. This has been based on a PCC value of 144 l/p/day, to ensure conservative limits are specified. These results are indicative only as the actual consent standards will be determined at the time of consent review, and will depend on flows, river and discharge quality, and cost benefit considerations (for example, the treatment processes that are considered to be technically feasible and financially viable can change).

4.5 Environmental Capacity

The Outline Study sets out the requirements of the Water Framework Directive (WFD) and the environmental considerations across the District. The wider environmental considerations drawn from the Outline Study are:

- Sites of Special Scientific Interest (SSSI);
- Local Wildlife Sites (LoWS);
- UK Biodiversity Action Plan (UKBAP) priority habitats;
- Special Areas of Conservation (SAC); and
- Special Protection Areas (SPA).

Each preferred site identified by the Local Plan process will impact on the wider water environment to different extents. Some possibly will impact on a number of European sites and SSSIs whilst others will present a much lower risk. A summary of the environmental constraints for each site are outlined in Table 8.4.

The sites will also provide opportunity for biodiversity enhancements such as habitat restoration and creation, and in all cases, but particularly where there is a high quantum of development proposed, the developer should strive to provide multi-functional greenspace to deliver positive benefits for wildlife and people at each location.

4.6 Limitations

In addition to the accuracy limitations associated with predicting occupancy rates and PCC, the high-level calculations described above contain a number of inherent limitations. These include:

- Linear interpolations of changes in metering penetration rates– this may not accurately represent future trends;
- Infiltration rates – these use a rough estimate based on water company experience, but will actually vary between individual WwTW catchment areas and as assets deteriorate/ are replaced;
- Future climatic changes may increase the demand for water – this is factored into water company plans, but will make targets such as the CSH more difficult to achieve; and
- The link between occupancy rates and PCC – the conventional understanding within the water industry is that smaller households tend to have higher PCC rates, as there are fewer opportunities to 'share' demand for washing machines, dishwashers etc. The predicted trend of falling occupancy rates therefore could make the above PCC targets harder to achieve.

5 Development Context

5.1 Residential development

UDC's Local Plan identifies approximately 3,300 new homes at an average delivery rate of 338 new homes per year. Appendix C includes UDC's preferred residential site locations. The estimated housing trajectories and total amounts were supplied by UDC for Market Towns & Rural Settlements (See Table 5-1) and Key Villages (See Table 5-2). The housing trajectories for the preferred sites have been presented as anticipated dwelling phasing, as informed by UDC, subject to other factors such as market conditions and time requirements for approvals and site construction.

The population projections associated with the new dwellings projections are based on the average household sizes calculated by UDC on the basis of average occupancy rates of 2.51 in 2001 (2001 Census) but it is estimated that this will decrease to 2.29 by 2028. It was agreed at the Stakeholder meeting on the 20th June that an Occupancy Rate of 2.43 should be adopted for calculations in the detailed WCS based on UDC supplied data.

The growth trajectories do not consider:

- Sites under construction and approved applications;
- Live Applications;
- Applications at appeal;
- Windfall Sites; or
- Traveller Sites.

AWS and TWU have confirmed the 2,756 sites that are either under construction or approved applications noted in the draft Local Plan (2012) have already been accounted for and their needs can be met. It is expected that for live applications and those at appeal that there has been sufficient discussion between the water and sewerage companies and the developers during consideration of the application. Therefore, if the impacted water companies feel that the requirements of these applications can be met, then there is no need to consider them as part of the detailed WCS.

This leaves a remainder of **3,223** dwellings to be allocated to meet the 2028 Local Plan target.

The Local Plan which was put out for consultation in June 2012 sets out the policies and site allocations showing where and how this new development will be delivered over the next 15 years, as illustrated in Table 5-1 and 5-2.

Settlement	UDC Policy Area	Construction Commences	Dwellings per year 2013- 2015	2016- 2018	2019- 2022	2023- 2025	2026- 2028	Total within UDC PA	Total Within Settlement
	PA 2	2014	60					60	
Saffron Walden	PA 1	2020			200	300	300	800	
	PA 3	2014	20					20	880
Great Dunmow	PA 1	2019			250	300	300	850	
	PA 2	2017		200	100			300	1150
	PA 1	2014	55	100				155	
	PA 2	2015	40	75				115	
Elsenham	PA 3	2017		80	50			130	400
Great Chesterford	PA 1	2015	20	20				40	
	PA 2	2014	60					60	100
	PA 2	2015	20	50				70	
Newport	PA 1	2015		100	200			300	370
	PA 1	2014	11					11	
	PA 2	2014	14					14	
Stansted	PA 3	2015	35					35	60
	PA 1	2015	40	40				80	
	PA 2	2013	25	13				38	
	PA3	2013	40					40	
	PA 4	2016		15				15	
Takeley &	PA 5	2015		30				30	
Little Canfield	PA 1	2014	60					60	
Thaxted	PA1	2014							203
			500	723	800	600`	600	3223	

Table 5-1 Housing Trajectories & Phasing for Market Towns and Rural Settlements

Site Description	2013- 2015	2016-2019	Total	Total in Settlement
Clavering 1: Land to the rear of the shop and Oxleys Close	20		20	20
Henham 1: Land south and east of Vernons Close		20	20	30
Henham 2: land north of Chickney Road and east of Lodge Cottages		10	10	
Radwinter 1: Land north of Walden Road		40	40	40
Stebbing 1: Land to east of Parkside and Garden Fields		10	10	10
	20	80		100

Table 5-2 Housing Trajectories & Phasing for Key Villages

The site allocations also include approximately 100 dwellings that will be accommodated in the small rural villages within the District between 2013– 2028. The scale of this growth is likely to be limited to around 10–30 dwellings per village.

The most sustainable form of development would be to focus this growth in key market towns and villages which have existing facilities like a school or village shop. The key areas currently identified are listed below:

- Saffron Walden;
- Elsenham;
- Great Chesterford;
- Newport; and
- Great Dunmow.

Any major water infrastructure, or water environment, constraints or opportunities, which may preclude or support the choice of these new settlement locations and villages, have been identified in Sections 6 to 10, and are summarised in Section 12.

Figure 5-1 illustrates the potential range of development locations in relation to the existing settlements and the main rivers.

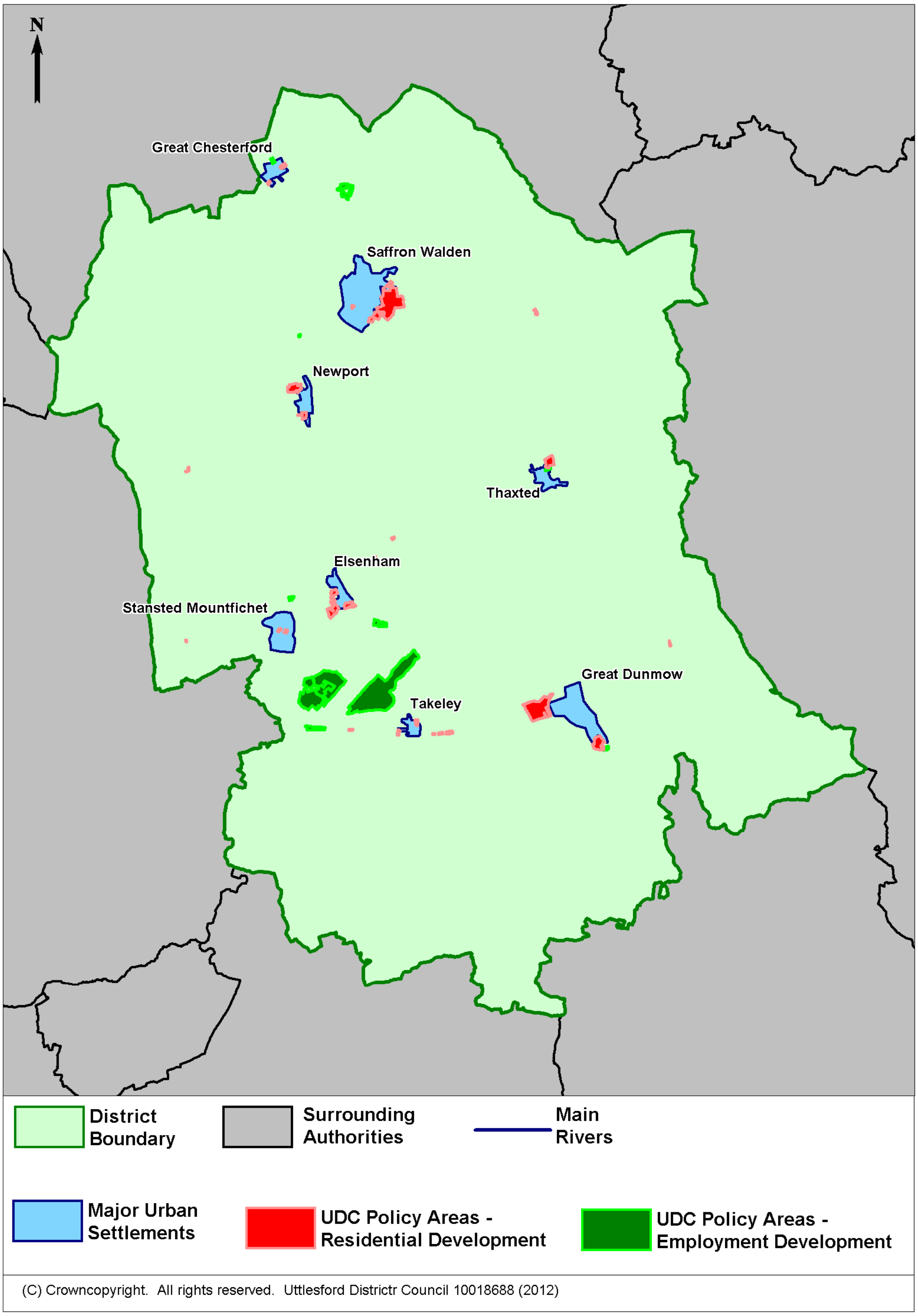

Figure 5-1 Residential and Employment UDC Policy Areas

5.2 Employment area development

Since the revocation of the RSS, UDC has been required to revisit their employment strategy. UDC's policies have been developed with full regard to the Employment Land Review (ELR) prepared in April 2011.

The ELR predicts a net increase in demand for employment land in the District of 3.8 ha between 2011 and 2028.

UDC has identified a number of possible employment sites across the District, on top of those sites already allocated or under construction. However, the configuration of the employment demand will change over this period, this is summarised in the Table 5.3 below.

	Number of Jobs (created /lost)	Employment Densities	Floor space Requirements sq. m. gross)	Land Requirements (Ha)
Factories	-1,600	32	-51,200	-12.8
Warehousing	1,150	32	36,800	9.2
Offices	1,650	18	29,700	7.4

Table 5-3 Changes in the Employment land allocations to be taken forward in the Local Plan

The sites that have been brought forward as part of the Local Plan are summarised in Table 5.4 below. The locations of employment sites are shown in alongside the UDC residential sites in Figure 5-1. The layout of the Stansted Airport sites is shown below in Figure 5-2.

Site Description	Site Size (Hectares)
Chesterford Park Draft local plan policy SAE7 - allocated employment site	15.7
Wendens Ambo Draft local plan policy SAE3 - allocated employment site	0.42
Wendens Ambo Protected employment	0.57
Wendens Ambo Protected employment	1.46
Elsenham Gaunts End Draft Local Plan policy Elsenham policy 4	3.53
Elsenham Gaunts End Draft local plan policy Elsenham policy 4	2.07
Elsenham Gaunts End Safeguarded employment site	2.98
Stansted Airport Stansted Policy 2 - non airport related employment	18.09
Stansted Airport Stansted Airport policy 1	72.67
Stansted Airport Stansted airport policy 1	12.17
Stansted Airport Stansted airport policy 1	51.12
Stansted Airport Stansted airport policy 1	210

Site Description	Site Size (Hectares)
Start Hill Gt Hallingbury Gt Hallingbury policy 1.	5.58
Start Hill Employment area	2.22
Takeley Protected employment site 1	0.07
Takeley Protected employment site 2	1.79
Great Dunmow Policy area 3 Waste transfer site	1.77
Alsa Street Policy SA E6	2.08
Clavering Employment land	1.25

Table 5-4 Potential employment land allocations to be taken forward in the Local Plan

At this time, the AWS and TWU do not consider it is appropriate to make qualitative or quantitative assessments of the above areas until the full details of the sites are understood at the pre-planning stage of an application. However, high level advice has been provided for these sites, in relation to the following topics:

- Flood risk constraints are discussed in Section 7.2; and
- Local wastewater network capacity constraints, WwTW process capacity constraints and receiving watercourse quality constraints are all discussed in Section 8.4.2.

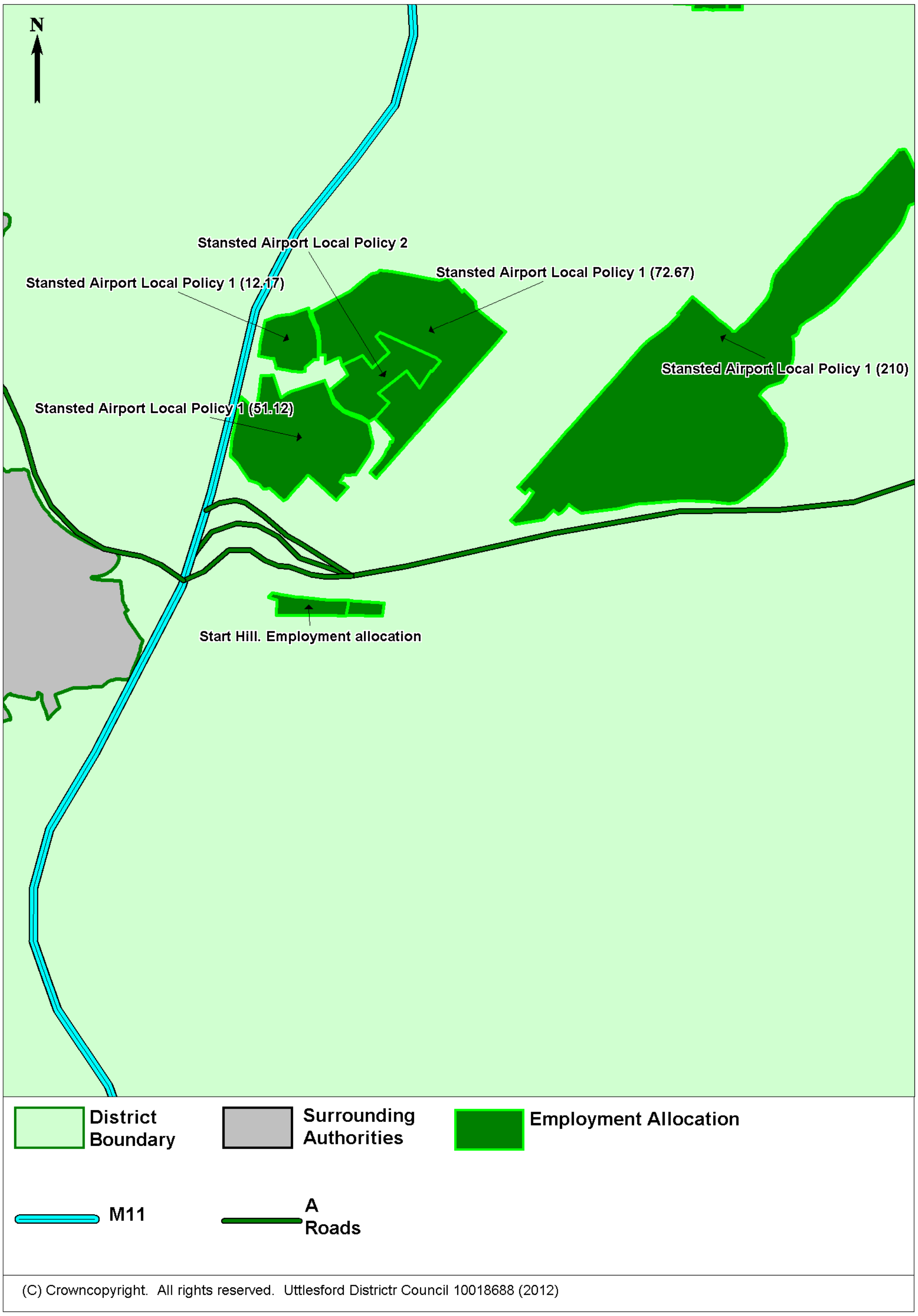

Figure 5-2 Stansted Airport Employment Sites

6 Water Resources and Supply

Potable water is supplied to Uttlesford District via the VWC trunk main network, and localised groundwater abstractions. VWC receive an import of water from the AWS Ruthamford WRZ into their Northern WRZ. The District contains nine borehole pumping station locations. These are all groundwater sources, with treatment carried out at source before being put into supply. Water resources and supply are discussed in more detail below.

6.1 Current Supply

6.1.1 Hydrology

The Outline Study reviewed the EA Catchment Abstraction Management Strategies (CAMS) for the surface water and groundwater catchments from which VWC supply the District with potable water.

Each CAMS uses Water Resource Management Units (WRMU) to make integrated assessments of groundwater and surface water resources. Table 6-1 shows the relevant CAMS and WRMU for the District, and highlights the availability of water for further abstraction

CAMS catchment	WRMU reference	Uttlesford Rivers Affected	Resource Availability Status
Cam and Ely Ouse	C: (Upper River Cam, Rhee and Granta)	Cam and tributaries, Granta (River Bourn near Ashdon)	Over-licensed, (the underlying chalk aquifer is assessed as Over-abstracted)
Combined Essex	1: Pant/Blackwater, Ter, Roman/Layer, Wid, Brain, Chelmer	Pant, Ter and Chelmer	Over-abstracted
Roding, Beam and Ingrebourne	2: Upper Roding	Roding	No water available
Upper Lee	1: Rivers Lee, Mimram, Beane, Rib, Ash and Upper Stort	Stort	Over-abstracted
	2: River Stort and Pincey Brook	Stort, Pincey Brook, Stansted Brook	Over-licensed

Table 6-1 Resource Availability in the WRMU around Uttlesford

The following key points have been extracted from the CAMS[4] document:

The Rivers Stort and Cam 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 EA is the national lead. Abstraction of water resources and point source discharges are recognised as resulting in significant impacts on Chalk Rivers.

As shown in Table 6-1 none of the WRMUs in the vicinity of Uttlesford 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.

This CAMS information still stands, however a new CAMS document is due out in December 2012. In advance of this document, the EA provides the following advice in terms of abstractions:

“Our CAMS assessment process is somewhat different this time around, since the advent of the Water Framework Directive (WFD). Now water availability is calculated on the WFD water body scale, rather than on the catchment scale as done previously. Also a minimum environmental flow has to be protected, which is based on the sensitivity of the ecology of the catchment to water stress, rather than the more 'flat figure' approach used previously. We also assess water availability across four points of the flow duration curve - at Q95, Q70, Q50 and Q30, to give a more rounded picture than the previous assessment at Q95 alone.

The practical upshot of this for Uttlesford District that there is some water available to be licensed across the flow duration curve, down to just above Q95, around the River Roding, where it runs up through Aythorp Roding and Bamber Green. Elsewhere in the District area, surface water has been assessed as either over licensed or over abstracted at all four assessment points - meaning that any water available to be abstracted is only available at very high flows of above Q30, and as such only limited volumes will be available”.

6.1.2 Hydrogeology

The northern half of the District is underlain by the Chalk aquifer, with extensive superficial deposits of Boulder Clay. The Chalk aquifer is a major aquifer, in that it is a highly productive stratum, which is important for regional supply and for supporting flows in local watercourses.

Since the Outline Study, the EA has changed their classification system for Groundwater Vulnerability Zones (GWV zones) to Aquifer Maps and refers to these as Principal, Secondary A or Secondary B Aquifers.

The extent of the Principal and Secondary aquifers within the District is most clearly illustrated by mapping the EA’s Aquifer Maps (see Figure 6-1). These zones were created based on existing soil maps and databases, and describe the vulnerability of the underlying groundwater resources to pollution from surface contaminants, as high, intermediate or low. This EA classification of the land surface reflects the ability of contaminants to leach through the covering soils and pose a potential risk to groundwater at depth. The maps also indicate areas where the presence of low permeability drift may provide additional groundwater protection.

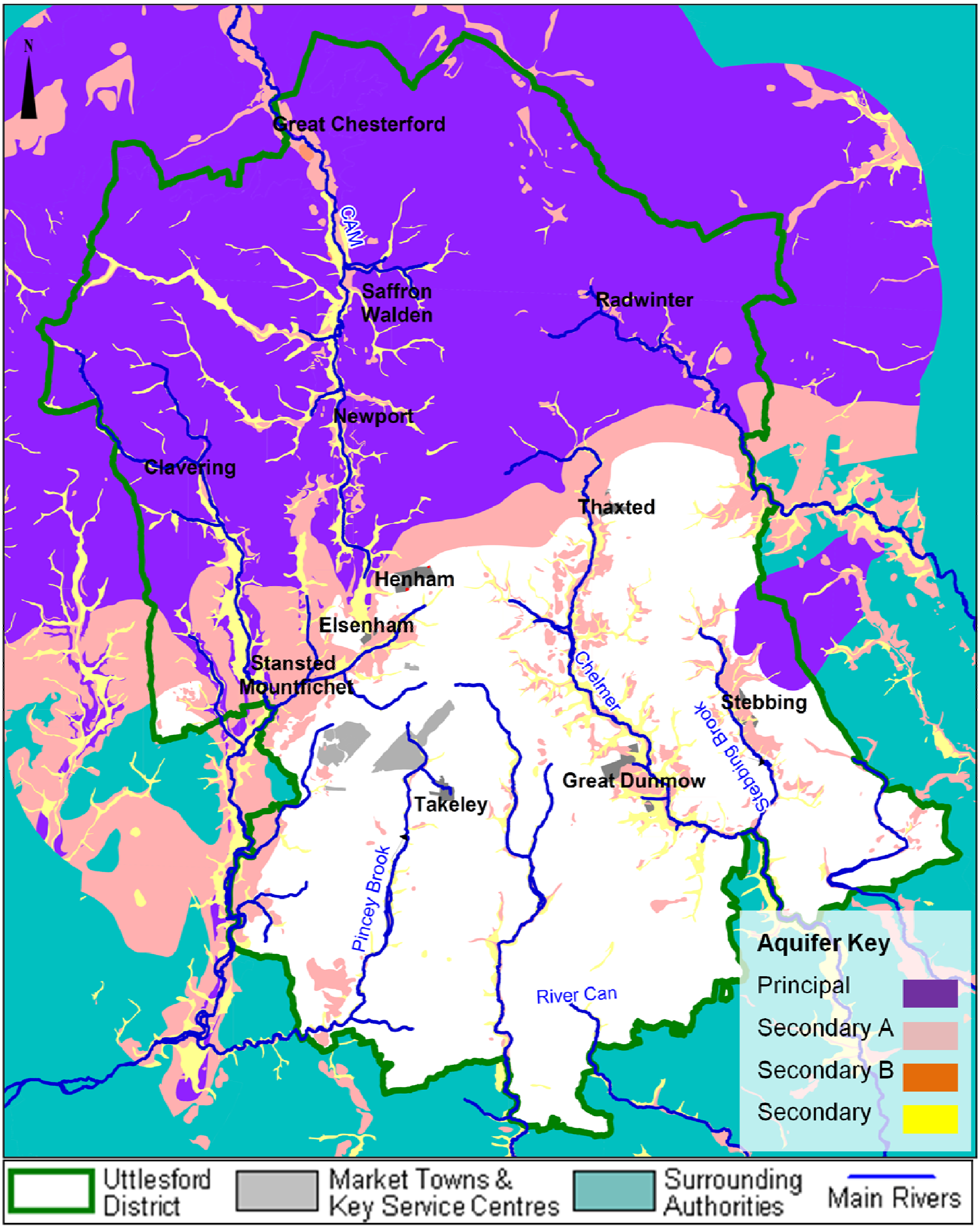

Figure 6-1 Aquifers within the District, as depicted by Grounder Vulnerability

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 further in Section 7.

6.2 Future Supply

VWC predict that supply/demand for their northern WRZ balance is currently stable, as a result of a programme of investment to improve capacity and reliability of the system. Analysis indicated that VWC do not need to carry out further investment to maintain security of supplies until 2035 at average demand, or 2026 for the critical period demand. No supply or demand side options are required before 2026 since VWC do not have a supply-demand deficit before this date. It is predicted that a supply-demand deficit begins to emerge after 2025-26 so that by the end of the VWC planning period (2035) there is only a small supply demand surplus of 0.6 Ml/d at average demand, and a deficit of 44 Ml/d during the critical period demand.

The least cost schemes that are required to close this future supply-demand deficit have been identified by VWC. These schemes represent the least cost combination of additional schemes to balance supply and demand in the longer term, including metering, resource development, strategic transfers, pressure management, water audits, optimisations of licences and water efficiency and water audit schemes. No active leakage control (ALC) options to reduce leakage are included in the least cost set of options, indicating and confirming that VWC are operating below the long term economic level of leakage.

The VWC 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. The target is to reduce leakage by 20 Ml/d per year by 2030 starting in 2015 across the water resource regions. There will also be additional environmental pressures placed on the supply of water from more stringent legislation such as the Water Framework Directive.

Currently, 34% of VWC customers have water meters attached to their supply. By 2030, VWC have stated in their WRMP that they plan to accelerate the take up of metering of properties to 90% of their customer base. The WRMP also states that on average, once metered, customers use 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. The metering programme for 2015 to 2030 combined with the leakage reduction programme will ensure there is no need to invest in alternative supply or demand options before 2035 as per their business plan.

The Supply-Demand balance for the Northern WRZ, as set out in the VWC WRMP, for both Dry Year Annual Average and Dry Year Critical Period can be seen in Figure 6-2 and Figure 6-3.

However, as stated in Section 2.4, achievement of the final planning components of demand indicated in Figure 6-2 and Figure 6-3 is subject to approval by Ofwat, and constraints on funding could influence the phasing of planned demand reductions and leakage reduction measures.

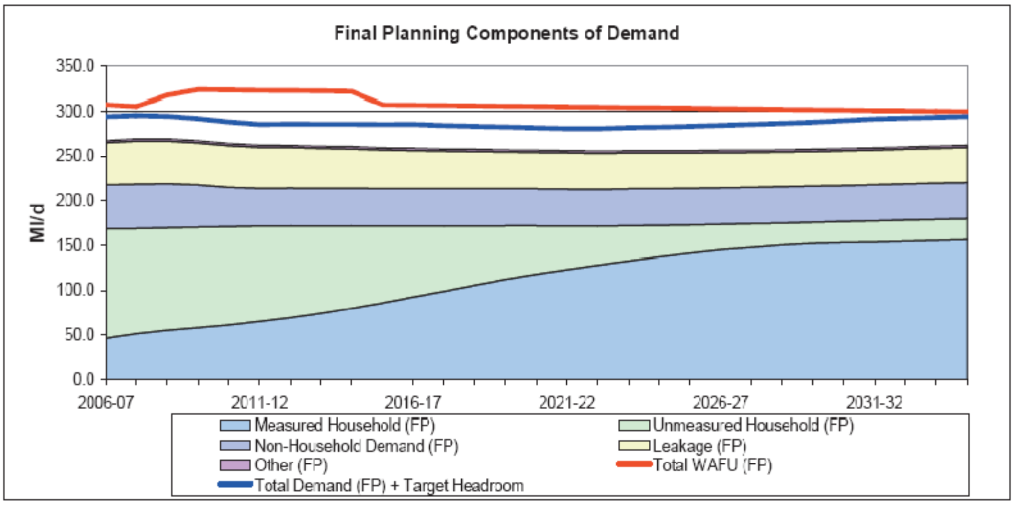

Figure 6-2 VWC Northern WRZ Dry Year Annual Average Supply-Demand Balance

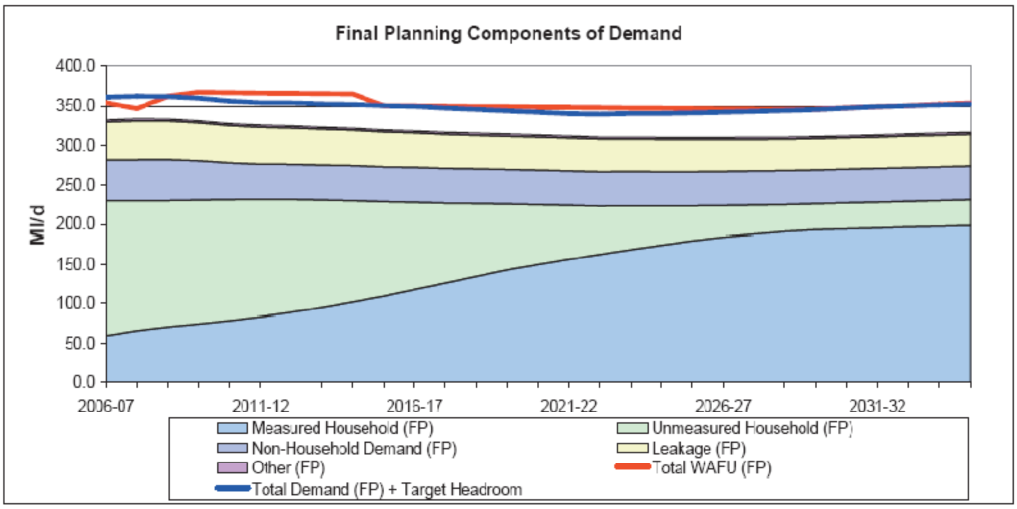

Figure 6-3 VWC Northern WRZ Dry Year Critical Period Supply-Demand Balance

(VWC Water Resource Management Plan 2010)

Both figures show a decrease in Water Available For Use (WAFU) around 2015. This 15 Ml/d decrease is due to **sustainability reductions** that the EA have advised (following review of the VWC WRMP). The reductions will be required at two VWC abstraction points, to reduce the effect of these abstractions on the environment.

Potentially further sustainability reductions will 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 developments. The outcome of these studies may impact on the strategy that VWC adopts to ensure the District is adequately supplied. 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.

In addition, both figures show 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 UDC and VWC promoting water efficiency in both new and existing dwellings, and aspiring towards water neutrality within the District (discussed in Section 6.4.) to further reduce average PCC past that predicted by VWC in their FWRMP, and hence increase security of supply and reduce reliance on imported water.

6.3 Development impacts

Calculations based on the three PCC scenarios (described in Section 4.2) provide the following results regarding the potable water demand from the existing domestic population within Uttlesford District.

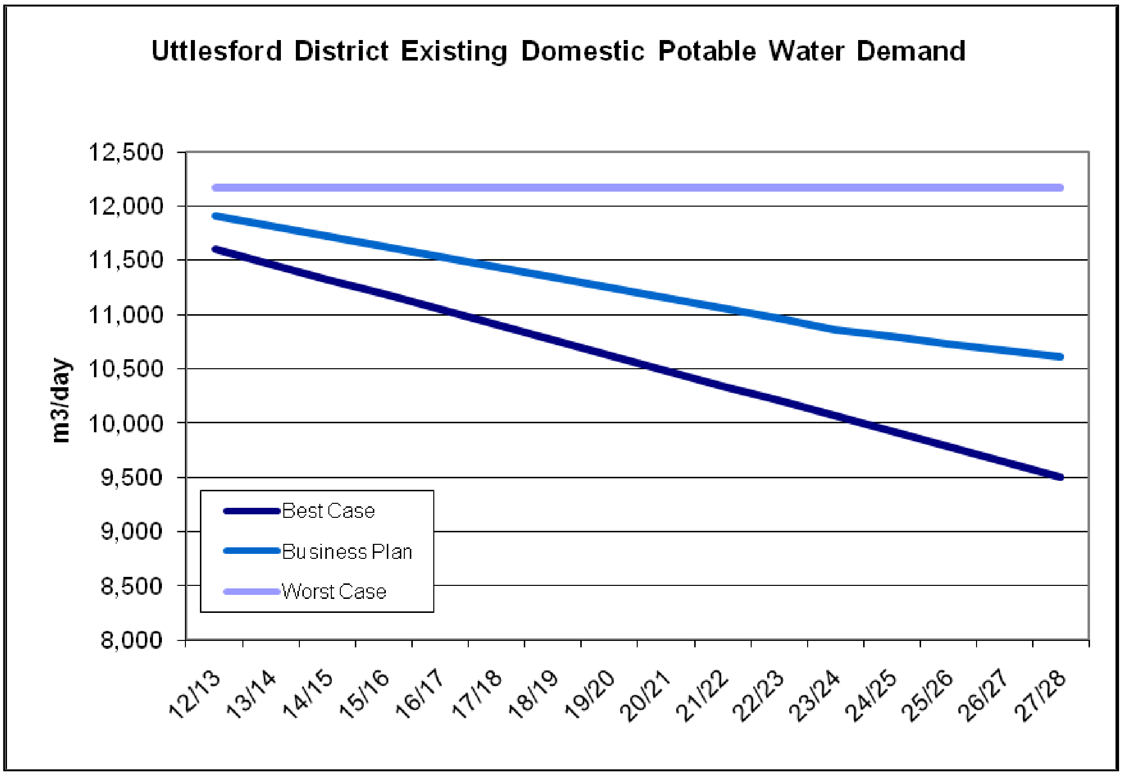

Figure 6-4 Potable water demand from existing properties

As expected, the reducing PCC rates in the existing dwellings all result in a reduction in overall demand, except for the worst case scenario.

The predicted demand from the new developments is shown below in Figure 6-5, for the preferred sites discussed in Section 5.1. Note that the Best Case and Business Plan scenarios both predict the same demand due to new developments, so only Best Case is displayed for simplicity and clarity. This lack of variation is because the PCC values specified in UDC policies are in keeping with the CSH implementation targets that make up the Best Case and Business Plan Case Scenario.

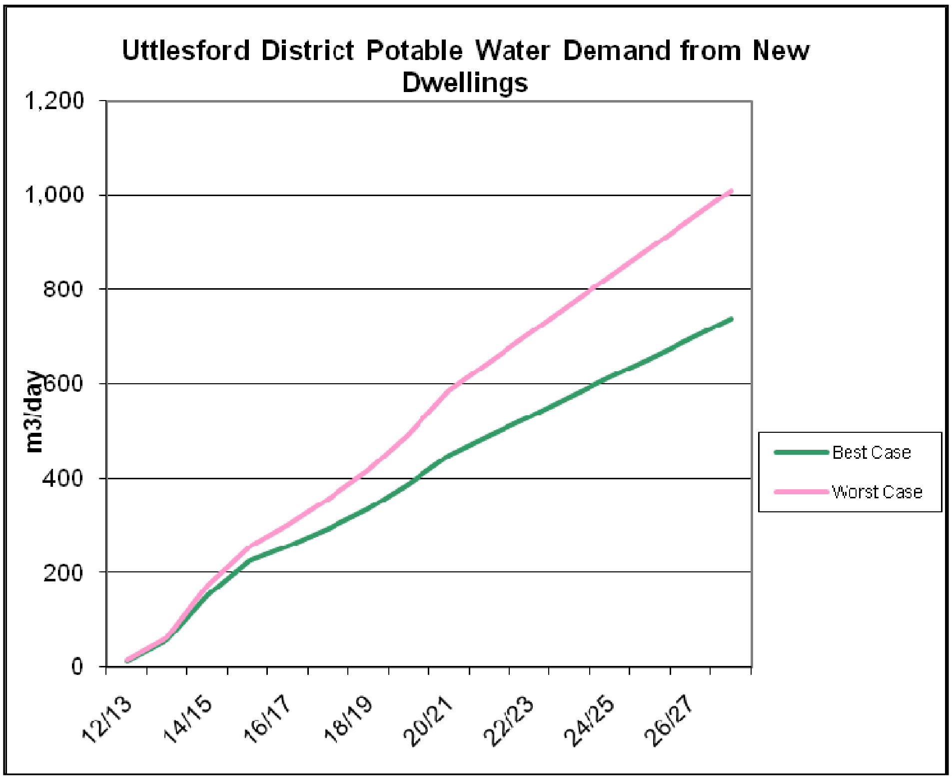

Figure 6-5 Potable water demand for new dwellings

The proximity of the potential new development sites to the trunk main network, and their capacity in this location, will determine the ease with which the site can be supplied by VWC, and hence have a significant impact on the cost.

6.4 Water neutrality

The concept of offsetting the potable water demand from new development by increased water efficiency and reduced demand in existing buildings is referred to as water neutrality. This concept allows the new development to be served without impacting on water resources (and in some cases the supply network), and therefore minimises the risks to supply from future climate change.

Water neutrality allows water to remain in the environment for ecological and leisure purposes and negates the need for the development of new resources such as reservoirs. As the amount of water in the supply system is not increased, there are no increases in the energy (and hence carbon footprint) required to supply the water. Water neutrality also benefits sewerage and wastewater treatment, as the hydraulic assets involved in these processes do not have to deal with increased flows from new development in the long term. However, as the proliferation of water efficient fittings reduces the volume of water released into the sewerage network, there will be an increased risk of settlement and blockages in areas of shallow gradient. In addition, WwTW process will have to deal with more concentrated wastewater, which have implications on the treatment methods and operational costs required in order to meet environmental standards. As this is an issue affecting all water companies, and driven by national policy, it is outside of the scope of the WCS.

Achieving the required reductions in PCC to move towards water neutrality 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 TWU and UDC 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 will revert back to higher usage fittings due to consumer preference.

Combining the demand predictions from existing and new dwellings produces an estimation of total domestic demand within the District. Figure 6-2 below shows the total domestic demand predictions for the three scenarios. The 2012/13 demand is also shown as a constant throughout the study timeframe, to assess if water neutrality for the residential developments can be achieved.

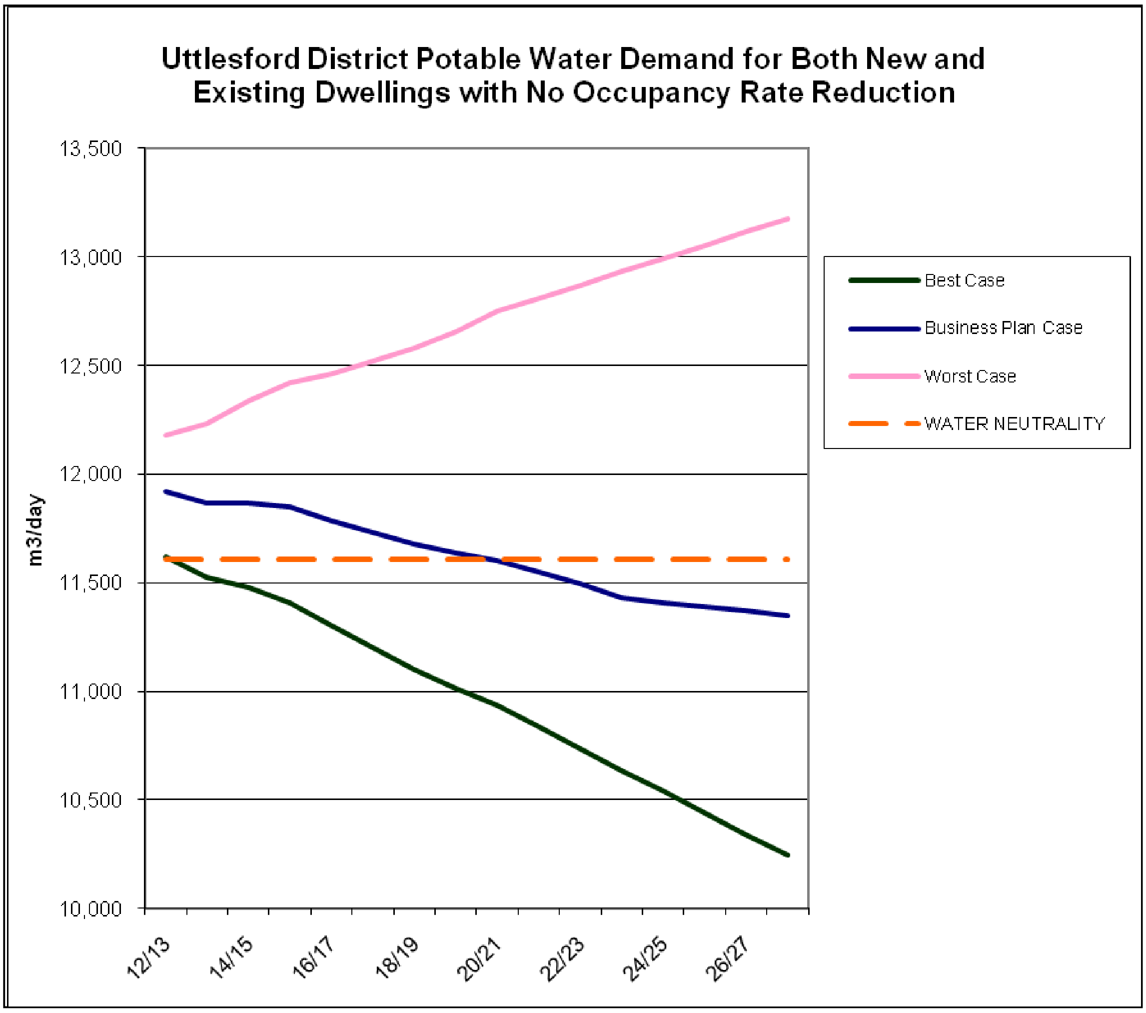

Figure 6-1 Potable water demand for new and existing dwellings

As Figure 6-2 demonstrates, if PCC rates in new dwellings follow the implementation targets for the CSH (which UDC are proposing to require of developers) and the average PCC of the existing dwellings falls in line with VWC predictions (i.e. Business Plan Case), then **water neutrality can be achieved** for domestic development across the District by approximately 2020/21.

This reinforces the message from VWC in the above section; that sufficient potable water can be supplied to accommodate the proposed development. The only major constraint to the potential development sites, regarding the supply of potable water, will therefore be from capacity limitations in the localised supply network, assuming that the planned efficiency measure can be met.

If UDC were also able to reduce the PCC of the population in the estimated 2,880 council (or housing association) managed properties from the VWC estimated average to the Defra aspirational target of 130 l/p/d, then the reduction in demand would be enough to supply around 900 new dwellings at CSH Level 3. It may be possible to achieve this, possibly in cooperation with VWC, through the retrofitting of water efficient fittings, increased consumer education, financial incentives and the provision of consumption reducing devices, such as shower timers and aerating tap inserts.

The figures highlight the importance of achieving the PCC values estimated by VWC and specified CSH efficiency targets for new dwellings by UDC. Rigorous specification through the planning process, and monitoring of the water usage of new developments post construction, will be required to ensure these targets are achieved. If the average PCC in existing dwellings remains constant from 2012/13, and new dwellings only achieve 125 l/p/d, total domestic demand by 2026 could increase by nearly 8% on 2012/13 levels (based on proposed Local Plan growth), dependant on whether occupancy rates decrease or not. An increase in demand such as this, when coupled with the risk of decreasing summer river flows due to climate change, and possible sustainability reductions that may be applied to VWC abstractions in the future, would significantly increase the requirement to source and import more expensive supplies of water from further afield to supply the District.

Table 6-2 below highlights the reductions in PCC that would be required by residents in the existing dwellings in the District (i.e. through water reuse and/or reduced consumption) to work towards various percentage levels of water neutrality to accommodate the proposed Local Plan growth.

PCC Reduction Required in Existing Dwellings (l/p/day)

% towards Water Neutrality	Business Plan Case	Worst Case (166 l/s)
25%	2.5	3.4
50%	5.0	6.9
75%	7.6	10.3
100%	10.1	13.8

Table 6-2 Reductions required in existing dwelling PCC to achieve water neutrality

It must be noted that this assumes PCC in the new dwellings will remain at the levels agreed at the design stage. Any reversion to higher levels of PCC by the occupants of these new dwellings will make the target of water neutrality harder to achieve for the District.

6.5 Constraints and Funding

As the majority of the policy sites needed to meet the Local Plan targets are in the market towns or key service centres, VWC predict **no major constraints** to supplying these sites with potable water, providing the EA do not enforce further sustainability reductions in the Northern WRZ. Similar to the village scale development, 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.

On a localised level, whilst the existing network can be adapted (with some reinforcement) to transfer water from the trunk mains to supply the village scale development in the more rural locations, it would be preferable for these locations to continue to be served primarily by boreholes.

7 Flood Risk Management

7.1 Existing situation

The Outline Study captures the fluvial, surface water, groundwater and sewer flooding flood risk within the District. However, since writing the Outline Study new sources of data have become available, these have been identified as:

7.1.1 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.

Uttlesford District falls within three CFMP areas:

- North Essex;
- Thames; and
- Great Ouse.

The CFMPs underwent a period of consultation in 2006/07, and the final results of the North Essex and Thames CFMP were published in December 2009 with the Great Ouse CFMP being published in January 2011.

The relevant CFMP sub-area in the North Essex CFMP is Blackwater Chelmer, Upper Reaches and Coastal Streams. The flood risk management strategies proposed in the North Essex CFMP consultation documents for the Blackwater and Chelmer are shown in the table below.

General Actions across the sub-area	Action Specific to Upper Reaches	Actions specific to Blackwater and Chelmer
Investigate options to cease or reduce current bank and channel maintenance and flood defence maintenance	Continue with flood warning service including maintenance of flood warning infrastructure and public awareness plans	Continue with flood warning service including maintenance of flood warning infrastructure and public awareness plans
Encourage planners to develop policies to prevent inappropriate development in the floodplain using measures set out in Planning Policy Statement 25 (PPS25) Note: this has now been superseded by the NPPF – See Section 3	Work with partners to develop emergency response plans for critical infrastructure and transport links at risk from flooding	Work with partners to develop emergency response plans for critical infrastructure and transport links at risk from flooding

Table 7-1 North Essex CFMP Actions

The relevant CFMP sub-area in the Thames CFMP is Sub-area 1 – Town and Villages in open floodplain (North & West) and particularly relates to the Upper Roding. The actions proposed in the CFMP are to;

- Maintain the existing capacity of the river systems in developed areas that reduces the risk of flooding from more frequent events;
- Identify locations where the storage of water could benefit communities by reducing flood risk and providing environmental benefits and encourage flood compatible land uses and management. For example in the Roding Catchment, planned flood storage will reduce the risk to local communities and larger urban areas downstream; and
- Increase public awareness, including encouraging people to sign-up for the free Floodline Warning Direct service and help communities and local authorities produce community flood plans identifying vulnerable people and infrastructure.

The relevant CFMP sub-areas in the Great Ouse are Sub-area 1 – Bedford Ouse Rural and Eastern Rivers and Sub-area 8 Saffron Walden. The CFMP classed both of these sub-areas as areas of low to moderate flood risk where the EA are generally managing existing flood risk effectively.

The actions proposed for Sub-area 1 are;

- Investigate opportunities to reduce current levels of flood risk management on the main rivers;
- Continue with current levels of flood risk management on all ordinary watercourses (including Award Drains);
- Work with Partners to develop emergency response plans for critical infrastructure, community facilities and transport links at risk from flooding; and
- Produce land management plans to explore opportunities to change land use and develop sustainable land management practices.

The actions proposed for Sub-area 8 specific to Saffron Walden are;

- Carry out an investigation to confirm responsibility for the Saffron Walden town culvert (The Slade) and assess its current condition;
- Reduce the consequences of flooding by improving public awareness of flooding;
- Investigate the feasibility of creating a flooding warning service for Saffron Walden;
- Continue investigations on flood risk and surface water run-off from the highways; and
- Work with partners to develop emergency response plans for critical infrastructure and community facilities at risk from flooding.

Many of the actions proposed across all CFMPs relevant to the Uttlesford District area centre around changing behaviour of communities rather than investment in hard engineering, however a number of improvements to existing surface water drainage systems in the urban areas will be required ensure suitable and reliable flow paths exist for effectively draining the development areas.

7.2 Flood Risk Constraints

Following a review of the SFRA and the latest Environment Agency Flood Map, the following fluvial flood risk key constraints to the strategic development sites have been identified in Table 7-2 and 7-3. The employment sites are all in Flood Zone 1 and therefore at a low risk from Main River flooding. Localised sewer flooding is not included, as the postcode area scale resolution of the SFRA results does not provide the detail required to assess individual sites in a meaningful way. However, the possible impact of the development on the sewerage network, which in turn may affect the risk of sewer flooding, is discussed further in Section 8-3. Table 7-4 summarises surface water flood risk to the employment and residential development sites.

Development Location	Site Address	Fluvial Flood Risk Constraint
Saffron Walden Policy Area 2	119 - 121 Radwinter Road, Former Willis and Gambier site	Fluvial Flood Risk: No Main river flooding. Not at risk from Main River 100 year Blockage Scenarios
Saffron Walden Policy Area 1	Land between Radwinter Road and Thaxted Road East of SW	Fluvial Flood Risk: No Main river flooding. Not at risk from Main River 100yr Blockage Scenarios
Saffron Walden Policy Area 3	Tudor Works, Debden Road	Fluvial Flood Risk: No Main river flooding. Not at risk from Main River 100yr Blockage Scenarios
Great Dunmow Policy Area 1	Land west of Great Dunmow	Fluvial Flood Risk: No Main river flooding.
Great Dunmow Policy Area 2	Smiths Farm, Hoblongs	Fluvial Flood Risk: No Main river flooding.
Elsenham Local Policy Area 1	Land west of Station Road (Also Live Application)	Fluvial Flood Risk: No Main river flooding.
Elsenham Local Policy Area 2	Land west of Hall Road	Part of site (Approximately 3%) within the 1 in 20 year Flood Extent. Development in this flood zone is not permitted and should be avoided
Elsenham Local Policy Area 3	Land south Stansted Road	Fluvial Flood Risk: No Main river flooding.
Great Chesterford Local Policy Area 1	Greenhouse site, New World Timber, London Road	Fluvial Flood Risk: No Main river flooding.
Great Chesterford Local Policy Area 2	Land south of Stanley Road	Fluvial Flood Risk: No Main river flooding.
Newport Local Policy Area 2	Land at London Road by primary	Fluvial Flood Risk: No Main river flooding.

Development Location	Site Address	Fluvial Flood Risk Constraint
	school	
Newport Local Policy Area 1	Bury Water Lane/Whiteditch Lane/Secondary school	Fluvial Flood Risk: No Main river flooding.
Stansted Local Policy Area 1	14-28 Cambridge Road	Fluvial Flood Risk: No Main river flooding.
Stansted Local Policy Area 2	Land at 10 Cambridge Road	Fluvial Flood Risk: No Main river flooding.
Stansted Local Policy Area 3	St Mary's Primary School, St Johns Rd	Fluvial Flood Risk: No Main river flooding.
Takeley Local Policy Area 1	Land at and to the rear of Takeley Primary School	Fluvial Flood Risk: No Main river flooding.
Takeley Local Policy Area 2	Land South of Dunmow Road and east of The Pastures/Orchard Fields	Fluvial Flood Risk: No Main river flooding.
Takeley Local Policy Area 3	North View and 3 The Warren	Fluvial Flood Risk: No Main river flooding.
Takeley Local Policy Area 4	Land at Former Takeley Service Station and between Ridge House and Remarc	Fluvial Flood Risk: No Main river flooding.
Takeley Local Policy Area 5	Land to the south of the B1256 between Olivias and New Cambridge House	Fluvial Flood Risk: No Main river flooding.
Thaxted Local Policy Area 1	Sampford Road	Fluvial Flood Risk: No Main river flooding.

Table 7-2 Flood Risk Constraints to the residential sites in key market towns & Villages

Rural Sites	Fluvial Flood Risk Constraints
Clavering	Fluvial Flood Risk: No Main river flooding.
Henham HEN1	Fluvial Flood Risk: No Main river flooding.
Henham HEN2	Fluvial Flood Risk: No Main river flooding.
Radwinter	Part of the site in the 20 year fluvial flood outline which must be avoided (Approximately 2% of the site).
Stebbing	WwTW in FZ3 upgrades must be avoided in this area.

Table 7-3 Flood Risk Constraints to the residential sites in rural areas

It is recommended that all new development sites in the smaller rural areas are to be located in Flood Zone 1 according to NPPF guidance. By fully applying the Sequential Test whilst considering all forms of flooding, UDC should utilise the mapping contained within the SFRA and the EA Flood Map to assess the flood risk to any development sites that come forwards through site allocations processes, or development elsewhere. In addition, UDC should take account of the historic flooding events listed within the SFRA, as some of these appear to have affected areas now shown as within Flood Zone 1.

The EA's surface water flood maps give an indication of the broad areas likely to be at risk of surface water flooding during a 1 in 30 year and 1in 200 year rainfall event. The maps are not suitable for identifying whether an individual property will flood. The Flood Map for Surface Water layers can be used to indicate two bandings: 'shallower' and 'deeper'. The deeper bands may be useful to help identify areas which have an inherent vulnerability to flood first, and flood deepest. The 1 in 30 year probability 'deeper' band will be useful to identify areas which have an inherent vulnerability to flood for relatively frequent, less extreme events.

The Table 7-4 below shows which of the Uttlesford Local Policy Areas are shown to be at flood risk in the Flood Map for Surface Water. At these sites, the majority of flood risk appears to be from the depressions that represent the Ordinary Watercourses that flow through the sites.

Surface water management is also a key consideration for all new developments, not just those listed in Table 7-4, and may significantly constrain the viability and design of some of these sites. Further investigation through site specific Flood Risk Assessments will be required dependent on the likely risk. Section 7.2.1 provides some guidance on the use of SuDS within Uttlesford District.

	SITE_NAME	30 year Deep Flood Risk (% of Site at Risk)	30 year Shallow Flood Risk (% of Site at Risk)	200 year Deep Flood Risk (% of Site at Risk)	200 year Shallow Flood Risk (% of Site at Risk)
Residential Sites	Elsenham Local Policy Area 1	YES (0.4)	YES (0.8)	YES (0.8)	YES (1.2)
	Saffron Walden Local Policy Area 1	YES (0.5)	YES (3.5)	YES (1.8)	YES (1.1)
	Saffron Walden Local Policy Area 2	YES (5.6)	YES (12.7)	YES (9.3)	YES (3)
	Stansted Local Policy Area 3	YES (4.2)	YES (6.1)	YES (6.1)	YES (12.9)
	Takeley Local Policy Area 3	YES (0.4)	YES (4.3)	YES (3)	YES (20.5)
	Elsenham Local Policy Area 2	YES (0.2)	YES (0.6)	YES (1.4)	YES (3.7)
	Great Dunmow Local Policy Area 2	YES (1.5)	YES (2)	YES (2.2)	YES (3.5)
	Elsenham Local Policy Area 3	NO	NO	YES (0.4)	YES (2.1)
	Radwinter Local Policy Area 1	YES (5.4)	YES (6.7)	YES (7.4)	YES (10)
	Takeley Local Policy Area 1	NO	YES (3.2)	YES (2.1)	YES (4)
	Great Dunmow Local Policy Area 1	NO	YES (0.7)	NO	YES (2.3)
Commercial Sites	Elsenham Gaunts End (Safeguarded employment site)	YES (1.3)	YES (5.7)	YES (2.8)	YES (9.3)
	Stansted Airport (Stansted Policy 2 - non airport related employment)	YES (2.5)	YES (6.3)	YES (4.6)	YES (13.1)
	Stansted Airport (Stansted Airport policy 1 - airport employment)	YES (0.6)	YES (4.5)	YES (1.9)	YES (8.9)
	Stansted Airport (Stansted Airport policy 1)	YES (0.9)	YES (4)	YES (2.1)	YES (8)
	Stansted Airport (Stansted Airport policy 1)	YES (2)	YES (5.8)	YES (4.6)	YES (11.4)
	Start Hill Gt Hallingbury (Gt Hallingbury policy 1.)	YES (0.6)	YES (7.9)	YES (4.4)	YES (15)
	Alsa Street (Policy SA E6)	YES (1.3)	YES (5.6)	YES (7.1)	YES (12.3)
	Gt Dunmow (Policy area 3 Waste transfer site)	YES (0.8)	YES (1.5)	YES (1.5)	YES (2.6)
	Wendens Ambo (Protected employment)	NO	NO	NO	NO
	Elsenham Gaunts End (Draft Local Plan policy Elsenham policy 4)	NO	NO	NO	YES (3.2)
	Elsenham Gaunts End (Draft local plan policy Elsenham policy 4)	NO	YES (1)	NO	YES (1.5)
	Stansted Airport (Stansted Airport policy 1)	NO	YES (1)	NO	YES (2.2)
	Clavering (Employment land)	NO	YES	NO	YES
	Great Chesterford Reserved for Education	YES (50.3)	YES (56.2)	YES (70.9)	YES (71.6)

Table 7-4 Surface Water Flood Risk

7.2.1 Suitability of SuDS

The Outline WCS provides high level guidance on the implementation of SuDS according to the SuDS hierarchy and the SuDS management train described in the Outline Study. Every opportunity should be taken by UDC and developers to incorporate techniques such as these at the potential development sites, in order to comply with the Building Regulations, NPPF and local policies implemented by both UDC and Essex County Council.

Figure 7-1 illustrates the EA Source Protection Zones (SPZ) in the District. When coupled with the GWV zones identified earlier in the report, and the soil permeability figures in the Uttlesford SFRA, a high-level strategic overview of the suitability, or not, of the development locations to utilise certain infiltration based SUDS techniques can be formed. However, this will still be subject to the depth of infiltration SuDS techniques and soil permeability tests.

The low permeability of the Boulder Clay, which overlies the majority of the District, may preclude the use of shallow infiltration SuDS techniques. However, if localised tests suggest that there is suitable permeability for a given technique, developers and UDC should consult the EA to ensure that any SuDS design takes account of any SPZ and other areas where the aquifers may be vulnerable, and ensure that the risk of pollution is adequately controlled.

Table 7-5 and Table 7-6 below describe how these factors may constrain the choice of infiltration SuDS at the development sites. It must be noted that there is still a need to undertake localised infiltration tests and ground investigations to confirm these constraints. It is recommended all new development sites aim to employ SuDS techniques according to the SuDS hierarchy and SuDS management train. New National Standards for SuDS are also due to be released by Defra following the consultation undertaken on the draft standards published in December 2011.Therefore, the choice of SuDS and their design (including water quality treatment requirements) should comply with the new standards when officially published.

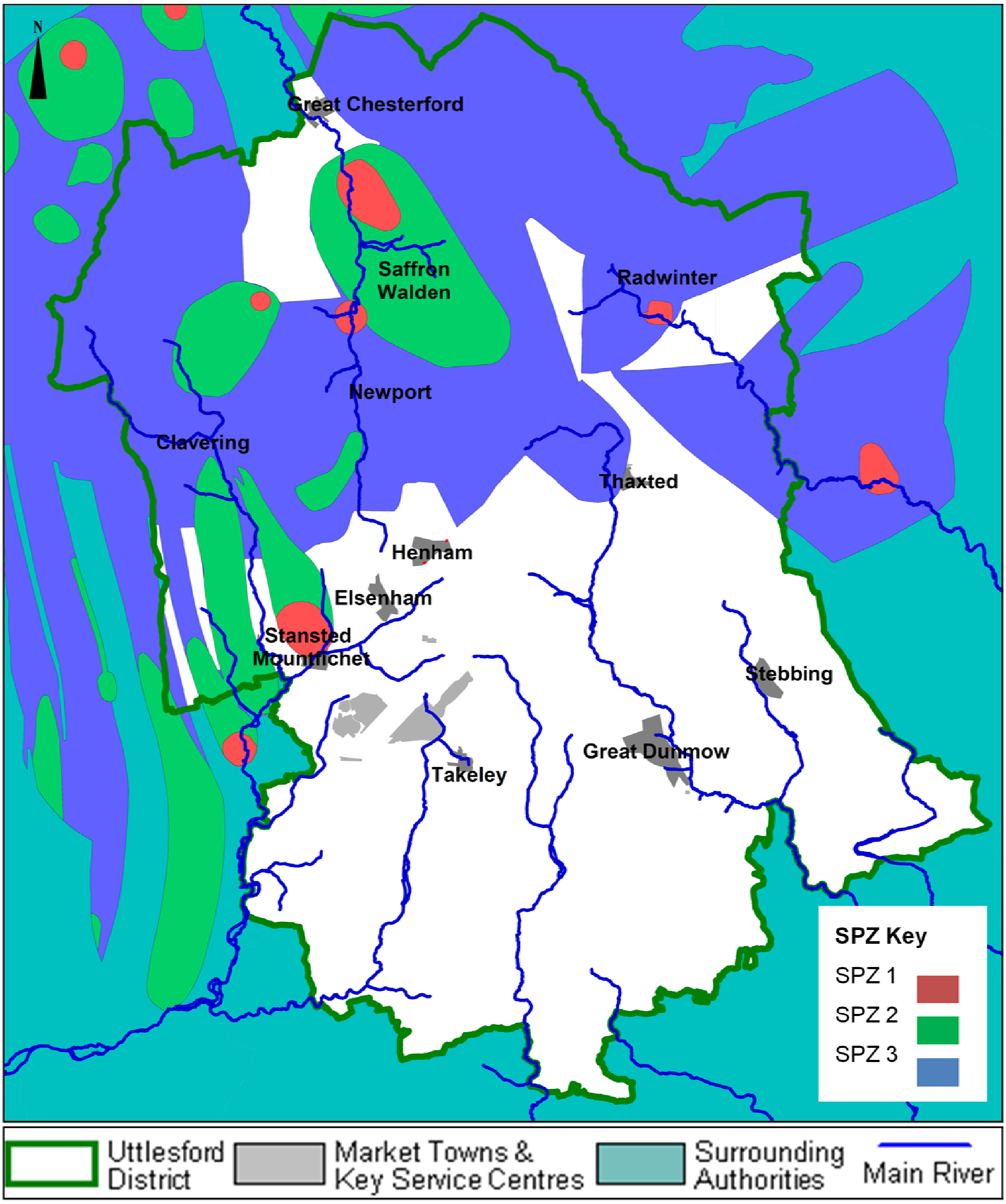

Figure 7-1 SPZ to show where certain infiltration based SuDS may not be appropriate without further investigation

	Development Area	Soil Permeability*	SPZ	Aquifer type (vulnerability according to EA) *see Section 6.1.2*
Key Villages	Elsenham	Slowly Permeable	N/A	Superficial- Secondary A and Secondary Bedrock- Principal and Secondary A
	Great Chesterford	Well Drained	SPZ 3	Superficial- Secondary A Bedrock- Principal
	Stansted Mountfitchet (sites to the north)	Slowly Permeable	SPZ 1	Superficial- Secondary A Bedrock- Principal and Secondary A
	Newport	Well Drained	SPZ 3	Superficial- Secondary A and Secondary Bedrock- Principal
	Takeley	Slowly Permeable	N/A	N/A
	Thaxted (sites to the east)	Slowly Permeable	SPZ 3	Bedrock- Secondary A
	Great Easton	Well Drained	N/A	Superficial- Secondary A
Market Town	Great Dunmow	Well Drained	N/A	Superficial- Secondary A and Secondary
	Saffron Walden (sites to the east)	Slowly Permeable	SPZ 2	Superficial- Secondary Bedrock- Principal

Table 7-5 Constraints to infiltration SuDS – Market Towns and Key Villages

Development Site	Soil Permeability*	SPZ	Aquifer type (vulnerability according to EA) *see Section 6.1.2*
Clavering	Slowly Permeable	SPZ 3	Superficial- Secondary A and Secondary Bedrock- Principal
Henham	Slowly Permeable	NA	Bedrock- Secondary A
Radwinter	Slowly Permeable	SPZ 3	Superficial- Secondary Bedrock- Principal
Stebbing	Slowly Permeable	NA	Superficial- Secondary A Bedrock- Principal

Table 7-6 Constraints to infiltration SuDS – Rural Settlements

The table shows that, if wetlands and basins are not feasible, (for example due to cost, safety or space constraints), SuDS based on infiltration techniques would be most suitable at the following locations, as there are no obvious constraints to such techniques:

- Great Chesterford;
- Newport;
- Great Easton;
- Bishops Stortford; and
- Elsenham Gaunts End.

The above results are based on an assessment of mapping which is at a District wide scale. As such, localised testing, and discussions with the EA regarding the suitability of SuDS techniques is recommended for every site, in conjunction with a Flood Risk Assessment where required by NPPF.

Development sites in the other potential locations could only be suitable for the less sustainable solutions from the EA SuDS hierarchy, unless localised tests can provide evidence to the contrary. The results of such investigations should form part of the application by the developer to the SAB, and inform discussions with AWS and TWU regarding alternative means of draining surface water from the proposed sites.

8 Wastewater treatment and sewerage network

8.1 Existing situation

As illustrated in Figure 8-1 there are 27 WwTW in the District, 18 are operated by AWS and 9 by TWU.

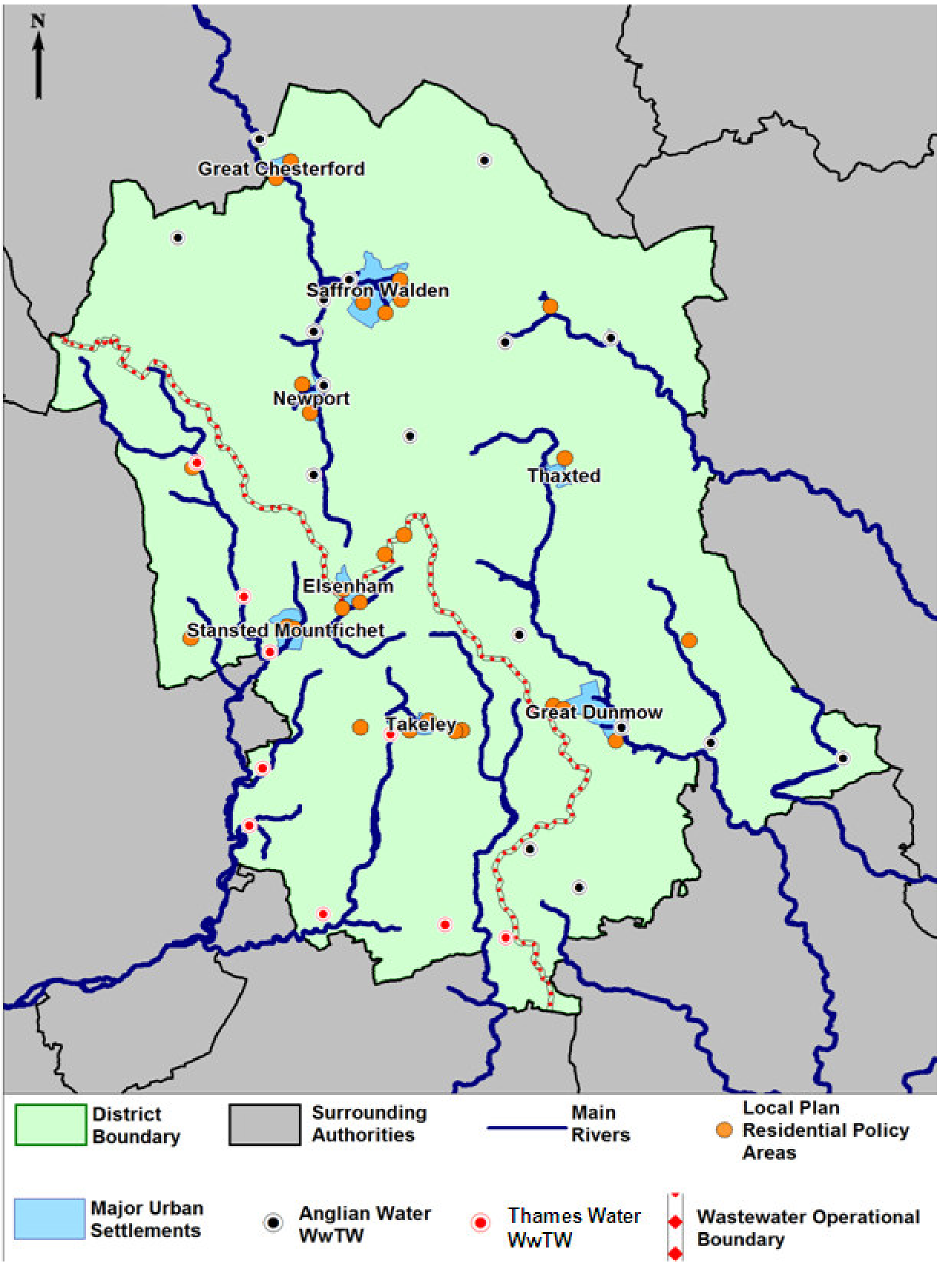

Figure 8-1 WwTW in the District

Table 8-1 shows which WwTW catchment areas the potential development locations fall under.

WwTW	Growth Area Served
Saffron Walden	Saffron Walden
Great Dunmow	Great Dunmow
Takeley and Bishops Stortford	Takeley
Great Easton	Thaxted
Newport	Newport
Stansted Mountfitchet	Stansted and Elsenham
Great Chesterford	Great Chesterford
Felsted	Stebbing

Table 8-1 Impacted WwTW catchments

8.2 Combined Sewer Outfalls

To reduce the risk of storm flows causing surcharging of sewers and overloading at WwTW, some combined sewer systems incorporate a Combined Sewer Outfall (CSO), which discharges untreated (usually screened) storm sewage into a watercourse during storm events. Whilst this spilled sewage is heavily diluted by excess storm water it can still be detrimental to the water quality and flood risk of the receiving watercourse.

The EA and AWS have a joint position statement for WCS which provides guidance on CSOs. The guidance recommends that the installation of new CSOs is an unsustainable option and should not be considered for future developments. New developments will be served by separate foul and separate surface water drainage systems. The guidance states that no increases in flows should be allowed upstream of CSOs where possible. If development will lead to an increase in population in WwTW catchment upstream of a CSO of more than 10%, the impact of growth should be assessed using Urban Pollution Management techniques to assess the mitigation required.

The data sets and comments provided by AWS and TWU suggest that the majority of the networks in the study area are separate systems for wastewater and storm water; however there are CSOs in Saffron Walden, Great Easton, Newport and Thaxted. New development that connects into combined sewers can decrease the available network capacity and also increase the risk of overflows occurring during storm events. Developer Impact Assessments should be undertaken in these areas to ensure there is no increased flood risk as result of the development and that separate foul and surface water systems are in place.

8.3 Development Impact

Where large scale growth through extensions, intensification or new settlements, is required to meet the Local Plan targets, the current volumetric flow consent figures, measured or calculated DWF figures, and estimated population equivalent (PE) have been assessed at each of the receiving WwTW. The capacity of each WwTW to receive wastewater flows from additional development has been estimated through high-level assessment and consultation with TWU and AWS. These WwTW include:

- Felsted
- Great Chesterford;
- Great Dunmow;
- Great Easton;
- Newport;
- Saffron Walden;
- Stansted Mountfitchet;
- Takeley; and
- Bishop's Stortford.

Any noticeable capacity issues associated with the above WwTWs and the existing sewerage network have also been identified through qualitative assessment and discussion with the water company representatives.

Table 8-2 below shows the total new dwelling estimates and the DWF estimates used in the wastewater impact calculations. Refer to Section 4.3 and 8.3.1 for a definition of DWF. Further details of the associated DWF calculations, including existing and post growth population numbers are detailed in Section 10.4 and Appendix E.

WwTW	Current Calculated Baseline DWF	Existing Consented DWF	Total New Dwellings Proposed 2012-2028	Post Growth DWF
Saffron Waldon	3,263	3,700	880	3,674
Great Dunmow	1,699	1,509	1150	2,202
Takeley	333	667	203	420[1]
Great Easton	657	874	60	683
Newport	563	738	370	725

WwTW	Current Calculated Baseline DWF	Existing Consented DWF	Total New Dwellings Proposed 2012-2028	Post Growth DWF
Stansted Mountfitchet	1,782	2,650	460	1,996
Great Chesterford	624	1,284	100	668
Felsted	1,164	1,630	43*	1,183

* The proposed development is approved development

Table 8-2 Total proposed dwellings by WwTW catchment

[1] The additional population is not drained to Takeley WwTW. It is passed to Bishops Stortford WwTW. The final population of Takeley STW will remain around the 1,850 (allowing for infill). The impact of the additional population on Bishops Stortford STW is negligible (less than 1%).

8.3.1 Consented Dry Weather Flow

DWF is defined as the flow of wastewater in a combined sewer during dry weather. Such flow consists mainly of wastewater, with no storm water included. As DWF represent 'undiluted' flow the consenting of DWF is important, as DWF has the potential to have a detrimental effect on the water environment. The existing consented flow is shown in Table 8-2 above and detailed information regarding the DWF calculations are contained within Appendix E. Based on the above figures (and supporting expected period of development information contained within the UDC SHLAA), wastewater development impact calculations were undertaken, using the methodology described in Section 4. Estimates of the wastewater increases due to the residential sites can be summarised as follows:

WwTW	Increase in Consented DWF Required prior to 2028?
Saffron Waldon	No
Great Dunmow	Yes
Takeley	No
Great Easton	Yes[1]
Newport	Yes[2]
Stansted Mountifichet	No
Great Chesterford	No
Felsted	No[3]

Table 8-3 Summary of consented DWF calculation results

1 It is currently not possible to verify flows at Great Easton until the end of 2013. Therefore, it cannot be said with certainty as to whether an increased consent is required.

2 Table 8-2 shows that the existing consent is not being exceeded post growth. However, due to the 10% buffer and the unavailability of headroom it is understood that a new consent is required to accommodate future development.

3 An increase in consent is not required with the current allocated development within Stebbing. AWS have confirmed that the flows transferred from Great Dunmow will not exceed the existing discharge consent at Felsted WwTW.

8.3.2 WwTW and Sewerage Capacity

The physical capacity of the WwTW to accommodate wastewater flows is determined by a combination of the hydraulic capacity of any pumps, channels, filters beds and tanks, and the loading that the physical, biological and chemical process can accommodate. Typically, AWS and TWU will investigate the hydraulic/ process upgrades required at a WwTW once it becomes apparent that the existing capacity is nearing its limit, and determine the investment required to cost effectively manage the risk of a consent breach or flooding event. Alterations can often be made to processes, in terms of operation or maintenance, to accommodate additional loading, although this can be at the expense of additional energy use/ carbon intensiveness. Spatial constraints (limited site footprints or proximity to other development) can potentially limit the upgrades that are available on some WwTW sites.

Exceeding treatment capacity at WwTW can lead to the deterioration of receiving water quality which is not acceptable under Water Framework Directive and other environmental regulations. It is therefore recommended that the UDC require that developers provide evidence to UDC that they have consulted with AWS and TWU regarding wastewater treatment and network capacity, and the outcome of this consultation, prior to development approval. UDC should consider the response from AWS when deciding if the expected timeframe for the development site in question is appropriate.

The onus is on AWS and TWU to maintain standards set within their current environmental permit. A number of measures can be taken to help create ‘headroom’ in the system (i.e. demand measures or infiltration reduction measures), which will help to reduce the risk from connecting in any properties already coming forward. Depending upon their efficacy, these measures could ultimately prove to be a preferable alternative to the WwTW upgrade.

There is currently no evidence to demonstrate the extent to which the above measures can deliver ‘headroom’, but as that evidence becomes available, the Environment Agency and AWS/TWU can make a judgement on the necessity and timing of the new discharge solution.

In the interim, in order to ensure that WFD objectives are not compromised by early phasing of growth before any required solution is in place, rigorous monitoring will be required. The Environment Agency will require sufficient evidence that development will not cause the WwTW’s flow consent to be exceeded in order to be confident that they do not need to raise objections to planning application to ensure WFD compliance. Therefore it is recommended that that for each forthcoming application, the developer provides sufficient evidence (via AWS/TWU pre-planning enquiry process) that demonstrates that there is either sufficient headroom or viable interim treatment solutions (such as tankering) until a permanent treatment solution is put in place.

The potential capacity issues within each WwTW catchment are discussed below based on the assessments and consultations undertaken during this WCS preparation:

Saffron Walden WwTW

Saffron Walden is predominantly served by a separate surface water and foul water sewerage system. The foul water sewerage system operates primarily by gravity, conveying wastewater to the WwTW to the northwest of the town.

The development trajectory for Saffron Walden proposes that 880 new dwellings are to be constructed. The majority of the new development is planned to occur in AMP7 and AMP8 (i.e. from 2020 to 2028). The Local Plan allocation sites are located at the opposite side of the town to the WwTW. The existing sewerage network is at capacity and extensive upgrades will be required. The linear distance from the development to the WwTW is approximately 2 km but the actual sewer lengths will depend on the route of any new sewers or specific sections that need upgrading. It is recommended that developers consult with AWS to determine the financial and timeframe implications of the required network upgrades through suitable Developer Impact Assessments (DIAs). It is also recommended that UDC's Local Plan Policies for Saffron Walden sites include the timely undertaking of DIAs prior to submitting any planning applications.

The predicted total DWF received by the Saffron Walden WwTW will not exceed its volumetric discharge consent. However, AWS may wish to apply for a new consent post 2020 to maintain additional headroom between the actual and consented DWF. It is recommended that close monitoring of measured DWF is undertaken to check potential trigger for a new consent to account for seasonal variations and predicted occupancy rate variations. We have calculated the indicative consent parameters if a new consent is required at Saffron Walden (contained within Appendix E) and the calculations show the WwTw will be able to accommodate development within the consent. However, the Ammonia parameter will need enhanced operation of conventional processes.

Great Dunmow WwTW

Great Dunmow is currently served by separate surface water and foul water sewerage systems, with the foul water being primarily conveyed to Great Dunmow WwTW via gravity sewers. AWS estimate that the existing network contains adequate capacity to accommodate the existing allocations. However, the scale of the growth proposed will either require upgrades to the existing network, or new strategic sewers to link the potential sites directly to the WwTW. The potential large-scale growth sites (e.g. to the south of Great Dunmow) to the WwTW will influence the costs associated with this infrastructure. Whilst primarily a gravity sewerage system, there are pumping facilities in the southwest and northeast of the existing town. Any significant development here will require the upgrading of these facilities.

The development trajectory for Great Dunmow proposes that 1,150 new dwellings are to be constructed. Development will commence in AMP6 and continue steadily through to AMP8 (i.e. 2017 to 2028). The capacity of the WwTW is a key constraint in Great Dunmow. AWS predict that the completion of the existing allocations alone will exceed the current process capacity, and also require a new volumetric discharge consent to be negotiated with the EA.

Therefore, at present, there is no capacity at the WwTW for the connection of additional flows from the potential extension sites. However, it is understood the required process capacity for development will be in place by 2016 and development within the catchment is not proposed until 2017. Additional WwTW capacity, along with revised volumetric discharge consent, will be required to accommodate the increased flows. AWS advise that this does not result in the higher growth levels being unachievable, but that there could be an additional delay in providing the required WwTW capacity and negotiating a new flow consent with the EA. Any such consent changes will come under the requirements of the Water Framework Directive, to prevent deterioration of water quality or achieve ‘good status’, which is likely to have implications for the long term deliverability of the proposed growth, discussed further in Section 10.

As Great Dunmow WwTW has been identified as having limited capacity to accommodate existing allocations, AWS are currently transferring part of the flow from Great Dunmow WwTW to Felsted WwTW for treatment. It is understood that the volume of flow transferred varies and that the population equivalence figures provided for Great Dunmow WwTW do not take into account the transfer of flows, i.e. AWS overestimate the population that is treated at Great Dunmow WwTW.

If all existing and new flows are treated at Great Dunmow WwTW, a new DWF consent will be required. It is recommended that phasing of the proposed development will give the water company time to explore and implement appropriate technology and also secure suitable funding to help mitigate the issue.

A portion of current wastewater from Great Dunmow is treated at Felsted WwTW and AWS have confirmed that the transferred flows (combined with the flows from the Felsted catchment) would not exceed the existing discharge consent for Felsted. It has not been possible to confirm the exact transfer amount to Felsted as AWS have confirmed the flow varies. It should be noted that AWS have indicated that closing Great Dunmow and transferring all flows to Felsted is unfeasible. Therefore, the transfer of all flows to Felsted has not been assessed within the WCS. The proposed small scale growth within Stebbing can be accommodated within the existing Felsted WwTW discharge consent.

It is recommended that UDC’s Local Plan Policies for Great Dunmow sites include the timely undertaking of DIAs prior to submitting any planning applications.

AWS have highlighted that both localised upgrades, or bypassing of the existing network will be required as well as significant off-site sewerage requirements to connect the foul water to the Network. Where new development looks to utilise existing pumping facilities in the southwest and northeast of the towns, consideration should be given as to whether any significant upgrade of these facilities is required.

Takeley WwTW

Currently some wastewater in Takeley is collected by a gravity sewer system which drains to a pumping station at Canfield End. Wastewater from here is then pumped to a location near Stansted Airport, before joining a further gravity sewer, which conveys the flows to Bishops

Stortford WwTW that is located outside the Uttlesford District. The rising main was designed to accommodate flows from the existing Priors Green allocation, of which 574 dwellings are currently being constructed. TWU estimate that the wet well at the pumping station can accommodate flows from an additional 1,000 dwellings in addition to this 574, and that the gravity sewer from the Airport to Bishops Stortford WwTW has adequate capacity for such growth which can be accommodated within the existing volumetric discharge consent. However, the rising main (with an approximate length of 2.5 km), would require upsizing, as it was originally sized for the existing Priors Green allocations only. Collection of wastewater through this route has been suggested for a number of the Uttlesford Local Policy Areas in Takeley and Little Canfield. Alternatively some wastewater is collected and drains to the Takeley WwTW which is smaller in comparison to the Bishops Stortford WwTW. For other Takeley Local Policy Areas it has been suggested that wastewater could drain to this WwTW.

The development trajectory for Takeley proposes that 203 new dwellings are to be constructed. Construction is due to commence at the end of AMP5 and continue steadily throughout AMP6 (i.e. from 2014 to 2018). Calculations indicate that the proposed growth will not result in the existing consent at Takeley WwTW being exceeded even if all 203 properties are connected to this works. However, future development may require works to upsize the existing rising main. It should be noted that there is not an option for the development to discharge to either Takeley or Bishops Stortford WwTW. The proposed development sites will be connected to the existing sewers and it is where those existing sewers currently discharge that will govern which WwTW is receiving the load.

It is recommended that UDC's Local Plan Policies for Takeley sites include the timely undertaking of DIAs prior to submitting any planning applications.

Great Easton WwTW

Thaxted is currently served by a network of rising mains and gravity sewers that convey wastewater southwards through the village to join a 225 mm diameter gravity outfall sewer, which flows parallel to the River Chelmer for nearly 6 km, to Great Easton WwTW. There are known capacity issues at Great Eastern WwTW, which are a potential issue and will need further discussion with AWS.

The development trajectory for Thaxted proposes that 60 new dwellings are to be constructed. Construction is due to commence at the end of AMP5 and early AMP6 (i.e. from 2014 to 2016). It is been calculated that the predicted total DWF received by the Great Easton WwTW will not exceed its volumetric discharge consent. However, there are known issues with flow capacity at the WwTW which will require careful consideration during development. It has been indicated by the EA and AWS that it is likely that the quality limits that will need to be achieved will be beyond what is currently regarded as the limit of conventional treatment technology and will therefore present difficulties in terms of achieving the full growth.

AWS have also confirmed there are issues regarding the verification of the measured flows at the WwTW and as such there is considered to be no headroom at the works until such time as verification is obtained. Due to this it is considered that there is no available capacity. It is recommended that phasing to take place post 2017 or until AWS can confirm the availability of capacity at the WwTW.

There are known flood risk issues from the existing combined Sewer Network (previously the Town Drain/Culvert). Additional development would exacerbate this problem and sewer network will require significant upgrades.

Developers will need to provide UDC with evidence of AWS consultation to demonstrate capacity is available for new development.

It is recommended that UDC's Local Plan Policies for Thaxted include the timely undertaking of DIAs prior to submitting any planning applications.

Newport WwTW

Newport is served primarily by a gravity sewerage system, with wastewater collecting at a pumping station to the northeast of the village, and then pumped across the River Cam to Newport WwTW.

The development trajectory for Newport proposes that 370 new dwellings are to be constructed. Construction is due to commence at the beginning of AMP6 (i.e. 2015), with the majority of development occurring in AMP 7 (i.e. 2018 to 2020).

Calculations indicate that the proposed development in the catchment would result in the existing DWF consent limit nearly being reached. AWS have indicated that, due to seasonal variations in existing DWF received at Newport WwTW, there is no capacity within the existing (or proposed higher) DWF consent, or the process capacity of the WwTW, to accommodate the flows from any new dwellings. This problem would be further compounded if occupancy rate reductions do not occur as predicted. Any increase in dwellings at Newport will require the negotiation of a new increased DWF consent with the EA, and this is likely to lead to tightening of the quality levels required in this discharge. It is therefore concluded that discharge consent and WwTW capacity has the potential to constrain development within the Newport catchment.

It is recommended that UDC's Local Plan Policies for Newport sites include the timely undertaking of DIAs prior to submitting any planning applications. AWS have highlighted that development to the south of the village will require significant network upgrades, the cost of which will be over and above that which can be funded through the normal developer requisition process. As such, the cost of upgrades versus the scale of development, may mean that sites to the south of the village are cost-prohibitive.

Stansted Mountfitchet WwTW

Stansted Mountfitchet WwTW serves both Elsenham and Stansted Mountfitchet. Stansted Mountfitchet is served by a combination of gravity and pumped sewers. Elsenham lies on the operational boundary between TWU and AWS. The majority of the existing village's wastewater is collected via AWS sewers, and then pumped over the boundary into the TWU network, where it then flows by gravity through an outfall sewer to the Stansted Mountfitchet network, for treatment at the WwTW. TWU estimate that the outfall sewer currently has the capacity to accept flows from a maximum of 500 new dwellings, although it is understood the existing network capacity in the village is less than this (around 20–30 dwellings max.), due to limitations in the pumping network. Alternatively, developer requisitions could be considered.

The development trajectory for Elsenham proposes that 400 new dwellings are constructed. Construction is due to commence at the end of AMP5 and continue steadily through to the end of AMP6 (i.e. 2015 to 2020). The development trajectory for Stansted Mountfitchet proposes that 60 new dwellings are constructed. Construction is due to commence at the end of AMP5 (i.e. 2014). The 60 dwellings suggested as intensification in the existing town should be able to connect to the existing sewerage network with minimal localised upgrades, funded through developer requisitions. Calculations indicate that the proposed growth will not result in the existing consent being exceeded at Stansted Mountfitchet WwTW. Whilst TWU predict that the existing sewerage network and WwTW at Stansted Mountfitchet can accommodate the flows from the sites within the town itself, any development at Elsenham will require the provision of additional WwTW capacity and significant network upgrades in Elsenham itself.

Stansted WwTW has capacity within the volumetric consent but TWU have indicated that the WwTW requires a process upgrade (additional tanks) to accommodate the growth proposed in Stansted and Elsenham. Any development above what is currently proposed in Stansted or Elsenham would require a significant network and process upgrade.

It is recommended that UDC's Local Plan Policies for Stansted Mountfitchet and Elsenham sites include the timely undertaking of DIAs prior to submitting any planning applications.

Great Chesterford WwTW

Great Chesterford WwTW treats the wastewater from Great Chesterford, Hinxton and Ickleton, There are several rising mains leading to the works but the existing sewerage system in Great Chesterford is primarily a gravity system with a network of small diameter pipes, which have no spare capacity.

The development trajectory for Great Chesterford proposes that 100 new dwellings are to be constructed. Construction is due to commence at the end of AMP5 and early AMP6 (i.e. from 2014 to 2017). The proposed development will require significant upgrades to the network or direct connection to WwTW (which will prove expensive given the Local Plan site locations). It is recommended that UDC's Local Plan Policies for Great Chesterford include the timely undertaking of DIAs prior to submitting any planning applications.

Calculations indicate the predicted total DWF received by the Great Chesterford WwTW will not exceed its volumetric discharge consent. The existing WwTW will be able to accommodate the increased flows from the new developments, in line with their phasing and actual build rates, providing that the flows remain within the current discharge consent limit.

Felsted WwTW

Felsted WwTW serves Stebbing where 43 dwellings have been approved for development. Development within the catchment will not exceed the existing volumetric discharge consent.

Felsted WwTW is currently taking extra flows from Great Dunmow WwTW and if necessary this relationship will continue. AWS have confirmed that all flows from Great Dunmow will not be transferred to Felsted WwTW. Flows from Great Dunmow WwTW will only be passed forward to Felsted that can be accommodated within the existing discharge consent. It has not been possible to confirm the exact transfer amount to Felsted as it varies. However, ultimately AWS want to see flow transfer to Felsted stopped.

8.4 Constraints Matrix

8.4.1 Residential Sites

The constraints matrix for the residential sites is detailed in Table 8.4 below.

Site Description	Constraints and Opportunities
Saffron Walden Policy Area 2 Saffron Walden Policy Area 1	Saffron Walden WwTW DWF discharge consent will not be exceeded by the increase in flow but the headroom will be limited. Available process capacity will need confirmation by AWS. The proposed sites are located at the opposite side of the town to the WwTW. The existing sewerage network is at capacity. Extensive upgrades are understood to be required. AWS have identified that there is unlikely to be capacity for receiving extra surface water drainage from these sites. River Cam is a UKBAP Priority habitat, with important habitats and species identified downstream, and is currently failing to comply with WFD due to phosphate and dissolved oxygen levels. It may be beneficial to water quality to limit future development as there is a risk that new/ tighter consents are required in future cycles of the RBMP (post 2015).
Saffron Walden Policy Area 3	It is considered that this smaller development would not pose problems due to small additional flows. It is unlikely that there will be capacity in the existing surface water network for receiving extra surface water drainage. See comments above regarding water quality in the River Cam.
Great Dunmow Policy Area 1	A portion of current wastewater from Great Dunmow is treated at Felsted WwTW – extra flows from the new development may require treatment at Felsted WwTW but a new DWF discharge consent will not be required at Felsted. The transferred flows from Great Dunmow will not exceed the existing discharge consent for Felsted WwTW. Significant off-site sewerage requirements to connect the foul water to the network. AWS state that there is unlikely to be sufficient capacity within the surface water network to receive additional surface water drainage. There are potential constraints posed by an increase in the flow permit of 46% at Great Dunmow WwTW.

Site Description	Constraints and Opportunities
Great Dunmow Policy Area 2	A portion of current wastewater from Great Dunmow is treated at Felsted WwTW – extra flows from the new development may require treatment at Felsted WwTW but a new DWF discharge consent will not be required at Felsted as a result. Localised upgrades, or bypass, of existing wastewater network will be required. AWS state that there is unlikely to be sufficient capacity within the surface water network to receive additional surface water drainage.
Elsenham Local Policy Area 2	This drains to Water Lane Pumping Station at Stansted Mountfitchet and then on to Stansted Mountfitchet WwTW. There are negligible capacity or treatment issues downstream however virtually all available spare capacity might be used by this and the two other ELS sites suggested (ELS1 and 6) leaving no capacity for any other sites in Elsenham. Sufficient headroom available within discharge consent at Stansted Mountfitchet WwTW. Rivers Stort are UKBAP priority habitats, with a number of important habitats and species identified downstream and are currently failing to comply with WFD due to phosphate and dissolved oxygen levels.
Elsenham Local Policy Area 3	There are negligible capacity or treatment issues downstream however virtually all available spare capacity may be used by this and the two other sites suggested (ELS6 and 9) leaving no capacity for any other sites in Elsenham. Sufficient headroom available within discharge consent. There are negligible treatment issues. Any outfall sewer constructed to serve this site would need to be designed to a line and level to also serve the adjacent ELS6 site. Rivers Stort are UKBAP priority habitats, with a number of important habitats and species identified downstream and are currently failing to comply with WFD due to phosphate and dissolved oxygen levels.
Elsenham Local Policy Area 1	There are negligible capacity or treatment issues downstream however virtually all available spare capacity may be used by this and the two other sites suggested (ELS1 and 9) leaving no capacity for any other sites in Elsenham. Sufficient headroom is available within discharge consent. This site is not well served by sewers in terms of both capacity and ground level. However, if the developer can be required to construct a new gravity outfall sewer from the site that will connect to the existing outfall sewer near Mill House then there will be no capacity issues. Rivers Stort are UKBAP priority habitats, with a number of important habitats and species identified downstream and are currently failing to comply with WFD due to phosphate and dissolved oxygen levels.

Site Description	Constraints and Opportunities
Thaxted Local Policy Area 1	Capacity at Great Easton WwTW, which serves Thaxted, is a potential issue and will need further discussion with AWS. Upgrades to the WwTW are likely to require additional land. Sufficient headroom is likely to available within discharge consent. The predicted DWF under growth is less than the existing discharge consent. However, it has been confirmed that flows at Great Easton cannot currently be verified and therefore it should be assumed that there is no available capacity at Great Easton WwTW. It is advised that growth in the Great Easton catchment is phased beyond 2017/18 to ensure AWS have sufficient time to verify the flows. The River Chelmer is currently impacted by poor phosphate and dissolved oxygen levels
Newport Local Policy Area 1 Newport Local Policy Area 2	Previous concerns on DWF headroom and process capacity still remain, compounded by the rise in proposed development numbers since the completion of the Outline Study. A new DWF consent is expected as there is a requirement to maintain headroom here. Will require significant off-site sewerage with possible attenuation to connect Foul Water to network. There is unlikely to be any capacity for SW drainage within all sites. River Cam is a UKBAP priority habitat with important habitats and species identified downstream and is currently failing to comply with WFD due to phosphate levels.
Great Chesterford Local Policy Area 1 Great Chesterford Local Policy Area 2	Great Chesterford WwTW discharge consent will not be exceeded by the increase in flows. AWS estimate that the WwTW currently has process capacity to accommodate the flows from up to 800 dwellings. No DIA seen by AWS as yet for either of the Great Chesterford sites. No spare network capacity and would require significant upgrades or direct connection to WwTW. River Cam is a UKBAP priority habitat with important habitats and species identified downstream and is currently failing to comply with WFD due to phosphate levels.
Stansted Mountfitchet Local Policy Area 1	Treatment capacity at Stansted Mountfitchet WwTW would not be an issue for this site. There is sufficient headroom available within discharge consent. The predicted DWF under growth is less than the existing discharge consent.
Stansted Mountfitchet Local Policy Area 2	A development that could drain by gravity to one of two gravity sewers in Cambridge Road. Neither will have any real issues and would drain by gravity through to the WwTW.

Site Description	Constraints and Opportunities
Stansted Local Policy Area 3 St Mary's Primary School Site	The presumption for this site is that it would utilise the outfall that previously served the school. This would drain to Water Lane Pumping Station but there would be negligible, potentially nil, net increase in flow. As such there are no concerns regarding network capacity.
Takeley Local Policy Area 2	Foul water pumped to Takeley WwTW, no issue identified. Sufficient headroom available within discharge consent. Single option is to connect to the sewer that passes through the site. No issues with capacity in the sewers. River Stort is a UKBAP priority habitat with a number of important habitats and species identified downstream, and is currently failing to comply with WFD due to phosphate and dissolved oxygen levels.
Takeley Local Policy Area 3	Single option is to connect to the sewer in the main road outside the site. No issues with capacity in the sewers, Pumping Stations or Bishops Stortford WwTW. River Stort is a UKBAP priority habitat with a number of important habitats and species identified downstream, and is currently failing to comply with WFD due to phosphate and dissolved oxygen levels.
Takeley Policy Area 1	TWU have proposed four options for draining foul water flows from this site. Generally there are no concerns over WwTW capacity for any of the four options. Sufficient headroom available within discharge consent.
Takeley Policy Area 4 Takeley Policy Area 5	Single option is to connect to the sewer in the main road outside these sites. This sewer goes to Bishops Stortford STW via. Canfield End Pumping Station and Stansted Airport Pumping Station. No issues with capacity in the Pumping Stations or Bishops Stortford STW.

Table 8-4 Residential Sites Constraints Matrix in Key Market Towns

Settlement	WwTW Capacity
Clavering	No issues identified. Unlikely to be any capacity issues as site is close to Clavering WwTW. A new pumping station is likely to be required to serve the site, which the developer could provide and offer to TWU for adoption subject to design standards and financial agreement.
Henham HEN1	No capacity or treatment issues downstream. The outfall

Settlement	WwTW Capacity
	sewer represents a very small increase in flow. These sewers drain through further pumping stations before draining back into Thames Water's sewers, Pumping Station at Stansted Mountfitchet and then on to Stansted Mountfitchet WwTW. No noticeable issues expected but AWS to confirm local sewer capacity.
Henham HEN2	From Henham, these sewers drain to a series of pumping stations before draining to Water Lane Pumping Station at Stansted Mountfitchet and then on to Stansted Mountfitchet WwTW. There is negligible capacity or treatment issues downstream as for the outfall sewer this represents a very small increase in capacity. The site is within Thames Water area and would drain to sewers controlled by TWU. Locally the capacity of the pumping station at Woodend Green would need to be checked. It is possible that this will require upgrading despite there being a small number of houses proposed.
Radwinter	No significant constraints identified by AWS
Stebbing	No significant issues identified by AWS. Future development may be a constraint if flows are continued to be transferred to Felsed WwTW from Great Dunmow WwTW.

Table 8-5 Residential Sites in rural villages Constraints Matrix

8.4.2 Employment sites

The constraints matrix for the employment sites is detailed in Table 8.5 below.

Site Description	Constraints and Opportunities
Chesterford Park Draft local plan policy SAE7 - allocated employment site (AWS)	No spare capacity in the Sewerage network or storm water network capacity. Ideally, network upgrades for the two Great Chesterford residential sites should also accommodate additional capacity to accommodate any domestic flows and trade effluent from this site. See comments in the table above regarding water quality in the River Cam.
Wendens Ambo Draft local plan policy SAE3 - allocated employment site (AWS)	No known constraints
Wendens Ambo Protected employment (AWS)	No known constraints
Wendens Ambo Protected employment	No known constraints

Site Description	Constraints and Opportunities
(AWS)	
Elsenham Gaunts End Draft Local Plan policy Elsenham policy 4 (TWU)	Gaunts End not served by public sewers. Rivers Cam and Stort are UKBAP priority habitats, with a number of important habitats and species identified downstream and are currently failing to comply with WFD due to phosphate and dissolved oxygen levels.
Elsenham Gaunts End Draft local plan policy Elsenham policy 4 (TWU)	
Elsenham Gaunts End Safeguarded employment site (TWU)	
Stansted Airport Stansted Policy 2 - non airport related employment (TWU)	Stansted Airport flows are regulated through the airport pumping station. No issues envisaged with the Pumping Station or Bishops Stortford WwTW.
Stansted Airport Stansted Airport policy 1 - airport employment	
Stansted Airport Stansted airport policy 1 (TWU)	
Stansted Airport Stansted airport policy 1 (TWU)	
Stansted Airport Stansted airport policy 1 (TWU)	
Start Hill Gt Hallingbury Gt Hallingbury policy 1	Start Hill is not served by public sewer
Start Hill Employment area	
Takeley Protected employment site 1	
Takeley Protected employment site 2	
Great Dunmow Policy area 3 Waste transfer site	The stakeholders remain concerned regarding the scale of increase in development in this area since the completion of the Outline WCS. The increase in trade flows is likely to be small due to size of site.
Alsa Street Policy SA E6	Alsa Street not served by public sewers
Clavering Employment land	Additional trade flow unlikely to result in any issues with due to the very small flows generated.

Table 8-6 Employment Sites Constraints Matrix

9 Flood risk from WwTW

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 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. AWS and TWU may undertake network modelling to inform their discussions with developers to ensure that upgrade requirements are understood; and
- DWF at WwTW will be increased following the connection of new dwellings to the network. Whilst some flows are 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 can increase the fluvial flood risk to properties on the watercourse downstream of the discharge point.

9.1 Methodology

To assess the existing and future capacities of the seven waste water treatment works (WwTW) within the District, the methodology set out in the Waste Water Environmental Capacity Assessment (Halcrow, 2009) report was used and is included in Appendix D. The capacity assessment uses a multi-criteria approach looking at the increase in peak flow, the sensitivity of the watercourse to changes in flood levels, and the potential impact of flooding, to define a combined flood risk index (Halcrow, 2009). The evaluation of flood risk comprises of three elements:

1 Quantification of the increase in peak river flows, resulting from the predicted increase in treated effluent discharges

2 Evaluation of the likely sensitivity of flood levels to increases in flood flows

3 Evaluation of the impact of increases in flood levels.

For each element, the impact at each site has been classified as high, medium or low and a multi-criteria analysis score has been applied to combine these elements. The capacity assessment has not been undertaken for Felsted as the development in the catchment is minor, consisting of 43 allocated developments.

9.1.1 Flow Calculation

The flow analysis has been conducted using the 1 in 2 year flood. This flood severity was selected because:

- Increases in WwTW discharge would contribute a relatively greater proportion of flood flows for this event than if a more extreme flood event had been used, and hence results are likely to be conservative
- The 1 in 2 year event is, very crudely, considered to approximate bank full conditions. Any increase in the 1 in 2 year event would therefore be expected to result in out of bank flooding.
- The 1 in 2 year event is the smallest event which can practically be estimated using standard techniques.

The 1 in 2 year flood has a 50% chance of occurrence in any one year and is more correctly referred to as the 50% Annual Exceedance Probability (AEP) event or QMED.

The increase in the 1 in 2 year peak flow in the receiving watercourse has been computed, firstly, by calculating the baseline peak flow using the Flood Estimation Handbook (FEH) method; and, secondly, by estimating the increase in discharge from the WwTW using population growth figures.

9.1.2 QMED Calculation

As there was no available flood peak data for the eight WwTW sites, FEH guidance recommends calculating QMED from catchment descriptors and adjusting by data transfer where possible. Catchment descriptors for each of the WwTW were exported from the FEH CD-ROM v3.

Potential donor stations were analysed within WINFAP-FEH 3, in particular the distance between catchment centroids and similarity of catchment descriptors were investigated. It is recommended that identification of donor catchments should be based on geographical closeness rather than on hydrological similarity as defined by catchment descriptors. Therefore, where possible, donor sites on the same watercourse were sought however for all eight of the sites the closest gauges were unsuitable for use. The adopted values of QMED are detailed below in Table 9-1 and further details of the methodology are contained within Appendix D.

WwTW Site	Receiving Water Course	QMED Value (m^3/s)	QMED Value (m^3/s) with 20% increase to allow for climate change
Saffron Waldon	Madgate Slade/ Kings Slade	2.17	2.60
Great Dunmow	Tributary of River Chelmer, Ash Grove	8.21	9.85
Takeley	Pincey Brook	2.30	2.76
Great Easton	Tributary of River Chelmer	0.50	0.60
Newport	River Cam	5.42	6.50
Stansted Mountfitchet	Stansted Brook	5.49	6.59

Great Chesterford	River Cam	8.61	10.33

Table 9-1- Adopted QMED Value

9.1.3 Discharge from the WwTW sites

AWS and TWU provided population estimates which were adjusted to reflect future growth figures for the upstream catchment areas for each of the WwTWs. Table 9-2 below summarises the expected increases by 2028.

WwTW	Existing Population	Future Population Growth (2028)	Percentage Increase
Saffron Walden	18,125	20,263	12%
Great Dunmow	9,439	12,234	30%
Takeley	1,850	2,336[1]	26%
Great Easton	3,649	3,795	4%
Newport	3,127	4,026	29%
Stansted Mountfitchet	9,900	11,091	12%
Great Chesterford	3,467	3,710	7%

Table 9-2- Catchment Population increase at each of the WwTW sites

[1] For the purposes of this assessment a worst case scenario of all the new development discharging to Takeley WwTW has been assumed. Whereas in reality, the majority, if not all, would drain to Bishops Stortford WwTW where TWU have confirmed the impact of development would be minimal.

The expected population growth figures outlined in Table 9-2 were used to calculate the potential impact on the Flow to Full Treatment (FFT) at each of the WwTWs. The following table outlines the impact increased population growth has on the FFT at each site.

WwTW Site	Existing FFT (m^3/s)	New FFT (m^3/s)	Consented FFT (m^3/s)
Saffron Walden	8,483	9,483	9,504
Great Dunmow	4,417	5,725	3,930
Takeley	866	1,093[1]	1,123
Great Easton	1,708	1,776	1,680
Newport	1,463	1,884	1,463
Stansted Mountfitchet	4,633	5,190	5,616
Great Chesterford	1,623	1,736	3,037

Table 9-3 Affect of population growth on FFT at each WwTW

[1] For the purposes of this assessment a worst case scenario of all the new development discharging to Takeley WwTW has been assumed. Whereas in reality, the majority, if not all, would drain to Bishops Stortford WwTW where TWU have confirmed the impact of development would be minimal.

As can be seen in the table above there are three WwTWs; Great Dunmow, Great Easton and Newport; which are likely to exceed the existing consented FFT levels with the predicted future population growth (the current FFT levels at Great Dunmow and Great Easton already exceed the consented value). Great Dunmow, Great Easton and Newport are shown to be above the current consented FFT level and therefore require further investigation to confirm the level of improvements required.

Part of the flow from Great Dunmow is currently being transferred to Felsted WwTW and therefore it is unlikely that Great Dunmow WwTW is exceeding the existing consented FFT. However, the volume of flow being transferred was not made available for use in this study.

Table 9-4 below shows the percentage difference between the baseline value of QMED and QMED with the increased WwTW FFT discharge at each site (i.e. the proportion of future river flows directly attributable to the discharge from the proposed growth). The percentage increase has been assessed both with and without an allowance for climate change in the baseline QMED value.

WwTW Site	New FFT (m^3/s)	% Increase from QMED	% Increase from QMED with extra 20% increase to allow for climate change
Saffron Walden	0.110	0.51%	0.43%
Great Dunmow	0.066	0.18%	0.15%
Takeley	0.013	0.11%	0.09%
Great Easton	0.021	0.15%	0.13%
Newport	0.022	0.09%	0.07%
Stansted Mountfitchet	0.060	0.11%	0.10%
Great Chesterford	0.020	0.02%	0.01%

Table 9-4- Percentage increase in flow from the WwTW sites

For both scenarios (with and without and allowance for climate change) the percentage increase is below 1% (low risk). As can be seen in the table above the percentage increase in flow from the WwTW decreases with the allowance for climate change added to QMED. This is due to the WwTW flow making up a smaller proportion of the increased climate change river flow. It is considered appropriate to use the QMED with an allowance for climate change values for the following reasons:

- The new FFT values have been projected to 2028 at each site, to account for the planned growth.
- Therefore using QMED values without an allowance for climate change would make the impact of the future FFT flows seem more significant than they could possibly be in 2030.

9.2 Multi-Criteria Approach

As discussed above, the methodology for determining the significance of any increases in FFT requires an assessment of the sensitivity of the watercourse to flood events, and the potential impact of these events on surrounding settlements, using decision trees (Appendix D). These assessments are weighted and combined to provide an overall risk score for each WwTW discharge.

The methodology involves applying three decision trees at all eight WwTW sites as follows (see Appendix D) (Halcrow, 2009):

1. **Reach lengths.** The first element is to estimate the length of the affected reach. The length of reach affected by additional flows is determined by the slope and shape of the channel and by constrictions to flood flows such as bridges, weirs and sluices. The reach length decision tree uses engineering judgement to estimate both the upstream and downstream affected reach lengths based on channel widths and slopes extracted from OS maps at 1:10 000 scale.

2. **Sensitivity of water levels.** Having identified the study reach for each WwTW a second decision tree was applied to identify the risk category. This decision tree identifies the most common controls of flood levels, such as channel constrictions and downstream structures. For each WwTW site the sensitivity of flood levels to increasing flows was recorded as high, medium or low.

3. **Impact zone.** The final analysis considers the likely impact of the changes in flood levels, in particular whether the affected reach of river is urban, sub-urban or rural in nature. The third decision tree was applied to determine whether the impact was considered high, medium or low. High impact was considered to be an urban area containing at least 50 properties whilst low impact was considered to be a rural area with less than 5 properties affected. The higher score of either the upstream or downstream reach has been adopted (Halcrow, 2009).

4. **Scoring.** The final scores from each assessment are weighted and combined to give an overall risk score at the site.

9.3 Assumptions and limitations

The following assumptions and limitations are associated with the applied methodology:

- The reach length decision tree recommends calculating the backwater effect (upstream reach length) using steady state hydraulic modelling software. Hydraulic modelling is outside the scope of this study, but is not considered crucial anyway, given the small predicted increases in flows. Due to the low calculated increase in flows from the WwTW it is assumed that the increase in flow would not impact more than 1 km downstream of each subject site.
- Due to the differing channel dimensions and slopes at each site, in reality the backwater reach will vary between watercourses. However, due to the relatively small flow increases the impacts are likely to be negligible.
- Site visits were not undertaken as part of this study. Information regarding downstream structures has been taken from OS mapping and readily available web based information. There is a possibility that there are un-mapped structures which exist that have not been taken into account in this study.
- Structure details have been taken from OS mapping and readily available web based information. It has been assumed that large road bridges are clear span and will not cause significant restrictions to flow under normal flow conditions. It has also been assumed that smaller bridge structures and foot bridges have piers which could cause flow restrictions under low flow conditions. It has not been possible to identify culverts from OS mapping or other readily available information.

9.4 Results

The decision trees and results of the multi-criteria analysis are shown in Appendix D. The total risk value for each site is shown on the extreme right of the table and the sites are ranked according to their score. The weightings used for this ranking were 0.4 for the percentage increase in flow and 0.3 for both Sensitivity and Impact. The colour coding used is red for a combined risk value greater than 3, amber greater than 2.5 and green for less than 2.5. A summary of the site details and the results of the Multi-Criteria scoring at each site are shown in Table 9-4 and discussed in more detail in Appendix D.

WwTW Site	Combined Risk Value	Assessment
Saffron Walden	1.6	Low
Great Dunmow	1.6	Low
Stansted Mountfitchet	1.6	Low
Great Chesterford	1.6	Low
Great Easton	2.2	Low
Newport	2.2	Low
Takeley	2.2	Low

Table 9-4- Multi-Criteria Analysis Results

9.4.1 Saffron Walden

The WwTW is located to the north east of Saffron Walden in an open area of land where it discharges into the Slade. OS 1:10000 mapping indicates that the Slade is approximately 10 m wide in the vicinity of the WwTW discharge and the slope of the river is 0.0052. There is a small footbridge located 660 m downstream of the works.

The combined risk value is 1.6, therefore the increased flow from the WwTW site is classified as having a low risk.

9.4.2 Great Dunmow

This WwTW is located to the south east of Great Dunmow between the B1256 and the Ash Grove Tributary. The works discharge into the River Chelmer. OS 1:10000 mapping indicates that the tributary is 9 m wide in the vicinity of the WwTW discharge and the slope of the river is 0.0021. There is a small access bridge located approximately 550 m downstream of the works.

The combined risk value is 1.6, therefore the increased flow from the WwTW site is classified as having a low risk.

9.4.3 Stansted Mountfitchet

This WwTW is located to the south east of Stansted Mountfitchet in open land and discharges into the Stansted Brook. OS 1:10000 mapping indicates that the river is approximately 11 m wide in the vicinity of the WwTW discharge and the slope of the river is 0.0013. There is a road bridge approximately 640 m downstream of the works.

The combined risk value is 1.6, therefore the increased flow from the WwTW site is classified as having a low risk.

9.4.4 Great Chesterford

This WwTW is located to the north of Great Chesterford and discharges into the River Cam. OS 1:10000 mapping indicates that the River Cam is 12 m wide in the vicinity of the WwTW discharge and the slope of the river is 0.0020. There is a road bridge located approximately 860 m downstream of the works.

The combined risk value is 1.6, therefore the increased flow from the WwTW site is classified as having a low risk.

9.4.5 Great Easton

This WwTW is located to the east of Great Easton and discharges into a tributary of the River Chelmer. OS 1:10000 mapping indicates that the tributary is approximately 6.5 m wide in the vicinity of the WwTW discharge and the slope of the river is 0.0078. There is a road bridge located approximately 630 m downstream of the works along with two small settlements at Cox Hill and Croys Grange.

The combined risk value is 2.2, therefore the increased flow from the WwTW site is classified as having a low risk.

9.4.6 Newport

This WwTW is located to the north east of Newport and discharges into the River Cam. OS 1:10000 mapping indicates that the River is 7 m wide in the vicinity of the WwTW discharge and the slope of the river is 0.0030. There is a footbridge located approximately 745 m downstream of the works and the north eastern part of Newport runs adjacent to the River Cam downstream of the works.

The combined risk value is 2.2, therefore the increased flow from the WwTW site is classified as having a low risk.

9.4.7 Takeley

This WwTW is located to the east of Takeley and discharges into Pincey Brook. OS 1:10000 mapping indicates that the River is 5m wide in the vicinity of the WwTW discharge and the slope of the river is 0.0030. There is an access bridge located approximately 300 m downstream of the works.

The combined risk value is 2.2, therefore the increased flow from the WwTW site is classified as having a low risk.

10 Water Quality

Mitigating the impact of the proposed growth on the water quality in the surrounding watercourses and aquifers is a key objective for the WCS, and correlates with UDC Policy EN2. 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 discharges from WwTW will increase, it is likely that the chemical constraints 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, as well as the current dilution available from the river flow, and the possible benefits of increased flows.

As shown in Table 10-1, the majority of receiving watercourses already exhibit high levels of phosphate, which cause them to be classed as not achieving good ecological status (or GES) 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. It should be noted that development should not be permitted if it will lead to deterioration in water status or will prevent Good Status from being achieved.

As discussed in Section 3 the legal requirement to protect and improve the water quality in watercourses, groundwater and environmental sites across the study area and wider area comes primarily from the following legal instruments:

- The European Habitats Directive and Birds Directive, transcribed into English law by the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended);
- Freshwater Fish Directive; and
- The Water Framework Directive (WFD).

The following Sections focus on the potential impacts on the water quality of the receiving watercourses (or groundwater bodies) and supported sites, from the proposed increases in treated wastewater effluent.

10.1.1 WFD implications

The following section describes the existing condition of the receiving watercourses, as reported in the RBMP.

The general objective of the WFD is to achieve ‘Good status’ for all surface waters by 2015. ‘Good status’ means both ‘good ecological status’ and ‘Good chemical status’. This will be realised by ensuring that there should be no deterioration and that improvements to good status need to be made. UDC has an important role in contributing towards the delivery of these objectives through exercising their strategic growth planning and the determination of planning applications roles.

Saffron Walden WwTW

Saffron Walden WwTW discharges to the River Slade, a tributary of the River Cam. The EA data provided assumes a direct discharge to the River Cam. The EA mapping indicates that at the location of the WwTW discharge, the River Slade is classified as heavily modified and the current ecological quality as Moderate Potential. The current chemical quality does not require assessment. The overall Physio Chemical is Moderate, with Ammonia classified as High and Phosphate as Poor. The River Cam is located approximately 880 m from the WwTW discharge location. The River Cam is classified as heavily modified and the current ecological quality as Poor Potential. The current chemical is classified as Good. The overall Physio Chemical is Moderate, with Ammonia classified as High and Phosphate as Poor.

The detailed data provided by the EA for the WCS indicates that under the No Deterioration target the RBMP status is Good for BOD, High for Ammonia and Bad for Phosphate. However, UWWTD P-removal scheme was installed at the end of 2008 (a measure quoted in the RBMP) and river quality is now predicted to be Poor status. This is based on 2006-2008 data at sample point 27M04. The Improve to Good Status applies to Phosphate only (Ammonia and BOD are already at, or better than, Good status).

Great Dunmow WwTW

The EA mapping indicates that at the location of the WwTW discharge the River Chelmer is classified as heavily modified and the current ecological quality as Moderate Potential. The current chemical quality does not require assessment. The overall Physio Chemical is Moderate, with Ammonia classified as High and Phosphate as Poor.

The detailed data provided by the EA for the WCS indicates that under the No Deterioration target the RBMP status is High for BOD, High for Ammonia and Poor for Phosphate. The Improve to Good Status applies to Phosphate only (Ammonia and BOD are already at, or better than, Good status).

Takeley WwTW

The EA mapping indicates that at the location of the WwTW discharge the current ecological status of the Pincey Brook is classified as Moderate Potential and the current ecological quality as Poor Status. The current chemical quality does not require assessment. The overall Physio Chemical is Moderate, with Ammonia classified as High and Phosphate as Poor.

The detailed data provided by the EA for the WCS indicates that under the No Deterioration target the RBMP status is High for BOD, High for Ammonia and Poor for Phosphate. This is based on 2006-2008 data at sample point PLER0107. The Improve to Good Status applies to Phosphate only (Ammonia and BOD are already at, or better than, Good status).

Great Easton WwTW

The EA mapping indicates that at the location of the WwTW discharge the River Chelmer is classified as heavily modified and the current ecological quality as Moderate Potential. The current chemical quality does not require assessment. The overall Physio Chemical is Moderate, with Ammonia classified as High and Phosphate as Poor.

The detailed data provided by the EA for the WCS indicates that under the No Deterioration target the RBMP status is High for BOD, High for Ammonia and Poor for Phosphate. This is based on 2006-2008 data at sample point CH10. The Improve to Good Status applies to Phosphate only (Ammonia and BOD are already at, or better than, Good status).

Newport WwTW

The EA mapping indicates that at the location of the WwTW discharge the River Cam is classified as heavily modified and the current ecological quality as Poor Potential. The current chemical quality does not require assessment. The overall Physio Chemical is Moderate, with Ammonia classified as High and Phosphate as Bad.

The detailed data provided by the EA for the WCS indicates that under the No Deterioration target the RBMP status is High for BOD, High for Ammonia and Bad for Phosphate. It has been noted that Bad status has no upper boundary, therefore to ensure 'no deterioration' in downstrean river phosphate quality, permit limits would be set to maintain the current effluent load. The Improve to Good Status applies to Phosphate only (Ammonia and BOD are already at, or better than, Good status).

Stansted Mountfitchet WwTW

The EA mapping indicates that at the location of the WwTW discharge the current ecological quality of the Stansted Brook is classified as Poor Status. There is no modification classification for the watercourse. The current chemical quality is Good. The overall Physio Chemical is Good, with Ammonia classified as High and Phosphate as Good.

The detailed data provided by the EA for the WCS indicates that under the No Deterioration target the RBMP status is High for BOD, High for Ammonia and Good for Phosphate. As all determinands are at or above there is no Improve to Good status.

Great Chesterford WwTW

The EA mapping indicates that at the location of the WwTW discharge the current ecological quality of the River Cam is classified as Poor Potential and the current chemical quality as Good. The overall Physio Chemical is Moderate, with Ammonia classified as High and Phosphate as Poor.

The detailed data provided by the EA for the WCS indicates that under the No Deterioration target the RBMP status is High for BOD, High for Ammonia and Bad for Phosphate. However, the UWWTD P-removal scheme installed at the end of 2008 at Saffron Walden STW (a measure quoted in the RBMP) has resulted in an improvement to Poor status for Phosphate. As this measure is planned and accounted for in the RBMP Poor (i.e. current) status is used as the No Deterioration target for phosphate. Improve to Good Status applies to Phosphate only (as Ammonia and BOD are already at, or better than, Good status).

Felsted WwTW

The WwTW discharges into the Stebbing Brook, the location of the WwTW discharge point is approximately 170 m from the confluence with the River Chelmer. The downstream data has been provided from a sampling point located on the River Chelmer, downstream of the confluence with the Stebbing Brook.

The EA mapping indicates that at the location of the WwTW discharge the current ecological quality of the Stebbing Brook is classified as Good Status. Chemical quality does not require monitoring. The overall Physio Chemical is High, with Ammonia classified as High and Phosphate as High. The EA mapping indicates that the current ecological quality of the River Chelmer is classified as Moderate Potential. Chemical quality does not require monitoring. The overall Physio Chemical is Moderate, with Ammonia classified as High and Phosphate as Poor.

The detailed data provided by the EA for the WCS indicates that under the No Deterioration target the RBMP status is High for BOD. High for Ammonia and Poor for Phosphate. This is based on 2006-2008 data at sample point CH08, the main river Chelmer downstream of the confluence with the Stebbing Brook. Improve to Good Status applies to Phosphate only (as Ammonia and BOD are already at, or better than, Good status).

10.2 Water quality: methodology

The EA River Quality Planning (RQP) tool (version 2.5) was made available for use in this WCS. The RQP tool uses mass balance Monte Carlo simulations to identify the indicative consent standards that would need to be applied to a new discharge, and the change in downstream concentrations of physio chemical elements following a discharge.

The RQP tool was used to calculate the effect of the WwTW discharges on downstream water quality in the receiving watercourse. In addition the RQP tool was used to calculate the indicative consent standards which would be required to ensure the increased discharges (from Section 8) do not cause deterioration in the existing water quality.

Indicative consent standards were calculated for the following situations:

- The permit limits required to achieve WFD No Deterioration targets pre- and post-growth;
- The permit limits required to achieve Good status. It should be noted that this only applies to phosphate, as all other elements are already at Good or better;

The EA provided data regarding the existing flow characteristics and measured quality standards in the receiving watercourses, as follows:

Discharge Location	**Receiving River**	**Q95 Mean flow** m³/day	**Monitoring Point**		**Monitored Results**		
					BOD mg/l (90%ile)	**Ammonia mg/l** (90%ile)	**SRP[1] mg/l** (Annual Average)
Saffron Walden WwTW	River Cam[2]	39,916	Upstream River Data	Mean	1.77	0.06	0.64
				SD	1.43	0.04	0.57
			STW Discharge Data	Mean	5.92	0.68	1.03
				SD	2.55	0.79	0.30
Great Dunmow WwTW	River Chelmer	34,773	Upstream River Data	Mean	0.94	0.05	0.43
				SD	0.48	0.05	0.26
			STW Discharge Data	Mean	2.94	0.38	6.21
				SD	2.39	0.48	1.43
Takeley WwTW	Pincey Brook	773	Upstream River Data	Mean	2.10	0.3	5.8
				SD	2.01	0.95	1.19
			STW Discharge Data	Mean	4.5	0.79	5.8
				SD	2.80	1.19	1.51
Great Easton WwTW	River Chelmer	23,874	Upstream River Data	Mean	1.79	0.03	0.09
				SD	1.08	0.02	0.03
			STW Discharge Data	Mean	5.29	1.00	5.92
				SD	2.7	1.1	1.34
Newport WwTW	River Cam	24,912	Upstream River Data [3]	Mean	0.86	0.09	0.025
				SD	0.52	0.05	0.025
			STW Discharge Data	Mean	5.2	1.27	4.72
				SD	2.68	0.96	0.91

Discharge Location	**Receiving River**	**Q95 Mean flow** m³/day	**Monitoring Point**		**Monitored Results** BOD mg/l (90%ile)	**Ammonia mg/l** (90%ile)	**SRP[1] mg/l** (Annual Average)
Stansted Mountfitchet WwTW	Stansted Brook	518	Upstream River Data [3]	Mean	2.36	0.25	0.085
				SD	1.42	0.15	0.085
			STW Discharge Data	Mean	2.1	0.3	5.8
				SD	2.01	0.95	1.19
Great Chesterford WwTW	River Cam	58,752	Upstream River Data	Mean	1.95	0.11	0.7
				SD	0.71	0.07	0.5
			STW Discharge Data	Mean	0.95	0.19	5.09
				SD	0.63	0.12	0.85
Felsted WwTW	Stebbing Brook	12,110	Upstream River Data	Mean	1.00	0.02	0.05
				SD	0.76	0.02	0.04
			STW Discharge Data	Mean	4.48	0.36	5.6
				SD	2.3	0.65	0.93

Table 10-1 Base data for use in the RQP tool

[1] Values have not been transferred from SRP into TP values prior to the RQP calculations.
[2] Assumed direct discharge to this watercourse, rather than the River Slade.
[3] No recent monitoring, assumed upstream mid-point good status.

The data contained in Appendix E illustrates the values the EA advised should be used when assuming that upstream water quality is already achieving its target (high status), due to future improvements in the upstream catchment. The 'Improve to Good' status applies to Phosphate only, as Ammonia and BOD are already at, or better than, Good status for all WwTWs.

Both the No Deterioration and Improve to Good Status scenarios will be tested with the existing permitted flow and the future post-growth flow, and the results are presented alongside each other in Table 10-5. This assessment has been undertaken to make it clear whether the growth makes achieving the WFD objectives any more difficult than the current permitted situation.

This ensures that water companies and their customers are not unduly penalised for existing upstream conditions, and highlights the importance of improving agricultural and surface water drainage practices which must be considered as part of a catchment wide approach to water quality improvements.

10.3 Water quality: limits of conventional technology

For the purposes of comparing indicative consent results, the following physio-chemical standards have been assumed to represent current and future best practice.

These should not be considered definitive, and will be subject to individual site conditions, existing processes employed, and strategic investment decisions undertaken by AWS/ TWU based on current and future Ofwat/ EA priorities.

	BOD mg/l (95%ile)	**Amm. N mg/l** (95%ile)	**SRP mg/l** (Annual Average)
Limits typically considered as reliably economically achievable using conventional technologies.	**8**	**3**	**1**
Limits that may be currently achieved by enhanced operation of conventional and emerging processes. Although not as reliable as the above, it is assumed that consents such as these will become more common over the study period if water quality constraints are to be met.	**5**	**0.5**	**0.5**
Limits more stringent than the above, where it is assumed unlikely a water company or process supplier would be able to guarantee such performance in the foreseeable future at a large scale without resorting to energy intensive processes normally reserved for potable water treatment.*	**<5**	**<0.5**	**<0.5**

Table 10-2 Current and future standards assumed to be economically achievable using conventional technology

* If such standards were required in the short term, it is likely the water company and the EA would have to agree to set lower targets for the waterbody under the provision of the WFD, allowing the failure to meet good status for reasons of technical feasibility or disproportionate cost. This would be reviewed every six years under the WFD.

The colour convention in Table 10-2 is used throughout the following Sections to identify where the modelled indicative consents standards fit in to the above categories.

10.4 Water quality: impacts of growth

The existing volumetric discharge consents and physio chemical consent standards are discussed in Section 8. Key findings and implications of the proposed growth are discussed in the following Sections and further information can found in Appendix E.

10.4.1 WwTW Discharge Implications

The calculations undertaken as part of this assessment are indicative and give a suggestion of the permit limits that might be required for WwTW catchments in the future. The figures presented within this chapter are not final and should be expected to change at the time a new discharge consent is submitted to the EA. The aim of this chapter is to point out the areas where there is the highest risk and therefore preparation can be made now for potential development constraints in the future.

Two assessments have been undertaken, the RQP tool has been used to predict the indicative effect that the new discharges would have on downstream water quality and the RQP tool was used to calculate the indicative consent standards which would be required to ensure no deterioration in status following the full discharge.

Indicative Effect of Discharges on Downstream Water Quality

For the details of calculations and a full discussion of the effect the discharges would have on the downstream water quality, (assuming the discharge were at the existing monitored physio chemical standards) refer to Appendix E. The calculations show the effect of the existing consented flow and the future post growth flow from the WwTW on water quality downstream i.e. the predicted water quality downstream of the WwTW discharge location.

The results of the assessment indicate that at the majority of WwTW the predicted future DWF is lower than the existing consented DWF and the future growth does not result in the WFD objectives being more difficult to achieve than the current permitted situation. Aside from at Great Dunmow where the predicted future DWF is higher than the existing consented flow the future growth makes does result in the WFD objectives being more difficult to achieve than the current permitted situation.

It is understood that there are capacity issues at Great Easton and Newport and that potentially development within the two WwTW catchments will have a detrimental effect on downstream water quality.

In general the results highlight that the downstream water quality for BOD and Ammonia are at Good or High. However, the Poor downstream results for phosphate (SRP) highlight the importance of AWS and TWU working to improve the concentrations of SRP in the effluent discharges of upstream WwTW in all of the catchments, and on-going strategies to engage all upstream stakeholders in targeting diffuse pollution. This should help water bodies to move towards achieving Good status.

Indicative Discharge Consent Standards Required

The EA have confirmed that where the proposed growth can be accommodated within the current permitted DWF there is no requirement to carry out a post-growth WFD assessment. However, to confirm if the discharge consents will need to be revised calculations have been undertaken for all WwTWs and are contained within Appendix E.

The results show that at the majority of the WwTW the predicted future DWF is lower than the consented DWF. This indicates that the proposed development can be accommodated within the existing consent and that the existing permit will remain in place with DWF and sanitary limits intact. As detailed in Table 8-2 the existing DWF consent is only being exceeded post development at Great Dunmow. In addition there are known capacity issues at Newport and Great Easton and therefore there is likely to be a requirement to revise the existing DWF consent to accommodate future development. Due to the known issues at Great Dunmow, Newport and Great Easton the RQP calculations are presented and reported in the following section. The results for all other WwTWs, which do not exceed the current DWF consent, are also contained within Appendix E.

At Great Easton and Newport it is understood that there is no 'headroom' in the permit and as such, when calculating the post-growth DWF, the current consented DWF figure, should be used as the baseline. The EA have also requested that this assessment is also undertaken for Great Dunmow.

At Great Easton WwTW additional calculations have been completed to assess the impact of development when the DWF of 874 m3/day is used as the base point, following advice from AWS that the current consent has no headroom. The increased DWF from the proposed growth (26 m3/day) has been added to the current consented DWF to create a combined future DWF. The details of which are shown in Table 10-4.

The EA have advised that Newport STW has no 'headroom' in the permit. As such, when calculating the post-growth DWF, the current DWF figure of 738 m3/day should be used as the baseline. The increased DWF from the proposed growth (162 m3/day) has been added to the current consented DWF to create a combined future DWF. The details of which are shown in Table 10-4.

Similarly, the current consented DWF of 1509m3/day was used as the baseline and the increased DWF from the proposed growth (503m3/day) has been added to this baseline to create a combined future DWF. The details of which are shown in Table 10-4.

WwTW	Existing calculated DWF Flow **(m3/day)**	Future DWF Flow **(m3/day)**	**Total Future DWF (using calculated flow as baseline)**
Great Dunmow	1,699	503	**2202**
Great Easton	657	26	**683**
Newport	563	162	**725**

Table 10-3 DWF Calculations using the WwTW population figures as the baseline

WwTW	Existing consented DWF Flow **(m3/day)**	Future DWF Flow **(m3/day)**	**Total Future DWF (using consent as baseline)**
Great Dunmow	1,509	503	**2012**
Great Easton	874	26	**900**
Newport	738	162	**900**

Table 10-4 DWF Calculations using the consented flow as the baseline

The tables above indicate that using the calculated future DWF based on the baseline population numbers given by AWS provides the most conservative estimate of DWF for Great Dunmow whereas for Great Easton and Newport the calculated future DWF using the existing consented DWF as the baseline provides the most conservative estimate.

Table 10-5 presents indicative consent results for Great Dunmow, Great Easton and Newport WwTWs for both the calculated future DWF based on the population figures provided by AWS as a baseline (Table 10-3) and the calculated future DWF using the existing consent as a baseline (Table 10-4). The RQP tool was used to calculate the **indicative** consent standards which would be required to ensure no deterioration in status following the full discharge.

STW name	Existing consented DWF (m3/day)	Total Future calculated 2028 DWF (m3/day)	*Existing Consented Flow*				*Future Post-growth Flow*			
			To Achieve WFD No Deterioration Targets			To Achieve Good Status	To Achieve WFD No Deterioration Targets			To Achieve Good Status
			BOD *(95%-ile)*	Ammonia *(95%-ile)*	Phosphate *(mean)*	Phosphate *(mean)*	BOD *(95%-ile)*	Ammonia *(95%-ile)*	Phosphate *(mean)*	Phosphate *(mean)*
			mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
Calculated DWF using population figures as the baseline to calculate the future DWF										
Great Dunmow	1,509	2,202	30.33	4.15	7.90	0.53[1]	22.42	3.00	5.78	0.41[1]
Great Easton	874	683	3.64	4.77	13.17	0.58[1]	3.65	5.96	16.48	0.70[1]
Newport	738	725	26.55	3.07	4.72[2]	1.43[1]	26.99	3.11	4.80[2]	1.46[1]
Calculated DWF using the existing discharge consent as the baseline to calculate the future DWF										
Great Dunmow	1,509	2,012	30.33	4.15	7.90	0.53[1]	24.09	3.24	6.22	0.43[1]
Great Easton	874	900	3.64	4.77	13.17	0.58[1]	3.52	4.64	12.84	0.50[1]
Newport	738	900	25.55	3.07	4.72[2]	1.43[1]	22.30	2.60	3.90[2]	1.15[1]

Table 10-5 WwTW RQP indicative consent results at fully consented conditions

[1] Assuming upstream improvements to Mid Good status (0.085) have been achieved discharge would have to be **0.12** mg/l SRP to achieve Good status

[2] To ensure 'no deterioration' in downstream river phosphate quality, permit limits have been set to maintain the current effluent load calculated using the following equation. 'no deterioration'= current DWF / future DWF x current mean effluent quality.

The capacity of the WwTW is a key constraint in Great Dunmow. AWS predict that development will exceed the current process capacity, and require a new volumetric discharge consent to be negotiated with the EA. Part of the flow from Great Dunmow is currently being transferred to Felsted WwTW. The population numbers provided by AWS are for the existing population served by Great Dunmow WwTW and do not take into account this transfer. It should be noted that AWS have indicates that closing Great Dunmow and transferring all flows to Felsted is unfeasible. Therefore, the transfer of all flows to Felsted has not been assessed within the WCS.

AWS have advised that the transferred flows vary and the calculations should be based on the consented figures. The WCS has concluded that discharging the future DWF from Great Dunmow WwTW to the River Chelmer will be more constrained by WFD water quality requirements than the current consented position. The level of constraint depends on the timing of future upgrades, the processes to be employed, and the volume of flows that are transferred to Felsted in the future. Without proposed improvements within the catchment there is the potential for development to result in the River Chelmer failing to meet Good Status.

The results in Table 10-5 show that the calculated future DWF based on the existing population figures provided by AWS is lower than the existing consented DWF at Newport and Great Easton WwTW. This indicates that the proposed development can be accommodated within the existing consent and that the existing permit will remain in place with DWF and sanitary limits intact. However, this conclusion is not in line with detailed knowledge of both WwTW and the EA and AWS have confirmed that both WwTW have no 'headroom' in the permits. Therefore, an additional assessment using the consented DWF as the baseline has been undertaken as highlighted above and the results of the assessment are discussed below.

When compared to the assessment based on DWF using population figures as the baseline for Great Easton and Newport the results show that the increased DWF above the existing consented flow will tighten the consent limits slightly for all determinands. It is understood that the EA is likely to require the consents to be tightened at the both the Great Easton and Newport works to improve the water quality in line with the requirements of the WFD. This is particularly relevant for Phosphate, as the results indicate that the water quality downstream of the WwTW discharge remains Moderate under the Improve to Good status for both WwTWs.

When compared to the assessment based on DWF using existing population figures as the baseline for Great Dunmow the RQP results show that the required future consent limits with the alternative baseline scenario (i.e. existing consented DWF) will become slightly less stringent. This is due to the future flow using the existing consented DWF as the baseline being lower by approximately 190m^3 than the calculated future DWF using the baseline population numbers provided by AWS. The results presented in Table 10-5 indicate that the SRP concentration required to bring the downstream quality 'up to Good status' is beyond the levels currently generally considered to be reliably economically achievable using conventional technology at Great Dunmow for the both baseline scenarios assessed.

The calculations show that that SRP concentration required to bring the downstream quality 'up to good status' is within the levels that could be currently achieved by enhanced operation of conventional processes at Great Easton and Newport (although, as these WwTW do not currently employ phosphorus stripping methods, significant investment will be required to provide the required processes).

It is recommended that development within the Great Dunmow, Great Easton and Newport catchments are phased, to allow improvements in the respective WwTW to be made before the majority of development is constructed. This would limit the impact on the receiving watercourses and make achieving the targets of the WFD more achievable.

At Great Dunmow significant improvements to the WwTW capacity are expected to occur in 2014/15. The proposed development trajectory indicates that development will not occur within the Great Dunmow WwTW catchment until 2017. Additional WwTW capacity, along with revised volumetric discharge consent, will be required to accommodate the increased flows. Any such consent changes would come under the requirements of the Water Framework Directive, to prevent deterioration of water quality or achieve 'Good status', which has the potential to impact on the long term deliverability of the proposed growth.

The development trajectory within the Great Easton catchment proposes that construction is due to commence at the end of AMP5 and early AMP6 (i.e. from 2014 to 2016). Calculations predict that the total DWF received by the Great Easton WwTW will not exceed its volumetric discharge consent. However, is has been highlighted that there are known capacity issues at the WwTW. It has been indicated by the EA and AWS and confirmed in Table 10.2 and 10.5 that it is likely that the quality limits that will need to be achieved will be beyond what is currently regarded as the limit of conventional treatment technology and is likely to present difficulties in terms of achieving the full predicted growth. It is considered that UDC are advised that growth in the Great Easton catchment should be phased beyond 2017/18 to ensure AWS have sufficient time to verify the flows, and therefore the capacity for growth. This would ensure there is no deterioration in downstream water quality. The calculated BOD quality parameter is beyond the levels currently generally considered to be reliably economically achievable using conventional technology. Therefore, the EA should confirm the exact requirements for the consent requirements before development commences in 2014 as it is a constraint for any further development in this catchment.

The development trajectory for Newport proposes that construction is due to commence at the beginning of AMP6 (i.e. 2015), with the majority of development occurring in AMP 7 (i.e. 2018 to 2020). Calculations indicate that the proposed development in the catchment would result in the existing DWF consent limit nearly being reached. AWS have indicated that, due to seasonal variations in existing DWF received at Newport WwTW, there is no capacity within the existing (or proposed higher) DWF consent, or the process capacity of the WwTW, to accommodate the flows from any new dwellings. Any increase in dwellings at Newport could require the negotiation of a new increased DWF consent with the EA, and this is known to lead to tightening of the quality levels required in this discharge. To maintain the current effluent load for Phosphate and to accommodate development it is likely AWS will have to install Phosphate-removal, which in turn could result in potential delays in funding and delivery of treatment infrastructure. It is therefore concluded that discharge consent and WwTW capacity is a constraint to the potential development within the Newport catchment.

10.4.2 Applying For a New Discharge Consent

The indicative calculations suggest that new discharge consents will be required at Great Dunmow, Great Easton and Newport WwTW to accommodate the proposed development within each WwTW catchment. WwTWs treat the sewage by a variety of methods to a standard that allows the water to be discharged to a water course without harm to the environment. The EA provides the regulatory framework in terms of rate of discharge and acceptable water quality that AWS and TWU must achieve to allow the effluent to be discharged.

For WwTWs which receive effluent from combined sewerage systems, the EA regulate flow volume discharged by limiting the DWF of the discharge to a maximum value. This is important, because the impact of a discharge on the receiving water is directly linked to the volume discharged. The effluent quality limits are determined on the basis of the consented DWF. In general, as the DWF increases, the quality limits become tighter.

The calculations to determine the permit limit for DWF are normally undertaken by the operator. The EA normally takes the applied-for DWF limit at face value, although details of the calculation form part of the consent application. However, it is in the operator's own interests to apply for the correct limit, as a too-low limit may lead to consent non-compliance and a too-high limit can result in tighter quality standards than would otherwise be the case.

Discharges from the WwTW are calculated by the operator and a new consent issued by the EA which states a maximum DWF and corresponding limits for various parameters, principally BOD, phosphate and Ammonia. It should be noted that the consent limits set by the EA for the new discharge consent may not be within the limit of conventional technology and thus could constrain development within a WwTW catchment.

10.5 Water quality: infrastructure options

10.5.1 Reducing flows

It has been suggested that additional dwellings can be accommodated with the DWF limits in all WwTWs within the study area (potentially aside from Great Dunmow), if the projected PCC of the new dwellings is reduced to 80 l/p/d or less via proposals for Grey Water Recycling (GWR) (at a domestic or neighbourhood level).

However, the overall effect of GWR is that the WwTW receives a similar loading of contaminants in a relatively lower volume of water, i.e. a higher concentration. As the effectiveness of the installed treatment processes depends on the concentration of the incoming wastewater, and the ability of the biological processes to breakdown the overall load, it should not be assumed that reducing PCC allows any further Population Equivalence (PE) to be accommodated.

Similarly, it has been suggested that the collection of rainwater from the development sites allows an opportunity to further dilute the wastewater effluent prior to discharge to the receiving watercourse, potentially by incorporating Sustainable Drainage Systems (SuDS) such as infiltration/ attenuation ponds with the reedbeds/ wetlands used for tertiary treatment.

However, relying on such an integrated treatment approach presents a risk that adequate dilution will not be available during unusually dry periods; expected to occur more frequently with climate change. This can be particularly problematic, as the receiving watercourses would also be drier during such periods, and would hence have less capacity to dilute the effluent.

It is likely that the discharge of high concentration effluent during such a period of low flows such as this would have a significantly acute impact on water quality and the aquatic ecology.

The potential integration of RWH and GWR with wastewater treatment is discussed in more detail in Section 11.

10.5.2 Treatment technology options

Reedbeds and wetlands

The utilisation of constructed reedbeds/ wetland areas for the tertiary treatment of wastewater is considered a feasible component of the overall wastewater strategy. The biological processes in the root systems assist in further polishing wastewater via the nitrification of ammonia, and the physical processes (i.e. settlement) can reduce suspended solids and potentially BOD, all with relatively low costs and energy requirements.

Additionally, plant life in these areas will remove nutrients from the water, assisting in reducing levels of P and Nitrates.

The incorporation of such features into the SuDS treatment train, through the construction of integrated wetland areas, offers a number of benefits (providing the overall discharge quality is not dependent on stormwater flows).

A well designed integrated wetland area would combine constantly wet ponds, reedbeds and small watercourses (benefiting from relatively consistent volumes of nutrient rich effluent from the secondary stage of wastewater treatment), with swales and open areas designed to be wet and dry throughout the year. The range of habitats and water levels provided by such a site would serve to significantly enhance local biodiversity, and provide habitat areas higher up in river catchments.

However, in terms of wastewater treatment, it is considered that reliance on reedbed/ wetland areas for full biological treatment is not acceptable, due to the potential for their efficiency to be hampered by extreme weather. They are only to be considered as a form of tertiary treatment to polish effluent which has already undergone biological treatment.

Reactor and filtration technologies

Numerous package solutions exist for wastewater treatment, relying on the principles of anaerobic reaction, followed by aerobic reaction, to achieve suitable levels of secondary treatment via biological means. Physical processes such as settlement and filtration are often provided within these package plants, or as external additions to the process.

Advanced media and process arrangements have been developed which allow the large surface areas needed for effective biological treatment to be provided in smaller package plants.

However, these technologies are only typically used by UK water companies where they do not have space for a conventional Activated Sludge Process (ASP) process, or want the benefit of the more flexible construction offered by the modular nature of these package plants.

Table10-6 illustrates the typical PE ranges and effluent quality situations where these technologies would typically be installed by UK water companies at present, and discusses their suitability for providing the necessary treatment, in comparison to the conventional ASP approach. It should be recognised that these are not definitive, and the uptake of any technology will be based on a financial and risk assessment undertaken by AWS/TWU based on local conditions.

The removal of BOD and Phosphate to the levels required may therefore only be achievable using Membrane Bioreactor (MBR) technology (not normally specified at this level of PE in the UK), supplemented by advanced tertiary treatment.

The reliable removal of BOD and Phosphate to these levels would likely require advanced tertiary filtration (potentially via fine membrane technology to capture phosphate (SRP) and extensive use of chemical dosing (such as chlorination followed by dechlorination to reduce BOD, and Aluminium/ Iron dosing to reduce P). The cost (and carbon) associated with the provision and continual transport of these additional elements to the sites must be considered.

Ultra-violet systems are used to reduce BOD, although the maintenance and replacement of bulbs entails a relatively high cost, and process design must be thorough to ensure that floating material in the effluent does not shadow pathogens from the UV light.

These technologies are normally reserved for the treatment of water to a potable level. Given the higher costs and energy intensity required to reliably achieve such levels, it is likely that AWS/TWU would seek to avoid the need for them by pursuing the provision of the WFD which allows for alternative water quality targets if the required treatment is shown to have a disproportionate cost.

Technology	Achievable Effluent Quality	Typical PE limit	Benefits	Risks
Membrane bioreactor (MBR)	BOD < 8 mg/l Amm. N < 3 mg/l P = technology developing to include EBPR in process to achieve < 1 mg/l, although metal dosing backup required.	Assumed to be uneconomical beyond 1,750 PE (~ 750 properties).	Modular components allow phased construction. Variant of ASP process which uses filtration rather than secondary settlement, significantly saving on space required. Excellent BOD removal.	Metal dosing for P removal can potentially blind filters. High capital, maintenance and energy costs.
Rotating biological contactor (RBC)	BOD = 8–15 mg/l Amm. N = 3 mg/l P = metal dosing and reedbed required for tertiary treatment towards 2 mg/l.	Assumed to be uneconomical beyond 2,000 PE (~ 875 properties).	Modular components allow phased construction. High surface area provided for biological reaction – significant space saving over traditional ASP.	Prone to odour issues, requiring additional operational energy to address. Additional disc/ sand filters may be required to reliably reduce P concentrations beyond 2 mg/l.
Submerged aerated filter (SAF)	BOD = 16-25 mg/l Amm. N = 10-4.5 mg/l (P = metal dosing and reedbed required for tertiary treatment towards 2 mg/l.	RBC normally favoured due to Amm. N and BOD performance. Assumed to be uneconomical beyond 2,000 PE (~ 875 properties).	Modular and condensed version of the biological trickling filter process, reducing land take and odour concerns.	Additional filtration or reedbed needed to further reduce Amm. N and BOD.
Small scale ASP (alternating oxi-ditches/	BOD = 5 mg/l provided good retention times and tertiary reedbed/filtration used	Typically used as more economical option to RBC for PE over 2,000 (~ 875 properties).	Well understood technology where on-going design is increasing efficiency and reliability (i.e. fine aeration,	Higher land take than the modular options. Some metal dosing required to reliably achieve levels of P

boxes)	Amm. N = 3 mg/l P = EBPR to 1 mg/l		or MBBR additions)	beyond 1 mg/l, and reedbeds/ filters required for further BOD/ Amm. N removal.
Sequential batch reactor (SBR)	As above, although condensed size can restrict the retention time provided, and the space available for EBPR.	Theoretically up to any size, although only required where traditional ASP cannot fit.	Condensed version of traditional ASP, where treatment and settlement occur within the unit.	Process known to struggle with varying flows and loads, less flexible than a series of ASP ditches due to design.
Moving bed bioreactor (MBBR)	Beyond current levels of ASP – technology is constantly developing for large scale adoption	Theoretically up to any size – process can be added to ASP if quality constraints require it	Floating plastic media added to ASP process to promote biofilm generation. AWS already utilise in +10,000 PE works such as Great Dunmow .	Additional cost of provision and control of the process compared to conventional ASP

Table 10-6 Treatment Technology Options

11 Water Efficiency Options

The potable water demand and wastewater calculations discussed in the Section 6 and 8 have primarily focussed on a conventional approach to the supply of water and conveyance/ treatment of wastewater, as illustrated in Figure 11-1.

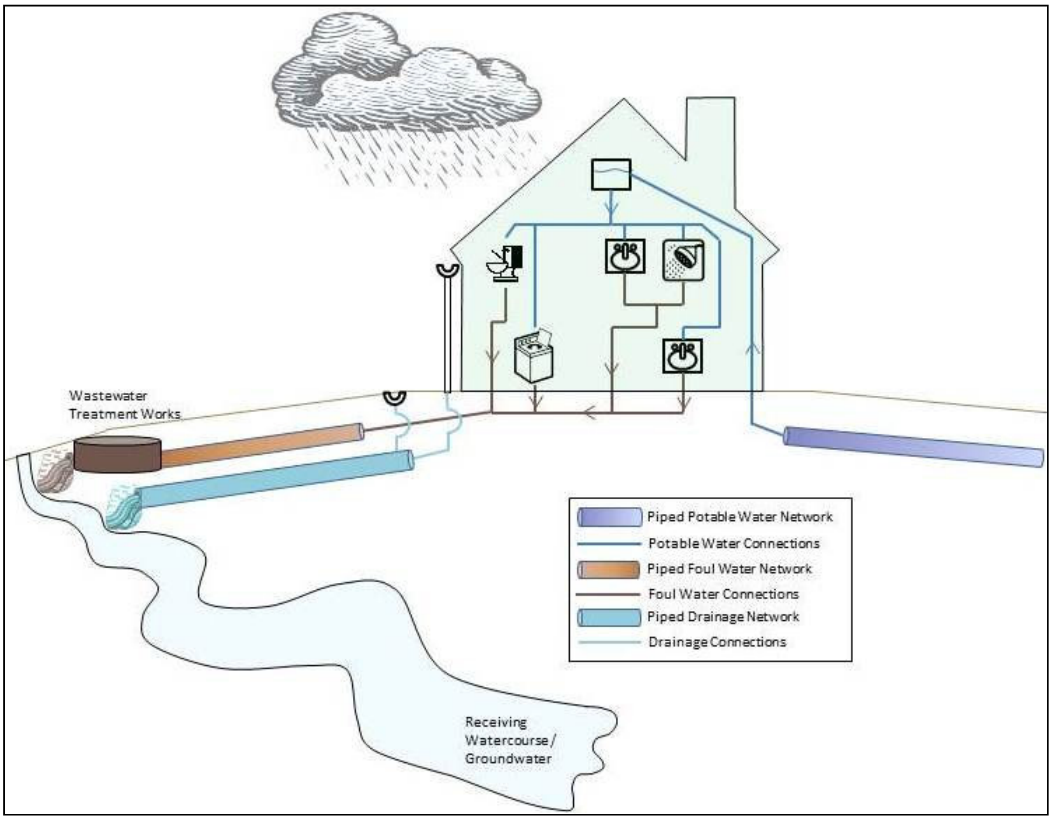

Figure 11-1 Conventional water/ wastewater arrangement

In 2007 UDC adopted a Supplementary Planning Document (SPD) entitled Energy Efficiency and Renewable Energy. The guidance contained within states UDC's position regarding the Code for Sustainable Homes:

The Council will negotiate to achieve a [CSH Level 3] rating on new development up to 2012. After this the Council will encourage all development to achieve a [CSH Level 4] rating up to 2016 when all development will be expected to be zero carbon with a [CSH Level 6] rating.

This builds on the guidance contained within the Essex Design Guide Urban Place Supplement, also adopted by UDC as a SPD in 2007, which again states that CSH Level 3 should be achieved on new builds up to 2012. The guidance included;

- The use of rainwater harvesting; and
- The use of Sustainable Drainage Systems (SuDS).

The Building Research Establishment (BRE) CSH Water Efficiency Calculator Tool[5] was used to determine the likely water efficient fittings and fixtures required to meet the PCC rates specified by the SPD (i.e. 105 l/p/d and 80 l/p/d).

It is considered that the Level 3/4 target (105 l/p/d) can sensibly be met through the specification and installation of water efficient fixtures, including the following:

- 2.6/ 4.0 l dual flush toilet;
- 9 l/minute shower;
- 150 l bath;
- 6 l/minute taps; and
- Conventional dishwasher and washing machine, assumed to use 4.5 and 17.16 l/p/d respectively.

The tool does allow for the specification of higher efficiency fixtures and fittings, however it is considered that the above levels of efficiency should broadly be considered the limit that occupiers will find acceptable for the foreseeable future. Relying on additional efficiency in the houses would increase the risk of occupiers replacing the efficient fittings in the future.

11.1 Reuse/ recycling options

In order to achieve the CSH Level 5/6 target (80 l/p/d) in the study area; it is necessary to consider the use of RWH or GWR to augment the incoming potable water supply (particularly where potable water standards are not actually required), in addition to water efficiency measures.

The British Standard for RWH systems[6] confirms that potable water standards are not required for toilet flushing or washing machines, as these uses do not involve drinking, food preparation and cooking, dishwashing or personal hygiene.

Data within the WRMP indicates that the current water use for the Northern WRZ for toilet flushing and laundry is 39.4 l/p/d. The BRE tool suggests that a typical house built to CSH Level 3/4 water efficiency will require just over 31 l/p/day for toilet flushing and laundry. In a house with efficient fittings (CSH 3), the replacement of the majority of this potable water, via RWH or GWR, should therefore allow the 80 l/p/d target to be met, and hence move towards a CSH 5/6 level.

Notably, the BRE tool also calculates that a typical three bedroom house would be able to capture an average of 89 l per day of rainwater from its roof[*], equating to a supply of 31 l/p/d for non-potable use (with an assumed occupancy of 3, or 36 l/p/d with an assumed occupancy of 2.43). This suggests that under average conditions, a domestic level RWH system (with a storage capacity of 3,000 l – see next Section) would be capable of meeting the non-potable demand for a house, allowing CSH Level 5/6 efficiency to be met. A sensitivity analysis which tests the parameters of the BRE tool is included in Appendix F.

[*] based on an assumption of 70 m^2 of roof area, with a yield coefficient of 80%, a filter with an efficiency of 90% and rainfall of approximately 647 mm/year (based on data from the Arkesden gauging station for the last 27 years).

The British Standard for greywater systems[7] suggests that the most preferable sources to collect domestic greywater from are showers, baths and wash/ hand basins, and that this water should be considered (once treated) to be suitable for non-potable uses i.e. toilet flushing and washing machines.

The BRE tool calculates that a typical house built to CSH Level 3/4 water efficiency would provide approximately 67 l/p/d of greywater from these sources. Allowing for a 50% collection and recycling rate would still provide more than the 30 l/p/d non-potable requirement.

It must therefore be considered that some degree of RWH or GWR will be required in order for the proposed development to comply with the standards set by the CSH. This could potentially be at either a domestic, neighbourhood or District level. The benefits and risks associated with these options are discussed in the following Sections.

It would not be necessary to provide both domestic level RWH and GWR, as the non-potable demand in the typical CSH Level 3/4 house can be met by either one of these technologies; and hence move the house to CSH Level 5/6.

Section 6 highlighted that, based on new properties requiring 80 l/p/d of potable water, the potential water savings across the wider study area would only allow water neutrality to be achieved under the best case scenario post 2021, depending on uptake of a scheme to retrofit existing properties with water efficiency measures. Therefore, in order to achieve the aspiration of further water neutrality across the study area, the local reuse of water to provide additional potable water must be considered.

The source for this recovered water could be from:

- Increased local abstraction supplemented by the additional infiltration provided by any proposed SuDS features (although unlikely to be preferable given the groundwater quantity concerns discussed throughout this WCS);
- The collection of rainwater from hard standing areas across the developments;
- The collection of greywater from houses (as this has been shown to be higher than the typical non-potable demand); or
- The recycling of effluent from WwTW, either directly, referred to as black water recycling (BWR), or via a discharge and subsequent abstraction from receiving watercourse/ aquifer.

Appendix F provides information on greywater and rainwater harvesting technique at domestic, district level.

12 Constraints, Solutions and Opportunities summary

The following summary tables illustrate the likely water infrastructure and water environment issues and solutions to the UDC's preferred allocation sites based on the WCS consultations undertaken (Section 2) and evidence base. As an indicative guide the issues are displayed and discussed using the following convention:

1	Major constraint to development, requiring extensive infrastructure improvements to allow development (possible showstopper at this stage but may be reclassified following further investigation by water company and developer).
2a	Major constraint to development, requiring extensive infrastructure improvements to allow development (Not considered as a showstopper at this stage but requires further investigation by water company and developer to confirm).
2b	Major or possible constraint to development, although infrastructure solutions and mitigation techniques are identified and/ or judged feasible to allow development.
3	No constraint to development, or minor localised improvements required to allow development

Table 12-1 Key for constrains summary tables

12.1 Potable Water Supply

Regarding the supply of potable water, as the allocation sites are centred on the existing market towns and key service centres, VWC are confident that adequate supply can be provided through the existing network and local boreholes. There is however a risk that future sustainability reductions imposed by the EA on VWC abstractions may require VWC to alter the strategy they adopt in their Northern WRZ, which have the potential to pass on higher costs to their customers. This issue is not entirely attributable to the proposed growth.

For the majority of locations, the connection of a site to the potable network will probably require the reinforcement of certain areas of the localised network. It is assumed that this need will be addressed by VWC through the normal developer requisition process. Whilst it is likely that all the proposed sites could be supplied with water, investment will be required to varying degrees; the extent of this investment will be understood once detailed plans for the sites are in place.

12.2 Wider Environmental Constraints

Each preferred site identified by the allocation process will impact on the wider water environment to different extents. Some impact on European sites and SSSIs whilst others will present a much lower risk. The sites will also provide opportunity for biodiversity enhancements such as habitat restoration and creation, and in all cases, but particularly where there is a high quantum of development proposed, the developer should strive to provide multi-functional greenspace (which include areas to manage surface water) to deliver positive benefits for wildlife and people at each location.

12.3 Flood Risk Constraints

It should be noted that flood risk constraints associated with individual development sites are not included in the tables in Section 7 unless the modelled flood outlines indicate high risk areas. It is assumed that the Sequential Tests undertaken as part of the UDC's Local Plan preparation process and developer Flood Risk Assessments and Drainage Strategies produced as part of the normal planning process would have dealt with such issues. It is also assumed that suitable Sustainable Drainage Systems (SuDS) would be incorporated at these sites and runoff from the proposed development will be managed and limited to the appropriate runoff rates based on predevelopment land use and flood risk constraints associated with the receiving system, in accordance with UDC policy and the emerging requirements of the FWMA.

To assess the future impact of the WwTW discharges on fluvial flood risk, a multi-criteria approach was used to investigate the increase in peak flow, the sensitivity of the watercourse to changes in flood levels, and the potential impact of flooding, to define a combined flood risk index. As described in Section 9.4 the combined risk value for all eight WwTW sites has been assessed as low, therefore the increased flow from the WwTW site is classified as presenting a low increase in overall fluvial flood risk.

12.4 Wastewater Constraints

The extent to which wastewater capacity constrains the preferred sites is related to

- The likelihood of the new development requiring capacity upgrades at the WwTW and within the sewerage network;
- The availability of land for such upgrades as well as the possibility that treated wastewater from the new development would trigger new discharge consents;
- The ability to overcome water quality and flood risk constraints that are associated with receiving watercourses;
- In some market towns the ability to upgrade the network may also be restricted by narrow streets and existing utilities

<table>
<tr><th>UDC Policy Area Reference</th><th>Potable Supply</th><th>Flood Risk</th><th>WwTW Capacity</th><th>Sewerage Network Capacity</th><th>Storm Water Network Capacity Issues</th><th>Wider Environment</th></tr>
<tr><td>Saffron Walden Policy Area 2</td><td>See comments above in Section 12.1
3</td><td rowspan="3">See comments above in Section 12.3.
2b</td><td rowspan="2">Saffron Walden WwTW DWF discharge consent will not be exceeded by the increase in flow but the headroom will be limited. AWS may wish to apply for a new consent at some point, as the flows from the growth is likely to compromise the 10% headroom between actual and consented DWF by 2020 onwards. Available process capacity will need confirmation by AWS.
2a</td><td rowspan="2">These allocation sites are located at the opposite side of the town to the WwTW. The existing sewerage network is at capacity. Extensive upgrades may be required. Linear distance is approximately 2 km but actual sewer lengths will depend on the route for any new sewers or specific sections that need upgrading. For allocation sites where construction is proposed to start in 2013 or 2014 (e.g. SAF03) AWS would expect to already be in consultation with developers regarding Developer Impact Assessments (DIAs). Developers have not yet discussed this site with AWS and therefore recommend that they consult with AWS soon to determine network upgrades through suitable DIAs.
2a</td><td rowspan="3">AWS have identified that there is unlikely to be capacity for receiving extra Surface Water flows from these sites in the AWS surface water sewerage network. Developers must ensure that a suitable drainage design is devised in conformity with the Building Regulations, FWMA, NPPF, and UDC/ECC policies.
3</td><td rowspan="3">River Cam is a UKBAP Priority habitat, with important habitats and species identified downstream, and is currently failing to comply with WFD due to phosphate and dissolved oxygen levels.
The River Cam is classified as heavily modified and the current ecological quality is Poor Potential. The current chemical is classified as Good. The overall Physio Chemical is Moderate, with Ammonia classified as High and Phosphate as Poor.
It is estimated that the future treated DWF from Saffron Walden WwTW to the River Cam, not make achieving the requirements of the WFD any more difficult than the current consented position.
It should be noted that increasing development can lead to a risk that new/ tighter consents may be required in future cycles of the RBMP (post 2015).
2b</td></tr>
<tr><td>Saffron Walden Policy Area 1</td><td>See comments above in Section 12.1. However, it is foreseen that a larger volume of infrastructure upgrade will be needed for this particular site.
2b</td></tr>
<tr><td>Saffron Walden Policy Area 3</td><td>See comments above in Section 12.1
3</td><td>It is considered that this smaller development would pose few problems due to small additional flows.
2b</td><td>No Comments on Sewerage Network Capacity Received.
3</td></tr>
</table>

UDC Policy Area Reference	Potable Supply	Flood Risk	WwTW Capacity	Sewerage Network Capacity	Storm Water Network Capacity Issues	Wider Environment
Great Dunmow Policy Area 1	See comments above in Section 12.1 3	See comments above in Section 12.3 3	A portion of current wastewater from Great Dunmow is treated at Felsted WwTW – extra flows from the new development may require treatment at Felsted WwTW but a new DWF discharge consent will not be required at Felsted. Increase in projected numbers from Outline WCS may be an issue. If all existing and new flows are treated at Great Dunmow a new DWF consent is required. There are constraints posed by an increase in the flow permit of 46% at Great Dunmow WwTW. It is likely that the quality limits that will need to be achieved will be beyond what is currently regarded as the limit of conventional treatment technology and is likely to present difficulties in terms of achieving the full quantum of growth. Phasing of GtDUN13 & 2 after GtDUN14 will give the water company time to explore and implement appropriate technology and also secure suitable funding to help mitigate the issue. 2a	Localised upgrades, or bypass, of existing village network will be required. Significant off-site sewerage requirements to connect the FOUL WATER to the Network. 2a	AWS state that there is unlikely to be sufficient capacity within the SW network. Developers must ensure that a suitable drainage design is devised in conformity with the Building Regulations, FWMA, NPPF, and UDC/ECC policies. 2a	The proposed development site lies directly adjacent to High Wood Great Dunmow Site of Special Scientific Interest (SSSI) it will be important that full and timely ecological assessment is made of the potential impacts arising (both during construction and operational phases), particularly with regards to surface water management. Great Dunmow WwTW discharges to the River Chelmer, which is classified as heavily modified and the current ecological quality as Moderate Potential. The current chemical quality does not require assessment. The overall Physio Chemical is Moderate, with Ammonia classified as High and Phosphate as Poor. Discharging the increased DWF from Great Dunmow WwTW to the River Chelmer, will be more constrained by WFD water quality requirements than the current consented discharge. The level of constraint will depends upon future upgrades and the volume of flows that are transferred to Felsted in the future. 2b
Great Dunmow Policy Area 2	See comments above in Section 12.1 3	See comments above in Section 12.3. 3				

UDC Policy Area Reference	Potable Supply	Flood Risk	WwTW Capacity	Sewerage Network Capacity	Storm Water Network Capacity Issues	Wider Environment
Elsenham Local Policy Area 2	See comments above in Section 12.1 3	Part of site within the Stansted Brook 20yr Flood Outline. Masterplan checked against modelled flood outline, currently proposed building footprints appear to be outside the 20yr Flood Outline. See comments above in Section 12.3 2b	This drains to a Pumping Station at Stansted Mountfitchet and then on to Stansted Mountfitchet WwTW. There are negligible capacity or treatment issues downstream however virtually all available spare capacity may be used by this and the 2 other ELS sites suggested (ELS1 and 6) leaving no capacity for any other sites in Elsenham. Sufficient headroom available within discharge consent. 2b	The main outfall sewer from the eastern side of Elsenham runs through this site and developers may have to avoid construction directly over this. However, the development could connect directly to this sewer, subject to confirmation of capacity by TWU Any upgrades required may be problematic, due to the crossing under the railway and the limited space available as the sewer passes between "Wood View" and "The Crossings". 2b	No specific comments on Storm Water Network Received. 3	River Stort are UKBAP priority habitats, with a number of important habitats and species identified downstream and are currently failing to comply with WFD due to phosphate and dissolved oxygen levels. Stansted WwTW discharges to the Stansted Brook. The current ecological quality of the Stansted Brook is classified as Poor Status. The current chemical quality is Good. The overall Physio Chemical is Good, with Ammonia classified as High and Phosphate as Good. Increased discharge consents from either Stansted Mountfitchet wTW may require tighter chemical consents although the current DWF consents would not be exceeded due to the preferred allocation sites. Discharging the increased DWF from Stansted Mountfitchet WwTW to the Stansted Brook, will not be any more constrained by WFD water quality requirements than the current consented discharge. 2b
Elsenham Local Policy Area 3	See comments above in Section 12.1 3	Part of site within the Stansted Brook 20yr Flood Outline. It is possible that a sequential approach to this site can removed properties from flood risk and only small parcels of land are covered by the 20yr outline See comments above in Section 12.3. 2b	There are negligible capacity or treatment issues downstream however virtually all available spare capacity may be used by this and the 2 other sites suggested (ELS6 and 9) leaving no capacity for any other sites in Elsenham. Sufficient headroom available within discharge consent. 2b	There are negligible treatment issues. Any outfall sewer constructed to serve this site would need to be designed to a line and level to also serve the adjacent ELS6 site. 2b	No specific comments on Storm Water Network Received. 3	

UDC Policy Area Reference	Potable Supply	Flood Risk	WwTW Capacity	Sewerage Network Capacity	Storm Water Network Capacity Issues	Wider Environment
Elsenham Local Policy Area 1	See comments above in Section 12.1 3	See comments above in Section 12.3. 3	This sewer drains to a Pumping Station at Stansted Mountfitchet and then on to Stansted Mountfitchet WwTW. There are negligible capacity or treatment issues downstream however virtually all available spare capacity may be used by this and the 2 other sites suggested (ELS1 and 9) leaving no capacity for any other sites in Elsenham. Sufficient headroom available within discharge consent. 2b	This site is not well served by sewers in both capacity and ground level. However, if the developer can be required to construct a new gravity outfall sewer from the site that will connect to the existing outfall sewer near Mill House then there will be no capacity issues. The design of this sewer should acknowledge the potential development of site ELS1 as well. 2b	No specific comments on Storm Water Network Received. 3	
Thaxted Local Policy Area 1	See comments above in Section 12.1 3	See comments above in Section 12.3. 3	Known capacity issues at Great Easton WwTW, which serves Thaxted, is a potential issue and will need further discussion with AWS. Upgrades to the WwTW will require additional land. It has been indicated by the EA and AWS that it is likely that the quality limits that will need to be achieved to overcome the existing issues and new discharge consent requirements will be beyond what is currently regarded as the limit of conventional treatment technology and is likely to present difficulties in terms of achieving growth. 2a	AWS has already completed a DIA for 60 properties in Thaxted. This would be an additional 60 properties. The initial DIA was approved despite reservations within AWS as a result of flood risk from combined Sewer Network (previously the Town Drain/Culvert). Additional development would exacerbate this problem. Sewer network will require significant upgrades. 2a	Flood risk issues linked to combined surface water/foul network capacity. 2a	The River Chelmer is currently impacted by poor phosphate and dissolved oxygen levels. The River Chelmer is classified as heavily modified and the current ecological quality is Moderate Potential. The current chemical quality does not require assessment. The overall Physio Chemical is Moderate, with Ammonia classified as High and Phosphate as Poor. Discharging the increased DWF from Great Easton WwTW to the River Chelmer, will not be any more constrained by WFD water quality requirements than the current consented discharge. 2b
Newport Local Policy Area 1	See comments above in Section 12.1 3	Small part of site within Flood Zone 3. See comments above in Section 12.3. 2b	Previous concerns on DWF headroom and process capacity still remain. A reduction in the number of proposed properties from outline study could have	Will require significant off-site sewerage with possible attenuation to connect Foul Water to network.	There is unlikely to be any capacity for SW drainage within all sites. Developers must ensure that a suitable drainage design is devised in conformity with the Building	River Cam is a UKBAP priority habitat with important habitats and species identified downstream and is currently failing to comply with WFD due to phosphate levels.

UDC Policy Area Reference	Potable Supply	Flood Risk	WwTW Capacity	Sewerage Network Capacity	Storm Water Network Capacity Issues	Wider Environment
Newport Local Policy Area 2	See comments above in Section 12.1 3	See comments above in Section 12.3 3	potentially reduced this issue but even higher numbers are proposed now. A new DWF consent is expected as there is a requirement to maintain headroom here. 2a	2a	Regulations, FWMA, NPPF, and UDC/ECC policies. 2a	The River Cam is classified as heavily modified and the current ecological quality is Poor Potential. The current chemical quality does not require assessment. The overall Physio Chemical is Moderate, with Ammonia classified as High and Phosphate as Bad. AWS revised DWF discharge consent will not be breached by proposed growth, but headroom is unlikely to be sufficient. Further discussion with AWS and EA is required. It may be beneficial to water quality to limit the development in this area. There is a risk that tighter consents may be required in future cycles of the RBMP (post 2015). 2a
Great Chesterford Local Policy Area 1	See comments above in Section 12.1 3	See comments above in Section 12.3. 3	AWS estimate that the WwTW currently has capacity to accommodate the flows from up to 800 dwellings.	No DIA seen by AWS as yet for either of the Great Chesterford development sites. No spare network capacity exists; the sites will	No spare capacity in the Surface Water Network. . Developers must ensure that a suitable drainage design is devised in conformity with the Building Regulations, FWMA,	River Cam is a UKBAP priority habitat with important habitats and species identified downstream and is currently failing to comply with WFD due

UDC Policy Area Reference	Potable Supply	Flood Risk	WwTW Capacity	Sewerage Network Capacity	Storm Water Network Capacity Issues	Wider Environment
Great Chesterford Local Policy Area 2	See comments above in Section 12.1 3	See comments above in Section 12.3. 3	3	require significant upgrades or direct connection to WwTW. 2a	NPPF, and UDC/ECC policies. 2b	to phosphate levels. The current ecological quality of the River Cam is classified as Poor Potential. The current chemical quality is Good. The overall Physio Chemical is Moderate, with Ammonia classified as High and Phosphate as Poor. Discharging the increased DWF from Great Chesterford WwTW to the River Cam, will not be any more constrained by WFD water quality requirements than the current discharge AWS proposed discharge consent will not be breached but it may be beneficial to water quality that tighter consents are imposed in future cycles of the RBMP (post 2015). 2b
Stansted Local Policy Area 1	See comments above in Section 12.1 3	See comments above in Section 12.3. 3	Treatment capacity at Stansted Mountfitchet WwTW would not be an issue for this site. The predicted DWF following growth is less than the existing discharge consent.	The frontage of this development could drain by gravity to the gravity sewer in Cambridge Road however; the fall of the land could limit drainage without resorting to pumping. An alternative would be to drain the site through to Clarence Road/St Johns Lane if a route through adjacent properties can be agreed. Either outfall route would have no significant capacity issues and would drain by gravity through to the WwTW. 2b	No specific comments on Storm Water Network Received. 3	The current ecological quality of the Stansted Brook is classified as Poor Status. The current chemical quality is Good. The overall Physio Chemical is Good, with Ammonia classified as High and Phosphate as Good. Discharging the increased DWF from Stansted Mountfitchet WwTW to the Stansted Brook, will not be any more constrained by WFD water quality requirements than the current consented discharge. 3

UDC Policy Area Reference	Potable Supply	Flood Risk	WwTW Capacity	Sewerage Network Capacity	Storm Water Network Capacity Issues	Wider Environment
Stansted Local Policy Area 2	See comments above in Section 12.1 3	See comments above in Section 12.3. 3		A development that could drain by gravity to one of two gravity sewers in Cambridge Road. Neither will have any real issues and would drain by gravity through to the WwTW. 2b	No specific comments on Storm Water Network Received. 3	
Stansted Local Policy Area 3	See comments above in Section 12.1 3	See comments above in Section 12.3. 3	3	The presumption for this site is that it would utilise the outfall that previously served the school. This would drain to a Pumping Station but there would be negligible, potentially nil, net increase in flow. As such there are no concerns regarding network capacity. 2b	No specific comments on Storm Water Network Received. 3	
Takeley Local Policy Area 2	See comments above in Section 12.1 3	See comments above in Section 12.3. 3	Foul water pumped to Bishops Stortford WwTW via Stansted airport pumping station. No issues with capacity at the Pumping Station or Bishops Stortford WwTW. Sufficient headroom available within discharge consent. 3	Single option is to connect to the sewer that passes through the site. No issues with capacity in the sewers. The sewer on the site may need diverting to avoid being built over by the new houses or the layout of the houses could be arranged to avoid the sewer being built over. 3	No specific comments on Storm Water Network Received. 3	River Stort is a UKBAP priority habitat with a number of important habitats and species identified downstream, and is currently failing to comply with WFD due to phosphate and dissolved oxygen levels. Discharging the treated DWF from Bishop Stortford WWtW, will not be any more constrained by WFD water quality requirements than the current consented discharge to the Pincey Brook.
Takeley Local Policy Area 3	See comments above in Section 12.1	See comments above in Section 12.3. 3	Foul water pumped to Bishops Stortford WwTW via, Canfield End Pumping Station and Stansted Airport Pumping Station. No issues with capacity at the Pumping Stations or Bishops Stortford WwTW. Sufficient headroom available within discharge consent. 3	Single option is to connect to the sewer in the main road outside the site. No issues with capacity in the sewers, Pumping Stations or Bishops Stortford WwTW. 3	No specific comments on Storm Water Network Received. 3	

UDC Policy Area Reference	Potable Supply	Flood Risk	WwTW Capacity	Sewerage Network Capacity	Storm Water Network Capacity Issues	Wider Environment
Takeley Policy Area 1	See comments above in Section 12.1 3	Site on tributary of Pincey Brook. Main River watercourse but with no associated Flood Outlines. Unable to quantify the level of fluvial risk to this site. See comments above in Section 12.3. 3	TWU have proposed 4 options for draining foul water flows from this site. Generally there are no concerns over WwTW capacity for any of the 4 options. Sufficient headroom available within discharge consent. 2b	TWU have proposed 4 options for draining foul water flows from this site. For some options proposed by TWU the capacity of the receiving sewer and receiving pumping station either at Wayletts Hill or Roseacres may need further investigation. 2b	No specific comments on Storm Water Network Received. 3	3
Takeley Policy Area 4 Takeley Policy Area 5	See comments above in Section 12.1 3	See comments above in Section 12.3 3	Single option is to connect to the sewer in the main road outside these sites. This sewer goes to Bishops Stortford WwTW via. Canfield End Pumping Station and Stansted Airport Pumping Station. No issues with capacity in the Pumping Stations or Bishops Stortford WwTW. 2b	Single option is to connect to the sewer in the main road outside these sites. This sewer goes to Bishops Stortford WwTW via. Canfield End Pumping Station and Stansted Airport Pumping Station. No issues with capacity in the sewers. Pumping Stations or Bishops Stortford WwTW. 2b	No specific comments on Storm Water Network Received. 3	

Table 12-2 Summary of constraints to Allocated Sites

Village scale growth

The small scale of the potential growth anticipated in the villages results in VWC being confident that **potable water supply will not be a constraint** to development. However, the following constraints, from other aspects of the water cycle, should be considered:

Settlement	Potable Water	Flood Risk	WwTW Capacity	Sewerage Network Capacity	Wider Environment
Clavering	See comments above in Section 12.1. 3	WwTW in Flood Zone 3 – **3**	No issues identified. **3**	Unlikely to be any capacity issues as site is close to Clavering WwTW. A new pumping station is likely to be required to serve the site. **3**	SSSI and UKBAP priority habitats and species located downstream of WwTW discharge. **2b**
Henham HEN1	See comments above in Section 12.1. 3	See comments above in Section 12.3 **3**	There are negligible capacity or treatment issues downstream, as for the outfall sewer this represents a very small increase in flow. **3**	These sewers drain through further pumping stations before draining back into Thames Water's sewers, Water Lane Pumping Station at Stansted Mountfitchet and then on to Stansted Mountfitchet WwTW. No signficant issues expected but AWS to confirm local sewer capacity. **3**	See above comments regarding water quality at Stansted Mountfitchet. Note that the flows from this site will have a negligible impact on the overall discharge here. **3**
Henham HEN2	See comments above in Section 12.1. 3	See comments above in Section 12.3	From Henham, these sewers drain to a series of pumping stations before draining to Water Lane Pumping Station at Stansted Mountfitchet and then on to Stansted Mountfitchet WwTW. There are negligible capacity or treatment issues downstream as for the outfall sewer this represents a very small increase in capacity.**3**	The site is within Thames Water area and would drain to sewers controlled by TWU. Locally the capacity of the pumping station at Woodend Green would need to be checked. It is possible that this may require upgrading despite there being a small number of houses proposed.	See above comments regarding water quality at Stansted Mountfitchet. Note that the flows from this site will have a negligible impact on the overall discharge here. **3**
Radwinter		Part of the site in the 20 year fluvial flood outline. See comments above in Section 12.3. **2a**	No significant capacity constraints identified by AWS. **3**	No significant capacity constraints identified by AWS. **3**	UKBAP Priority species previously identified downstream of WwTW. Poor phosphate levels in watercourse, although additional discharge would aid known low flow issues in

Settlement	Potable Water	Flood Risk	WwTW Capacity	Sewerage Network Capacity	Wider Environment
					headwaters. 2b
Stebbing	WwTW in FZ3 upgrades must be avoided in this area.	See comments above in Section 12.3. 3	No significant capacity constraints identified by AWS. The proposed growth within Stebbing can be accommodated within the existing WwTW discharge consent, However, a portion of current wastewater from Great Dunmow is treated at Felsted WwTW. AWS have indicated that closing Great Dunmow and transferring all flows to Felsted is unfeasible. Therefore, the transfer of all flows to Felsted has not been assessed within the WCS. 3	No significant capacity constraints identified by AWS. 3	Poor phosphate levels in watercourse. 2b

Table 12-5 Summary of constraints to village scale growth

Employment Sites

The small scale of the potential growth anticipated in the villages results in VWC being confident that **potable water supply will not be a constraint** to development. However, the following constraints, from other aspects of the water cycle, should be considered

UDC Policy Area Reference	Potable Supply	Flood Risk	WwTW Capacity	Sewerage Network Capacity	Wider Environment
Chesterford Park Draft local plan policy SAE7 - allocated employment site	See comments above in Section 12.1. 3	See comments above in Section 12.3. 3	No significant capacity constraints identified by AWS 3	No spare capacity in the Foul Water network or storm water network capacity. Network upgrades for the two Great Chesterford residential sites should also accommodate increase in trade flow. 2a	River Cam is a UKBAP priority habitat with important habitats and species identified downstream and is currently failing to comply with WFD due to phosphate levels. AWS proposed discharge consent will not be breached but it may be beneficial to water quality to limit the development in this area. There is a risk that tighter consents may be required in future cycles of the RBMP (post 2015). 2b
Wendens Ambo Draft local plan policy SAE3 - allocated employment site	See comments above in Section 12.1. 3	See comments above in Section 12.3. . 3	No significant capacity constraints identified by AWS 3	No significant capacity constraints identified by AWS. 3	No signficant issues identified. 3
Wendens Ambo Protected employment	See comments above in Section 12.1. 3	See comments above in Section 12.3. 3	No significant capacity constraints identified by AWS. 3	No significant capacity constraints identified by AWS. 3	No signficant issues identified. 3
Wendens Ambo Protected employment	See comments above in Section 12.1 3	See comments above in Section 12.3. 3	No significant capacity constraints identified by AWS. 3	No significant capacity constraints identified by AWS. 3	No signficant issues identified 3
Elsenham Gaunts End Draft Local Plan policy Elsenham	See comments above in Section 12.1. 3	See comments above in Section 12.3.	The available capacity in the Elsenham to Stansted Mountfitchet outfall sewer, and the WwTW, will be taken	Not served by public sewer. However, no issues currently identified 3	Rivers Cam and Stort are UKBAP priority habitats, with a number of important habitats and species

UDC Policy Area Reference	Potable Supply	Flood Risk	WwTW Capacity	Sewerage Network Capacity	Wider Environment
policy 4		3	up by the dwellings of all 3 Elsenham Residential Local Policy Areas leaving no further capacity for other development in the catchment. Additional capacity will need to be provided to accommodate additional trade flow. 2a		identified downstream and are currently failing to comply with WFD due to phosphate and dissolved oxygen levels. Increased discharge consents from either Stansted Mountfitchet WwTW would require tight chemical consents although it is unlikely that the current DWF consents would be exceeded due to the preferred allocation.
Elsenham Gaunts End Draft local plan policy Elsenham policy 4	See comments above in Section 12.1 3			Not served by public sewer. However, no issues currently identified 3	
Elsenham Gaunts End Safeguarded employment site	See comments above in Section 12.1. 3	Elsenham Guants End Safegaurd employment site shown to be at risk from Deep SW flooding (30yr) event. See comments above in Section 12.1 2a		Not served by public sewer. However, no issues currently identified 3	
Stansted Airport Stansted Policy 2 - non airport related employment	See comments above in Section 12.1. 3	Site shown to be at risk from Deep SW flooding (30yr) event. See comments above in Section 12.1 2a	Treatment capacity at Stansted Mountfitchet WwTW would not be an issue for these sites. Sufficient headroom available for additional trade flow within discharge consent.	No significant issues identified by TWU. 3	No significant issues identified. 3
Stansted Airport Stansted Airport policy 1 - airport employment	See comments above in Section 12.1 3	Site shown to be at risk from Deep SW flooding (30yr) event. See comments above in Section 12.1 2a		No significant issues identified by TWU. 3	No significant issues identified. 3

UDC Policy Area Reference	Potable Supply	Flood Risk	WwTW Capacity	Sewerage Network Capacity	Wider Environment
Stansted Airport Stansted airport policy 1	See comments above in Section 12.1. 3	See comments above in Section 12.3. 3		No significant issues identified by TWU. 3	No significant issues identified. 3
Stansted Airport Stansted airport policy 1	See comments above in Section 12.1. 3	Site shown to be at risk from Deep SW flooding (30yr) event. 2a		No noticeable issues identified by TWU. 3	No significant issues identified. 3
Stansted Airport Stansted airport policy 1	See comments above in Section 12.1 3	Site shown to be at risk from Deep SW flooding (30yr) event. 2a		No significant issues identified by TWU. 3	No significant issues identified. 3
Start Hill Gt Hallingbury Gt Hallingbury policy 1	See comments above in Section 12.1. 3	See comments above in Section 12.3. 3	No issues flagged for Bishops Stortford WwTW capacity. It should be possible to accommodate additional trade flow.	Not served by public sewer. However, no issues currently identified 3	River Stort is a UKBAP priority habitat with a number of important habitats and species identified downstream, and is currently improving its performance to comply with WFD due to phosphate and dissolved oxygen levels.
Start Hill Employment area	See comments above in Section 12.1. 3	See comments above in Section 12.3. 3		Not served by public sewer. However, no issues currently identified 3	
Takeley Protected employment site 1	See comments above in Section 12.1. 3	See comments above in Section 12.3. 3		No significant issues identified TWU. 3	
Takeley Protected employment site 2	See comments above in Section 12.1. 3	See comments above in Section 12.3. 3		No significant issues identified by TWU. 3	

UDC Policy Area Reference	Potable Supply	Flood Risk	WwTW Capacity	Sewerage Network Capacity	Wider Environment
Gt Dunmow Policy area 3 Waste transfer site (AWS)	See comments above in Section 12.1. 3	Great Dunmow employment site shown to be at risk from Deep SW flooding (30yr) event. 2a	Issues remain around the increase in development in this area from the Outline WCS even though the increase in trade flows is likely to be small due to size of site.	No issues identified by AWS. 3	No significant issues identified. 3
Alsa Street Policy SA E6 (TWU)	See comments above in Section 12.1. 3	Alsa Street employment site shown to be at risk from Deep SW flooding (30yr) event. 2a	No significant issues identified. 3	No significant issues identified. 3	No significant issues identified. 3
Clavering Employment land (TWU)	See comments above in Section 12.1. 3	See comments above in Section 12.3 3	Additional trade flow unlikely to result in any issues with WwTW capacity. 3	No significant issues identified by TWU. 3	No significant issues identified. 3

Table 12-6 Summary of constraints to employment sites

13 Detailed Strategy Conclusions and Recommendations

13.1 Major infrastructure requirements

UDC's preferred development sites determined by the SHLAA and subsequent site allocation process present challenges in terms of either their impact on the sewerage network, WwTW capacity, or the wider environment to differing extents. Analysis within the Detailed WCS has indicated that none of the proposed sites have been flagged as possible showstoppers.

Potential major constraints or significant infrastructure improvement related to sewerage capacity or wastewater treatment have been identified to accommodate the proposed development at, Great Dunmow, Newport, Saffron Walden, Great Chesterford and Thaxted, which need further consultation and investigation. AWS's current approach to the sites during consultations undertaken to date has been to agree in principle to these sites with the caveat that further investigation of the constraints at each site be carried out in terms of a timely Developer Impact Assessment at the request of the prospective developers.

Increased DWF discharge consents are likely to be necessary at Great Dunmow WwTWs (i.e. depending on where the extra flows are treated and also continuity of current operation at Felsted WwTW) and also at Newport and Great Easton WwTWs. The viability of achieving the tighter physio-chemical limits associated with these consent increases will depend upon financial and risk assessments undertaken by AWS in consultation with the EA, taking account of the downstream sensitive water environment.

Further consideration should be given to those sites that currently fall within the 20 year flood outlines. The 1 in 20 year flood extent is considered to be functional floodplain in the National Planning Policy Framework (Table 1 – Technical Guidance to the National Planning Policy Framework), where possible the Masterplans of the Policy Units that fall within the 20 year flood outline have been checked to ensure that the proposed building footprints do not fall in to the flood zone. Only water-compatible uses and essential infrastructure should be permitted in this zone. Developers and local authorities should seek opportunities to reduce the overall level of flood risk in the area through the layout and form of the development and the appropriate application of sustainable drainage systems. A sequential approach should be possible for these sites due to the small amounts of land in falling within the 20 year flood extent.

It is also strongly recommended that the UDC encourage the prospective developers to approach water companies to discuss Developer Impact Assessments as soon as possible and site development policies include the need for undertaking such assessments prior to planning approvals. This is essential for those development sites that are identified in this report as potential major constraints/ infrastructure upgrades and/or indicates a build start date of 2013 or 2014.

13.2 Implementation - constraints and solutions

It is anticipated that major extensions to the strategic potable water supply or sewerage network 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. Therefore, development phasing and planned development trajectories to meet Local Plan targets should clearly allow for the lead in time involved in investigating, planning and constructing the required key infrastructure needs.

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 processes capability at WwTW – up to five years; and
- Major upgrade of WwTW, or construction of new WwTW – up to ten years.

The EA have commented that they would want assurances that adequate funding for any wastewater treatment solutions and network improvements is in place prior to large scale development commencing, this is relevant for all WwTW and is particularly relevant at Stansted Mountfitchet, Great Dunmow, Saffron Walden, Takeley and Elsenham. It is therefore vital that developers contact TWU as soon as practicable to provide TWU with the development information they require to allocate the required funding in PR14. This is a very important point and will reduce the risk of the EA objecting to any planning applications coming forward.

The development option currently requires that additional development (in addition to that already allocated) begins at **Great Dunmow** from 2017 to meet Local Plan targets, however there is some flexibility, as the phasing information provided to date is not definitive. As described in previous sections, Great Dunmow WwTW is at capacity and will require upgrades, currently planned for 2014/15. It will also require a new discharge consent which will have tightened parameters at the works to improve the water quality in line with the requirements of the WFD.

Whilst TWU predict that the existing sewerage network and WwTW at **Stansted Mountfitchet** can accommodate the flows from the sites within the town itself, any development at Elsenham will require the provision of additional WwTW capacity and significant network upgrades.

Regarding **Takeley**, the additional development to meet Local Plan targets begins here from 2014/15. The necessary upgrade to the rising main and pumps that serve the Canfield End/ Priors Green development is likely to take up to five years; therefore the planning of this infrastructure solution will need to begin as soon as possible.

The development option does not require additional development sites to commence in **Saffron Walden** prior to 2020. It is likely that any required increases in treatment capacity at the WwTW, and network improvements such as new sewers bypassing the existing network, will be provided in this timeframe subject to developer requisitions. The existing discharge consent is unlikely to be exceeded, and AWS have indicated that process capacity is not an issue if development can be accommodated within the current consent. Therefore, development is unlikely to be significantly constrained.

The **Great Chesterford** development is unlikely to require upgrades to the WwTW, but will require local sewerage upgrades or new sewers direct to the existing WwTW. The economic viability of such upgrades, compared to the scale of development proposed for these options, will constrain such development at these locations to some extent. Further technical and financial assessment will be required by developers and AWS.

The previous sections also highlighted that there are significant sewerage needs associated with other development locations such as **Newport,** causing some doubt over their viability compared to the scale of development proposed. The development trajectory for Newport proposes that construction commences in 2015. AWS have indicated that, due to seasonal variations in existing DWF received at Newport WwTW, there is no capacity within the existing (or proposed higher) DWF consent, or the process capacity of the WwTW, to accommodate the flows from any new dwellings. It is therefore concluded that discharge consent and WwTW capacity could constrain the potential development within the Newport catchment.

At **Great Easton** it is understood that the EA may require the consents to be tightened at the works to improve the water quality in line with the requirements of the WFD. At Great Easton if a new consent is required then this would beyond what generally can reliably economically achievable using conventional technology in terms of BOD.

A high level water quality assessment is contained within Section 10. All of the above statements assume that adequate water quality standards can be achieved in the WwTW discharges, and any new discharge consents, which will be the case for some of the settlement options, can be agreed with the EA and the water companies. However, there is a risk that the EA will require tighter consent standards to be applied in the future in order to comply with the WFD, and protect the interest of downstream environmental sites.

The results highlight the importance of AWS working to improve the concentrations of SRP in the effluent discharges of upstream WwTW in all of the catchments. The SRP concentration required to bring the downstream quality ‘up to good status’ is beyond the levels currently generally considered to be reliably economically achievable using conventional technology at Saffron Walden, Great Dunmow, Takeley and Stansted Mountfitchet.

Given the small difference between the current DWF consent, and the predicted DWF by 2028; it can be concluded that the increase from the proposed growth in the study area will not make achieving the requirements of the WFD significantly more difficult than the current consented position.

13.3 Guidance for UDC and developers

Developers will continue to be required to comply with emerging UDC and ECC policies, in addition to statutory national policies such as NPPF.

UDC 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/ AWS regarding network capacity and possible strategic solutions. Contributions towards the costs of such infrastructure can be collected through the forthcoming Community Infrastructure Levy, although this will depend on local implementation guidelines.

The following checklist (Table 13-2) should be used to guide policy development by UDC, 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.

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 NPPF, utilising the sequential and exception tests, a FRA and District SFRA 2008 where appropriate?*	ⓘ	
	Does the FRA for the development site propose measures to reduce downstream flood risk, particularly from surface water runoff following WCS guidance?		✔
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), in line with EA guidance, CFMP, SAB 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 this WCS. Previous land use should be considered, and localised permeability tests will also be required, potentially as part of the site FRA or SAB application?	ⓘ	
	Has the developer consulted with UDC and ECC 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 be 105 l/p/d or less, as required by UDC 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 to raise the occupiers'/ community's awareness of the importance of water efficiency?		✔
Potable Supply	*Has the developer liaised with VWC to ascertain if supply can be provided, and agreed appropriate funding mechanisms?*	ⓘ	
Sewerage	*Has the developer provided evidence (following liaison with AWS/ TWU) that network capacity can be provided, that the receiving WwTW has adequate capacity to receive the flows, and that appropriate funding mechanisms are in place? Is funding available for any WwTW solutions and network improvements?*	ⓘ	
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, NPPF and UDC policies?*	ⓘ	
	Has the developer provided details of integrated site specific solutions to enhance biodiversity in the water environment?		✔

Table 13-2 Developer checklist

[1] JBA Consulting, Uttlesford District Strategic Flood Risk Assessment, 2008

[2] Water for Life, DEFRA 2011

[3] VWC, Final Water Resource Management Plan, 2010

[4] EA, Combined Essex CAMS Final Strategy Document, 2007

[5] Building Research Establishment Group, *Code for Sustainable Homes Water Efficiency Calculator Tool, Ver. 01,* 2010

[6] British Standards Institution, *BS 8515:2009: Rainwater Harvesting systems – Code of Practice,* 2009

[7] British Standards Institution, *BS 8525-1:2010: Greywater systems – Part 1 : Code of Practice,* 2010

Appendix A

Incoming Data Register

				Incoming Data				
ID	Dataset	Data quality	Comments	Name	Description	Sent By	Stakeholder	Format
INF01	Development Plan 2012. Sets the context for new development within Uttlesford for the next 15 years	1	Draft	Development Plan Management Policies Draft_Jan_2012[1].pdf	Policy Document		Uttlesford District Council	PDF
	Report on the Results of the Further Consultation on Local Development Framework Core Strategy Preferred Options	1	2010	Environment Committee Report on way forwards.pdf	Policy Document		Uttlesford District Council	PDF
	Public Participation on the Role of Settlements and Site Allocations	1	2012	Settlement Allocations Plan Draft_Jan_2012_revised[1].pdf	Policy Document		Uttlesford District Council	PDF
	UTTLESFORD DEVELOPMENT FRAMEWORK	1	2011	Uttlesford LDS Revision 5 July 11[1].pdf	Policy Document		Uttlesford District Council	PDF
	UTTLESFORD DEVELOPMENT FRAMEWORK	1	Chart showing programme of Local Development Documents	Uttlesford LDS.pdf	Policy Document		Uttlesford District Council	PDF
INF02	Uttlesford District Council Development Management Policies	1	Jan-12	Development Management DPD.doc	Policy Document		Uttlesford District Council	Word
	Development Management Policies DPD consulltation	1	Anglain Water consultation comments	Development Management Policies DPD consulltation.htm	Policy Document		Uttlesford District Council	HTML
	Uttlesford District Council Site Allocations DPD	1	01/01/2012 Environment Agency Response	Site Allocations DPD.doc	Policy Document		Uttlesford District Council	Word
INF03	Anglian Water development policy	1		AWS_cordon_sanitaire_document.pdf	Policy Document		Anglian Water	PDF
INF04	Wastewater Environmental Capacity Assessment	1	2009. Identifies environmental constraints to future growth	Wastewater capacity assessment 2009.pdf	Policy Document		Anglian Water	PDF
INF05	UDC housing tradjectory	1	Site and numbers for housing developments and employment sites.	Potential sites for June 2012 consultation 26 3 12.xls	Policy Document		Uttlesford District Council	Excel
INF06	Uttlesford Water Cycle Study – Initial Response	1	Stansted Mountfitchet STW consents and information	Uttlesford Water Cycle Study Notes April 2012.doc	Policy Document		Uttlesford District Council	Word
INF07	Natural England Response to consultation	1	Site Allocations Development Plan Document (DPD).	43759 Uttlesford Site Allocations DPD March 2012.pdf	Policy Document		Uttlesford District Council	PDF
		1	Development Management Policies DPD.	43765 Uttlesford Development Management Policies DPD March 2012.pdf	Policy Document		Uttlesford District Council	PDF
INF08	Report into Greater Essex Demographic Forecasts	1	Apr-12	cabinet report demographics.doc	Policy Document		Uttlesford District Council	PDF
	MapInfo SHLAA GIS dataset	2		SHLAA2.DAT	Policy Document		Uttlesford District Council	GIS
	MapInfo SHLAA GIS dataset	2		SHLAA2.dbf	Policy Document		Uttlesford District Council	GIS
	MapInfo SHLAA GIS dataset	2		SHLAA2.ID	Policy Document		Uttlesford District Council	GIS

	MapInfo SHLAA GIS dataset	2		SHLAA2.MAP	Policy Document		Uttlesford District Council	GIS
	MapInfo SHLAA GIS dataset	2		SHLAA2.shp	Policy Document		Uttlesford District Council	GIS
	MapInfo SHLAA GIS dataset	2		SHLAA2.shx	Policy Document		Uttlesford District Council	GIS
	MapInfo SHLAA GIS dataset	2		SHLAA2.TAB	Policy Document		Uttlesford District Council	GIS
	MapInfo SHLAA GIS dataset	2		SHLAA2_LIN.DBF	Policy Document		Uttlesford District Council	GIS
	MapInfo SHLAA GIS dataset	2		SHLAA2_lin.shp	Policy Document		Uttlesford District Council	GIS
	MapInfo SHLAA GIS dataset	2		SHLAA2_lin.shx	Policy Document		Uttlesford District Council	GIS
	MapInfo SHLAA GIS dataset	2		SHLAA2_POI.DBF	Policy Document		Uttlesford District Council	GIS
	MapInfo SHLAA GIS dataset	2		SHLAA2_poi.shp	Policy Document		Uttlesford District Council	GIS
	MapInfo SHLAA GIS dataset	2		SHLAA2_poi.shx	Policy Document		Uttlesford District Council	GIS
	Demographics and occupancy rates	1	Email from UDC to Hyder	Uttlesford Occupancy rates and trajectory information 190412.pdf	Policy Document		Uttlesford District Council	PDF
INF09	Anglian Water consultation response	1	Anglain Water DPD consultation comments	Anglian Water.htm	Policy Document		Uttlesford District Council	Word
	Uttlesford District Council Development Management Policies	1	Environement Agency Consultation Response	Development Management DPD.doc	Policy Document		Uttlesford District Council	Word
	Uttlesford District Council Site Allocations DPD	1	Environement Agency Consultation Response	Site Allocations DPD.doc	Policy Document		Uttlesford District Council	Word
INF10	SHLAA2 GIS Dataset	2	MapInfo	SHLAA2.DAT	Policy Document	Melanie Jones	Uttlesford District Council	GIS
		2		SHLAA2.dbf	Policy Document		Uttlesford District Council	GIS
		2		SHLAA2.ID	Policy Document		Uttlesford District Council	GIS
		2		SHLAA2.MAP	Policy Document		Uttlesford District Council	GIS
		2		SHLAA2.shp	Policy Document		Uttlesford District Council	GIS
		2		SHLAA2.shx	Policy Document		Uttlesford District Council	GIS
		2		SHLAA2.TAB	Policy Document		Uttlesford District Council	GIS
		2		SHLAA2_LIN.DBF	Policy Document		Uttlesford District Council	GIS
		2		SHLAA2_lin.shp	Policy Document		Uttlesford District Council	GIS
		2		SHLAA2_lin.shx	Policy Document		Uttlesford District Council	GIS
		2		SHLAA2_POI.DBF	Policy Document		Uttlesford District Council	GIS
		2		SHLAA2_poi.shp	Policy Document		Uttlesford District Council	GIS
		2		SHLAA2_poi.shx	Policy Document		Uttlesford District Council	GIS
INF11	UDC housing tradjectory	1	Site and numbers for housing developments and employment sites.	Potential sites for June 2012 consultation 26 3 12.xlsx	Policy Document		Uttlesford District Council	Excel
	UDC key notes summary on incoming data	1	Hyder notes on INF11	UDC Key notes.pdf	Policy Document			PDF
	Uttlesford Development Matrix	1		Uttlesford Representations matrix.xlsx	Policy Document		Uttlesford District Council	Excel

INF12	Spreadsheet showing details of current licensed abstractions in the Uttlesford District Council area	1	Licensed abstractions	Uttlesford District Council.xls	Licensed Abstractions	Melanie Jones	Uttlesford District Council	Excel
INF13	Water Quality Data	2	Anglian and Thames Water Quality Data	Uttlesford District Council.xls	Water Quality Data	Melanie Jones	Uttlesford District Council	Excel
		2	EA Description of code types	Sample Point Code Types.xls	Water Quality Data		Uttlesford District Council	Word
		2	EA Description of analyitical results	Analytical Data Notes.doc	Water Quality Data		Uttlesford District Council	Excel
		2	Thames raw water quality data	47645 WQ raw data Thames 3.xls	Water Quality Data		Uttlesford District Council	Excel
		2	Thames raw water quality data	47645 WQ raw data Thames 1.xls	Water Quality Data		Uttlesford District Council	Excel
		2	Thames raw water quality data	12941 WQ raw data Thames 2.xls	Water Quality Data		Uttlesford District Council	Excel
		2	Anglian raw water quality data	47645 WQ raw data Anglian 1.xls	Water Quality Data		Uttlesford District Council	Excel
		2	Anglian raw water quality data	47645 WQ raw data Anglian 1.xls	Water Quality Data		Uttlesford District Council	Excel
INF14	RQP Tool	1		Uttlesford Detailed WCS.xls	Water Quality Data		Environment Agnecy	Excel
INF15	UDC Master Plans	1	Drawings of Masterplans in UDC	1533_Layout 2 Sketch_A.jpg	Planning Application Supporting Document	Melanie Jones	Uttlesford District Council	Jpeg
				3074006 Masterplan Option F.pdf	Planning Application Supporting Document	Melanie Jones	Uttlesford District Council	PDF
				Elsenham_A3 Presentation_1111111.pdf	Planning Application Supporting Document	Melanie Jones	Uttlesford District Council	PDF
				North View - scheme v5b.pdf	Planning Application Supporting Document	Melanie Jones	Uttlesford District Council	PDF
				MWA-11-048-SK1 A.pdf	Planning Application Supporting Document	Melanie Jones	Uttlesford District Council	PDF
				Prelim 24 scheme to CH 25-01-12.pdf	Planning Application Supporting Document	Melanie Jones	Uttlesford District Council	PDF
				proposed_school_site.jpg	Planning Application Supporting Document	Melanie Jones	Uttlesford District Council	Jpeg
INF16	Guidance Docs	1	Guidance Documents for completion of WCS	Andrew-pitt-technical-aspects-of-water-efficiency.pdf	Policy Document		Internet Download	PDF
				AW_EA Joint Position Statements - full set.pdf	Policy Document		Internet Download	PDF
				EA WCS 2009.pdf	Policy Document		Internet Download	PDF
INF17	Allocation GIS Layer	1	UDC Allocations GIS	ALLOC.DAT	Policy Document		Uttlesford District Council	GIS
				ALLOC.dbf	Policy Document		Uttlesford District Council	GIS
				ALLOC.ID	Policy Document		Uttlesford District Council	GIS
				ALLOC.MAP	Policy Document		Uttlesford District Council	GIS
				ALLOC.shp	Policy Document		Uttlesford District Council	GIS
				ALLOC.shx	Policy Document		Uttlesford District Council	GIS
				ALLOC.tab	Policy Document		Uttlesford District Council	GIS
				ALLOC_POI.dbf	Policy Document		Uttlesford District Council	GIS
				ALLOC_poi.shp	Policy Document		Uttlesford District Council	GIS
				ALLOC_poi.shx	Policy Document		Uttlesford District Council	GIS
INF18	Development Phasing	1	UDC Housing trajectories for SHLAA Sites	Allocation June 2012 trajectory.xls	Policy Document		Uttlesford District Council	Excel
				Housing Trajectory_5-year supply at 2011.doc	Policy Document		Uttlesford District Council	Word
INF19	Veiola Water Company Water Resource Management Plan	1	Water Resource Management Plan and Spporting Tables	9033,VWC-FWRMP-Version_3.9-Website.pdf	Policy Document		Veiola Water	PDF

				13562,ResourceMGMTPlanTablesv2.pdf	Policy Document		Veiola Water	PDF
INF20	Veiola Water Initial Response to Allocated Sites	1	Email response	RE Uttlesford District Council Water Cycle Study.msg	Email Response	Nicolas Gilbert	Veiola Water	Msg
INF21	Natural England GIS Datasets	1	Download of Environmental Designations in Study Area	spsittab.zip	GIS	Internet Download	Natural Englnd	GIS
				tlawitab.zip	GIS	Internet Download	Natural Englnd	GIS
				thleshtab.zip	GIS	Internet Download	Natural Englnd	GIS
				tlnnr.tab.ip	GIS	Internet Download	Natural Englnd	GIS
				tlramtab.zip	GIS	Internet Download	Natural Englnd	GIS
				tlsittab.zip	GIS	Internet Download	Natural Englnd	GIS
				tlspatab.zip	GIS	Internet Download	Natural Englnd	GIS
				tlssstab.zip	GIS	Internet Download	Natural Englnd	GIS
				tqawitab.zip	GIS	Internet Download	Natural Englnd	GIS
				tqeshtab.zip	GIS	Internet Download	Natural Englnd	GIS
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				tqramtab.zip	GIS	Internet Download	Natural Englnd	GIS
				tqsitab.zip	GIS	Internet Download	Natural Englnd	GIS
				tqspatab.zip	GIS	Internet Download	Natural Englnd	GIS
				tqssstab.zip	GIS	Internet Download	Natural Englnd	GIS
INF22	UDC Representations Received	1	EA, TWU and AWS repsonses to UDC Development Managment Policies	Development Management DPD.doc	Policy Document	Melanie Jones	Uttlesford District Council (EA Response)	Word
				DM Policies with new Cover.pdf	Policy Document	Melanie Jones	Uttlesford District Council	PDF
				Site Allocations DPD.doc	Policy Document	Melanie Jones	Uttlesford District Council (EA Response)	Word
				Thames Water.doc	Policy Document	Melanie Jones	Uttlesford District Council (TWU Response)	Word
				Anglian Water.htm	Policy Document	Melanie Jones	Uttlesford District Council (AWS Response	html
INF23	AWS WwTW	1	Response to initial SHLAA Sites	C00013566_120306141001978623.htm__00057869_Site Allocation Consultation table Uttlesford.pdf	Policy Document	Rob Morris	Anglian Water	pdf
			Waste Water Treatment Data	WwTW data 01.xls	Policy Document	Rob Morris	Anglian Water	Excel

Appendix B

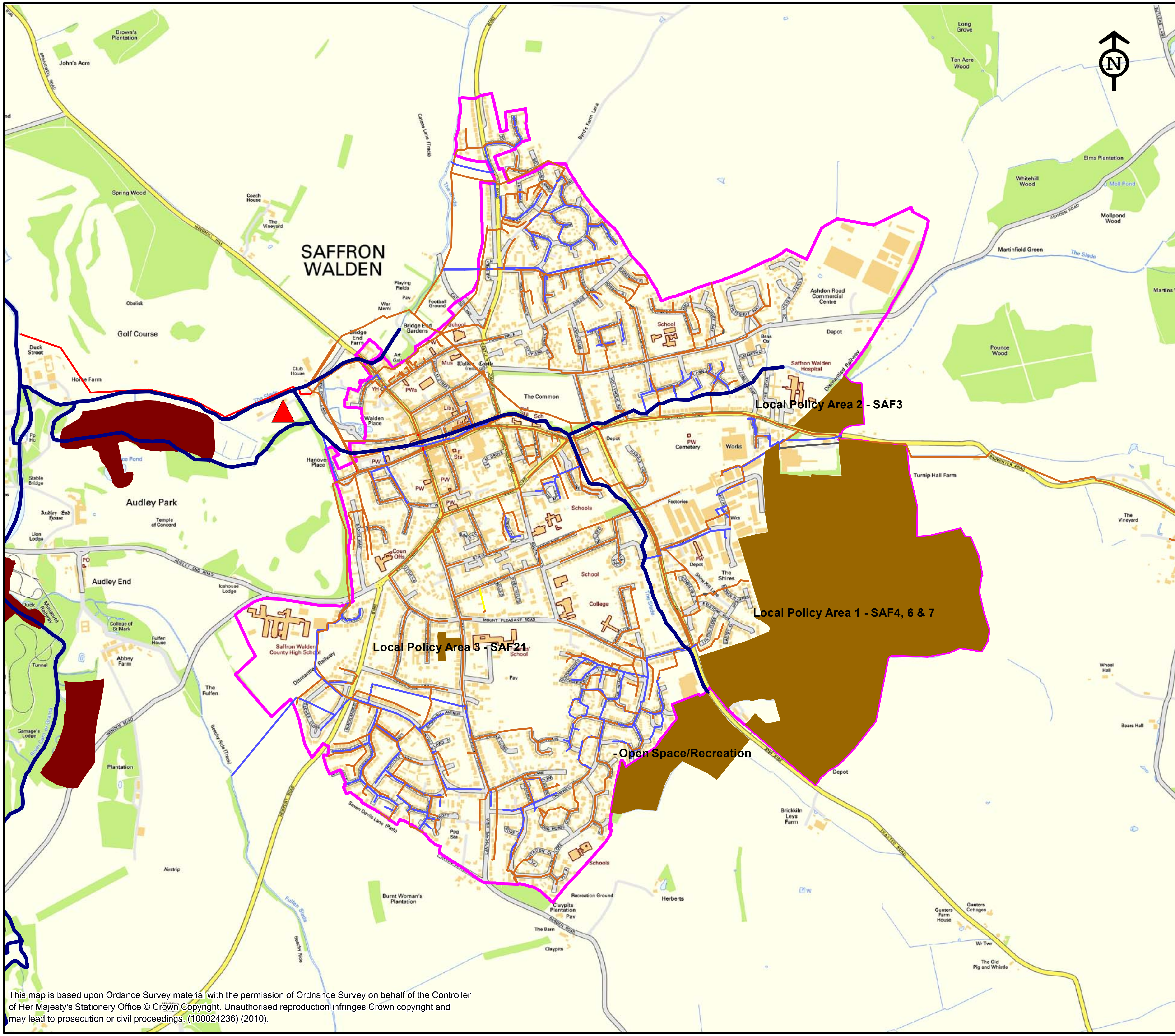
Housing Trajectories

Settlement	UDC Policy Area Reference	Site address	SHLAA reference	Possible capacity	Construction Commences	Dwellings per year															Total within SHLAA Site	Total Within Settlement
						Yr1 13/14	Yr2 14/15	Yr3 15/16	Yr4 16/17	Yr5 17/18	Yr6 18/19	Yr7 19/20	Yr8 20/21	Yr9 21/22	Yr10 22/23	Yr11 23/24	Yr12 24/25	Yr13 25/26	Yr14 26/27	Yr15 27/28		
	Saffron Walden Policy Area 2	119 - 121 Radwinter Road, Former Willis and Gambier site	SAF03	60	2014		30	30													**60**	
	Saffron Walden Policy Area 1	Land between Radwinter Road and Thaxted Road East of SW	SAF04, 6 and 7	800	2020								100	100	100	100	100	100	100	100	**800**	
Saffron Walden	Saffron Walden Policy Area 3	Tudor Works, Debden Road	SAF21	20	2014		20														**20**	**880**
	Great Dunmow Policy Area 1	Land west of Great Dunmow	GtDUN13 and 2	850	2019							50	100	100	100	100	100	100	100	100	**850**	
Great Dunmow	Great Dunmow Policy Area 2	Smiths Farm, Hoblongs	GtDUN14	300	2017					100	100	100									**300**	**1150**
	Elsenham Local Policy Area 1	Land west of Station Road (Also Live Application)	ELS6	155	2014		25	30	50	50											**155**	
	Elsenham Local Policy Area 2	Land west of Hall Road	ELS9	115	2015			40	40	35											**115**	
Elsenham	Elsenham Local Policy Area 3	Land south Stansted Road	ELS1	130	2017					30	50	50									**130**	**400**
	Great Chesterford Local Policy Area 1	Greenhouse site, New World Timber, London Road	GtCHE 1 and 8	40	2015			20	20												**40**	
Great Chesterford	Great Chesterford Local Policy Area 2	Land south of Stanley Road	GtCHE3	60	2014		30	30													**60**	**100**
	Newport Local Policy Area 2	Land at London Road by primary school	NEW2	70	2015			20	50												**70**	
Newport	Newport Local Policy Area 1	Bury Water Lane/Whiteditch Lane/Secondary school	NEW4, 5, 6 and 7	300	2015						100	100	100								**300**	**370**
	Stansted Local Policy Area 1	14-28 Cambridge Road	STA10	11	2014		11														**11**	
	Stansted Local Policy Area 2	Land at 10 Cambridge Road	STA11	14	2014		14														**14**	
Stansted	Stansted Local Policy Area 3	St Mary's Primary School, St Johns Rd		35	2015			35													**35**	**60**

	Takeley Local Policy Area 1	Land at and to the rear of Takeley Primary School	TAK2	122	2015			40	40												**80**	
	Takeley Local Policy Area 2	Land South of Dunmow Road and east of The Pastures/Orchard Fields	TAK7	38	2013		12	13	13												**38**	
	Takeley Local Policy Area 3	North View and 3 The Warren	LtCan4	40	2013		20	20													**40**	
	Takeley Local Policy Area 4	Land at Former Takeley Service Station and between Ridge House and Remarc	TAK16	12	2016					15											**15**	
	Takeley Local Policy Area 5	Land to the south of the B1256 between Olivias and New Cambridge House	TAK15	30	2015				15	15											**30**	**203**
Thaxted	Thaxted Local Policy Area 1	Sampford Road	THA11	60	2014		30	30													**60**	**60**
				Total		**0**	**192**	**308**	**228**	**245**	**250**	**300**	**300**	**200**	**200**	**200**	**200**	**200**	**200**	**200**	**3223**	

Appendix C

Preferred Sites



LEGEND

- Settlement Boundary
- Local Policy Areas
- Wastewater Treatment Works
- Combined Network
- Storm Network
- Foul Network
- SSSI Boundary
- Floodplain Garzing
- Low Meadows
- Wet Woodlands
- Local Wildlife Sites
- Main River

Hyder

Uttlesford District Council

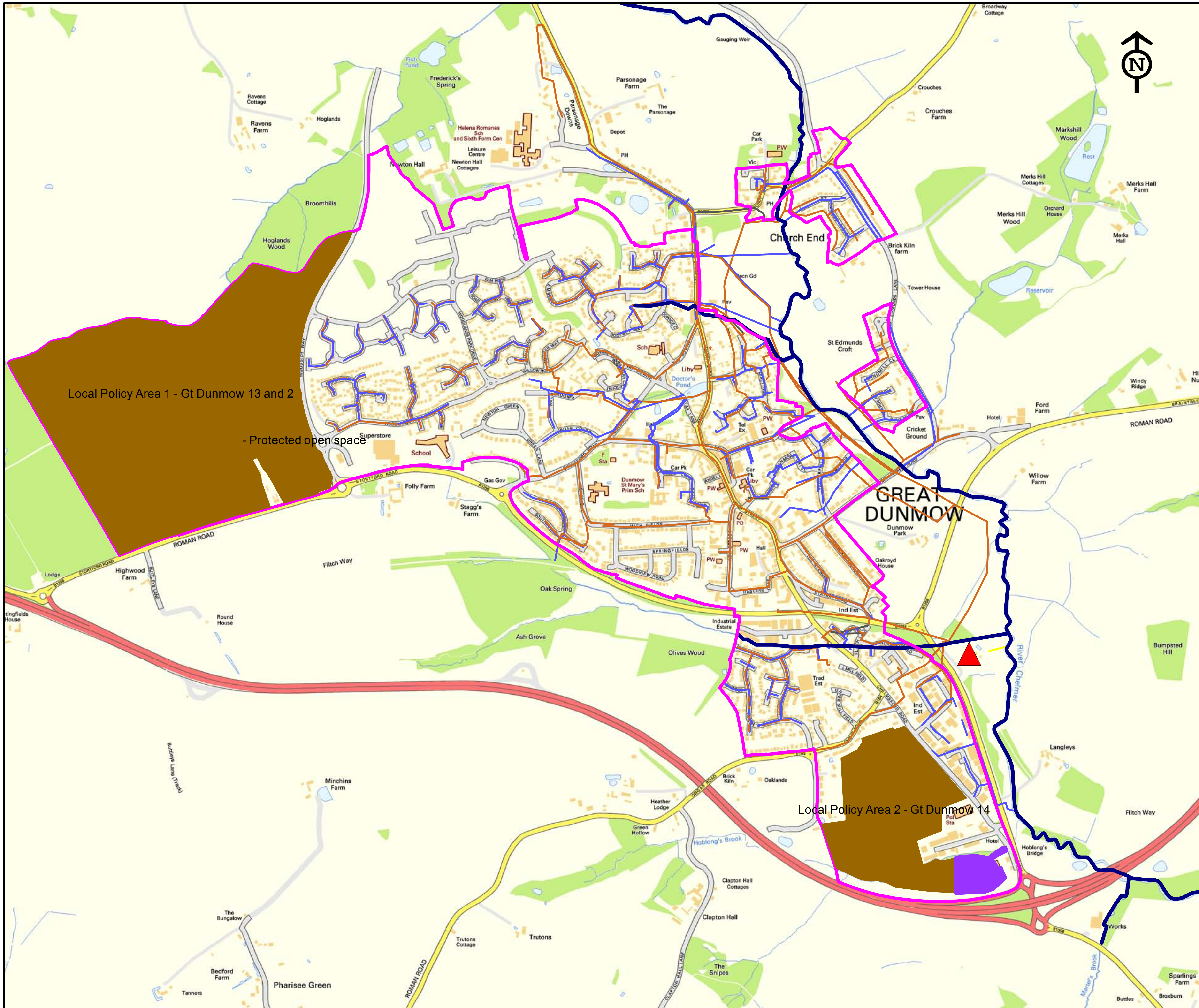
Council Offices London Road Saffron Walden
Essex CB11 4ER

UTTLESFORD WATER CYCLE STRATEGY

SAFFRON WALDON SHLAA SITES

SCALE			
1:15,000 @ A3	Produced	TL	MAY 2012
	Checked	HT	MAY 2012
	Approved	RG	MAY 2012

DRAWING NO. 0001-UA004462-BMD-01



LEGEND

- Settlement Boundary
- Local Policy Areas
- Employment Site
- Wastewater Treatment Works
- Combined Network
- Storm Network
- Foul Network
- SSSI Boundary
- Floodplain Garzing
- Low Meadows
- Wet Woodlands
- Local Wildlife Sites
- Main River

Hyder

Uttlesford District Council

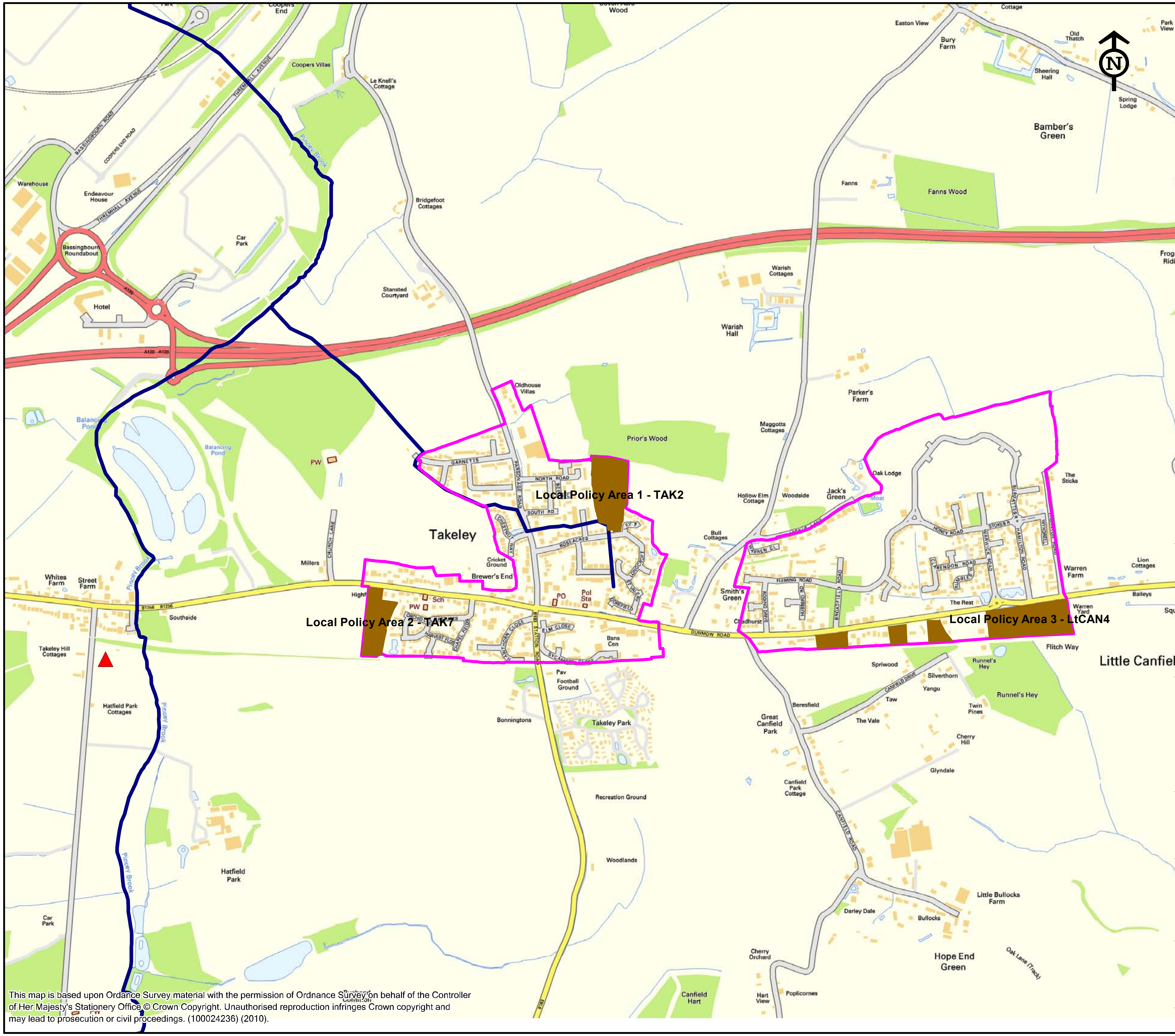
Council Offices London Road Saffron Walden
Essex CB11 4ER

UTTLESFORD WATER CYCLE STRATEGY

GREAT DUNMOW SHLAA SITES

SCALE			
1:15,000 @ A3	Produced	TL	MAY 2012
	Checked	HT	MAY 2012
	Approved	RG	MAY 2012

DRAWING NO. 0002-UA004462-BMD-01



LEGEND

- Settlement Boundary
- Local Policy Areas
- Employment Site
- Wastewater Treatment Works
- Combined Network
- Storm Network
- Foul Network
- SSSI Boundary
- Floodplain Garzing
- Low Meadows
- Wet Woodlands
- Local Wildlife Sites
- Main River

Hyder

Uttlesford District Council

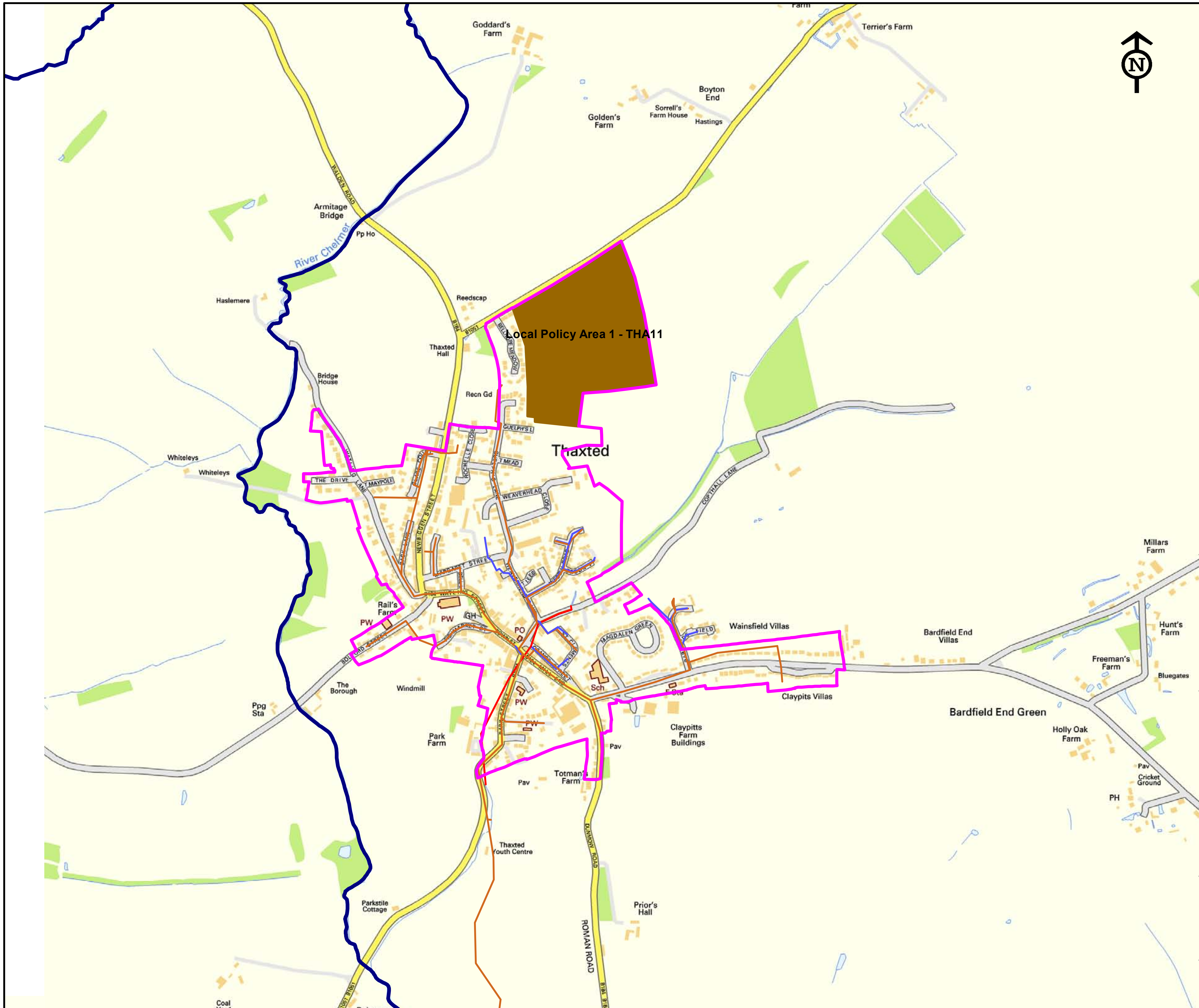
Council Offices London Road Saffron Walden Essex CB11 4ER

UTTLESFORD WATER CYCLE STRATEGY

TAKELEY SHLAA SITES

SCALE			
1:15,000 @ A3	Produced	TL	MAY 2012
	Checked	HT	MAY 2012
	Approved	RG	MAY 2012

DRAWING NO. 0004-UA004462-BMD-01



LEGEND

- Settlement Boundary
- Preferred SHLAA Sites
- Employment Site
- Wastewater Treatment Works
- Combined Network
- Storm Network
- Foul Network
- SSSI Boundary
- Floodplain Garzing
- Low Meadows
- Wet Woodlands
- Local Wildlife Sites
- Main River

Hyder

Uttlesford District Council

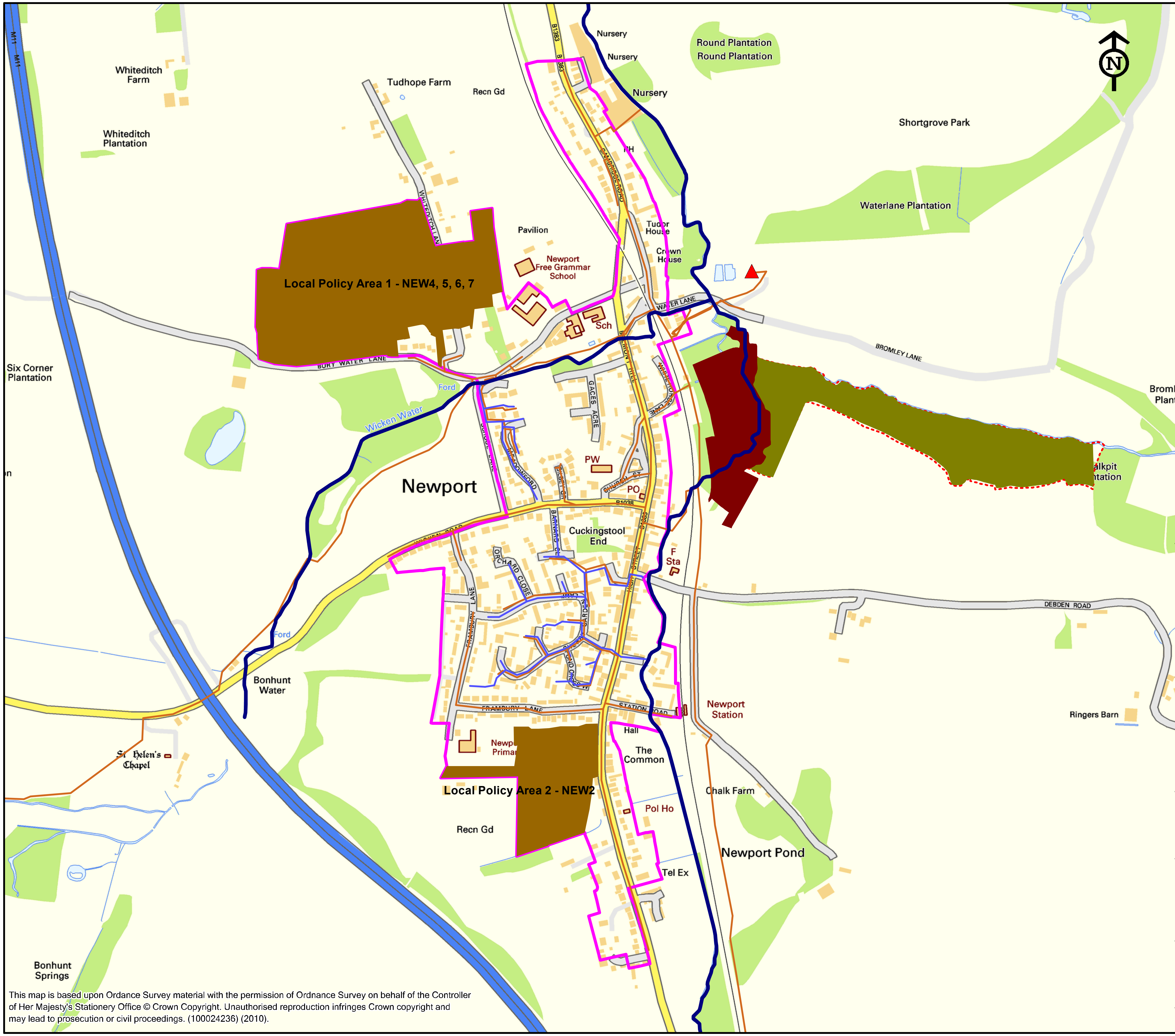
Council Offices London Road Saffron Walden Essex CB11 4ER

UTTLESFORD WATER CYCLE STRATEGY

THAXTED SHLAA SITES

SCALE			
1:15,000 @ A3	Produced	TL	MAY 2012
	Checked	HT	MAY 2012
	Approved	RG	MAY 2012

DRAWING NO. 0006-UA004462-BMD-01



LEGEND

- Settlement Boundary
- Local Policy Areas
- Employment Site
- Wastewater Treatment Works
- Combined Network
- Storm Network
- Foul Network
- SSSI Boundary
- Floodplain Garzing
- Low Meadows
- Wet Woodlands
- Local Wildlife Sites
- Main River

Hyder

Uttlesford District Council

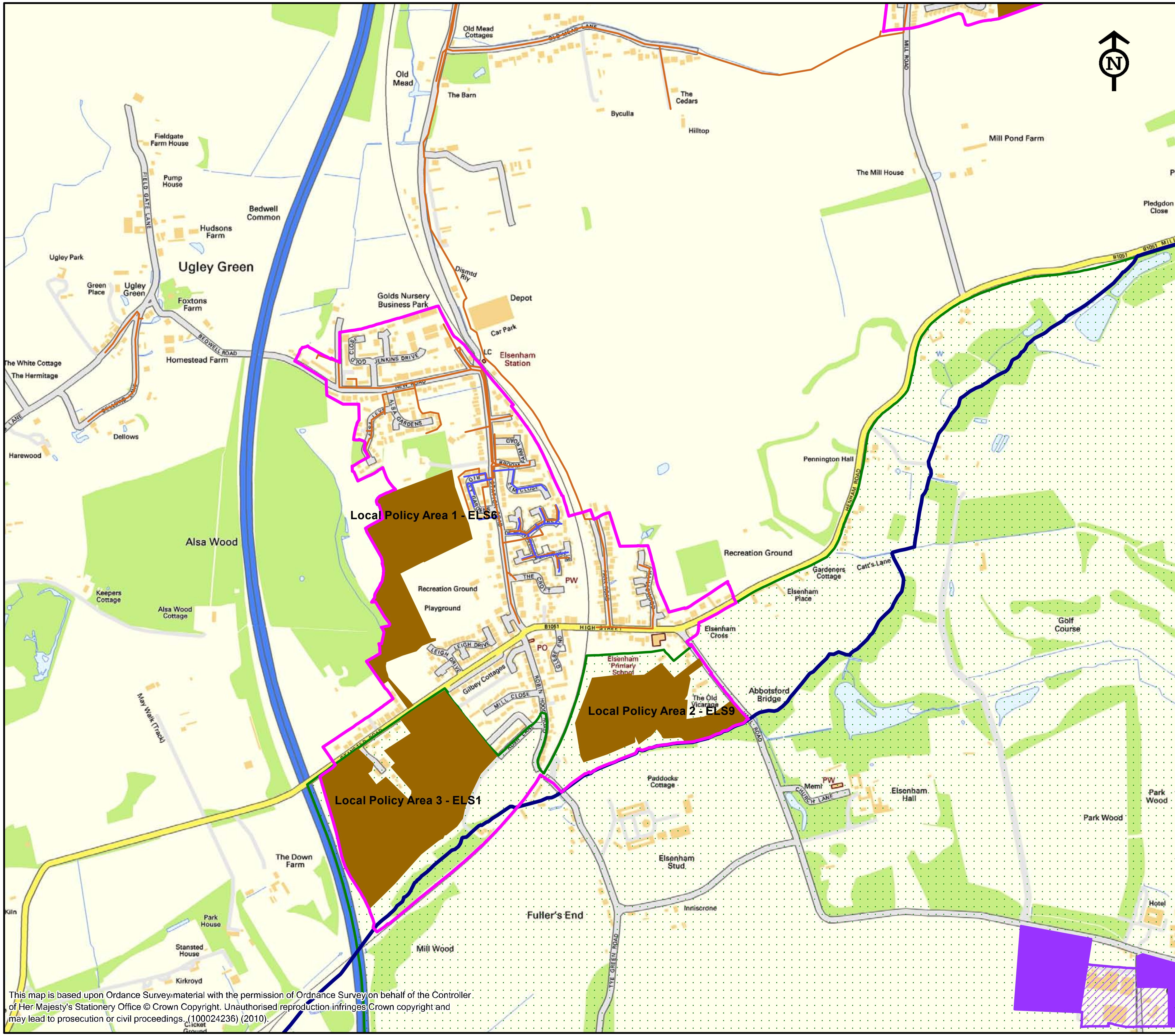
Council Offices London Road Saffron Walden Essex CB11 4ER

UTTLESFORD WATER CYCLE STRATEGY

NEWPORT SHLAA SITES

SCALE	Produced	TL	MAY 2012
1:15,000 @ A3	Checked	HT	MAY 2012
	Approved	RG	MAY 2012

DRAWING NO. 0006-UA004462-BMD-02



LEGEND

- Settlement Boundary
- Local Policy Areas
- Employment Site
- Wastewater Treatment Works
- Combined Network
- Storm Network
- Foul Network
- SSSI Boundary
- Floodplain Garzing
- Low Meadows
- Wet Woodlands
- Local Wildlife Sites
- Main River
- Countryside Protection Zone

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UTTLESFORD WATER CYCLE STRATEGY

ELSENHAM SHLAA SITES

SCALE			
1:15,000 @ A3	Produced	TL	MAY 2012
	Checked	HT	MAY 2012
	Approved	RG	MAY 2012

DRAWING NO. 0007-UA004462-BMD-01

LEGEND

- Settlement Boundary
- Local Policy Areas
- Employment Site
- Wastewater Treatment Works
- Combined Network
- Storm Network
- Foul Network
- SSSI Boundary
- Floodplain Garzing
- Low Meadows
- Wet Woodlands
- Local Wildlife Sites
- Main River
- Metropolitan Green Belt

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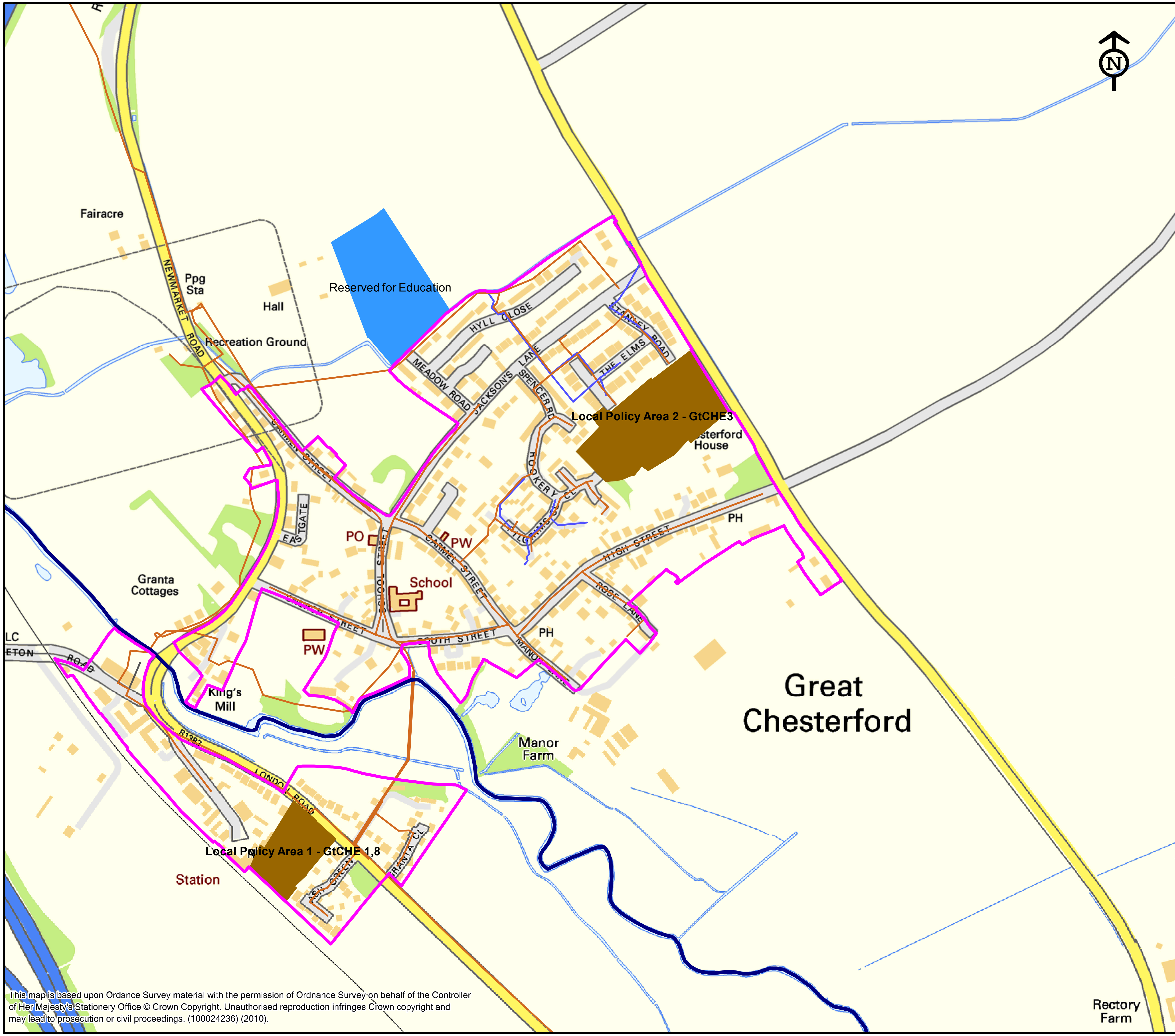
UTTLESFORD WATER CYCLE STRATEGY

STANSTED SHLAA SITES

SCALE			
1:15,000 @ A3	Produced	TL	MAY 2012
	Checked	HT	MAY 2012
	Approved	RG	MAY 2012

DRAWING NO. 0008-UA004462-BMD-01



LEGEND

- Settlement Boundary
- Local Policy Areas
- Employment Site
- Wastewater Treatment Works
- Combined Network
- Storm Network
- Foul Network
- SSSI Boundary
- Floodplain Garzing
- Low Meadows
- Wet Woodlands
- Local Wildlife Sites
- Main River

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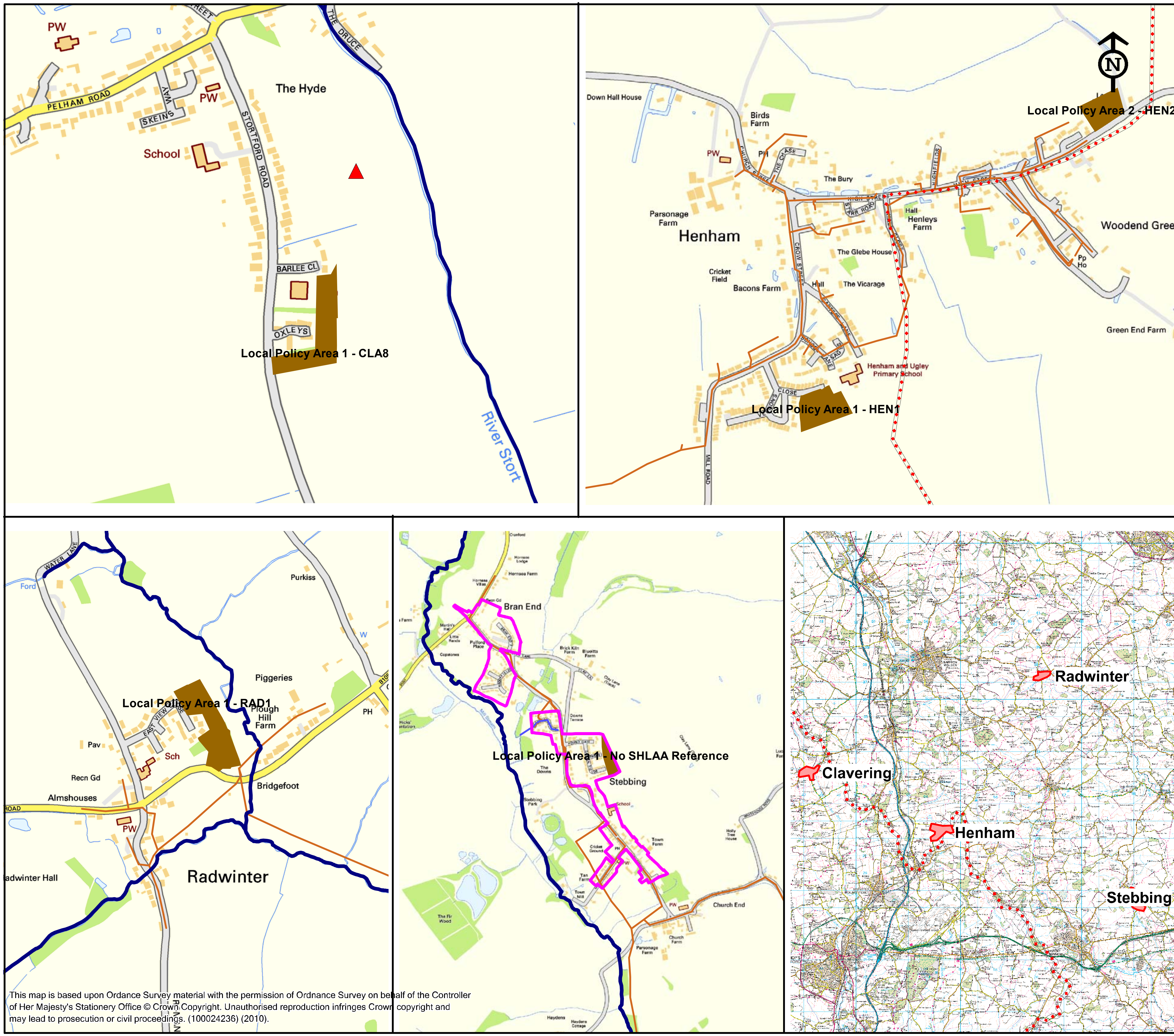
UTTLESFORD WATER CYCLE STRATEGY

GREAT CHESTERFORD SHLAA SITES

SCALE			
1:15,000 @ A3	Produced	TL	MAY 2012
	Checked	HT	MAY 2012
	Approved	RG	MAY 2012

DRAWING NO. 0009-UA004462-BMD-01



LEGEND

- Settlement Boundary
- Local Policy Areas
- Employment Site
- Wastewater Treatment Works
- Combined Network
- Storm Network
- Foul Network
- SSSI Boundary
- Floodplain Garzing
- Low Meadows
- Wet Woodlands
- Local Wildlife Sites
- Main River
- AWS TWU Boundary

Hyder

Uttlesford District Council

Council Offices London Road Saffron Walden
Essex CB11 4ER

UTTLESFORD WATER CYCLE STRATEGY

RURAL SETTLEMENTS SHLAA SITES

SCALE			
1:15,000 @ A3	Produced	TL	MAY 2012
	Checked	HT	MAY 2012
	Approved	RG	MAY 2012

DRAWING NO. 0010-UA004462-BMD-01

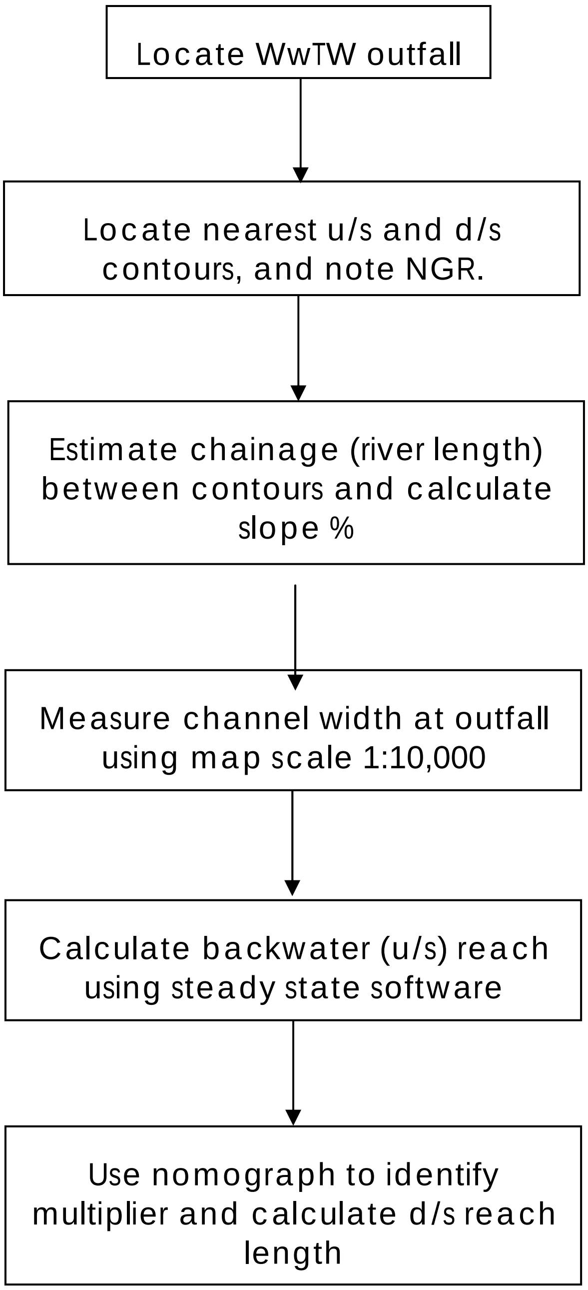
Appendix D

WwTW Capacity Assessment Methodology and Results

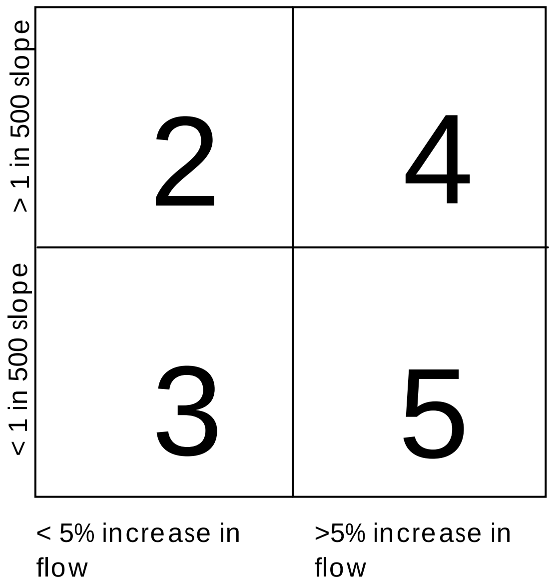
4 Appendices

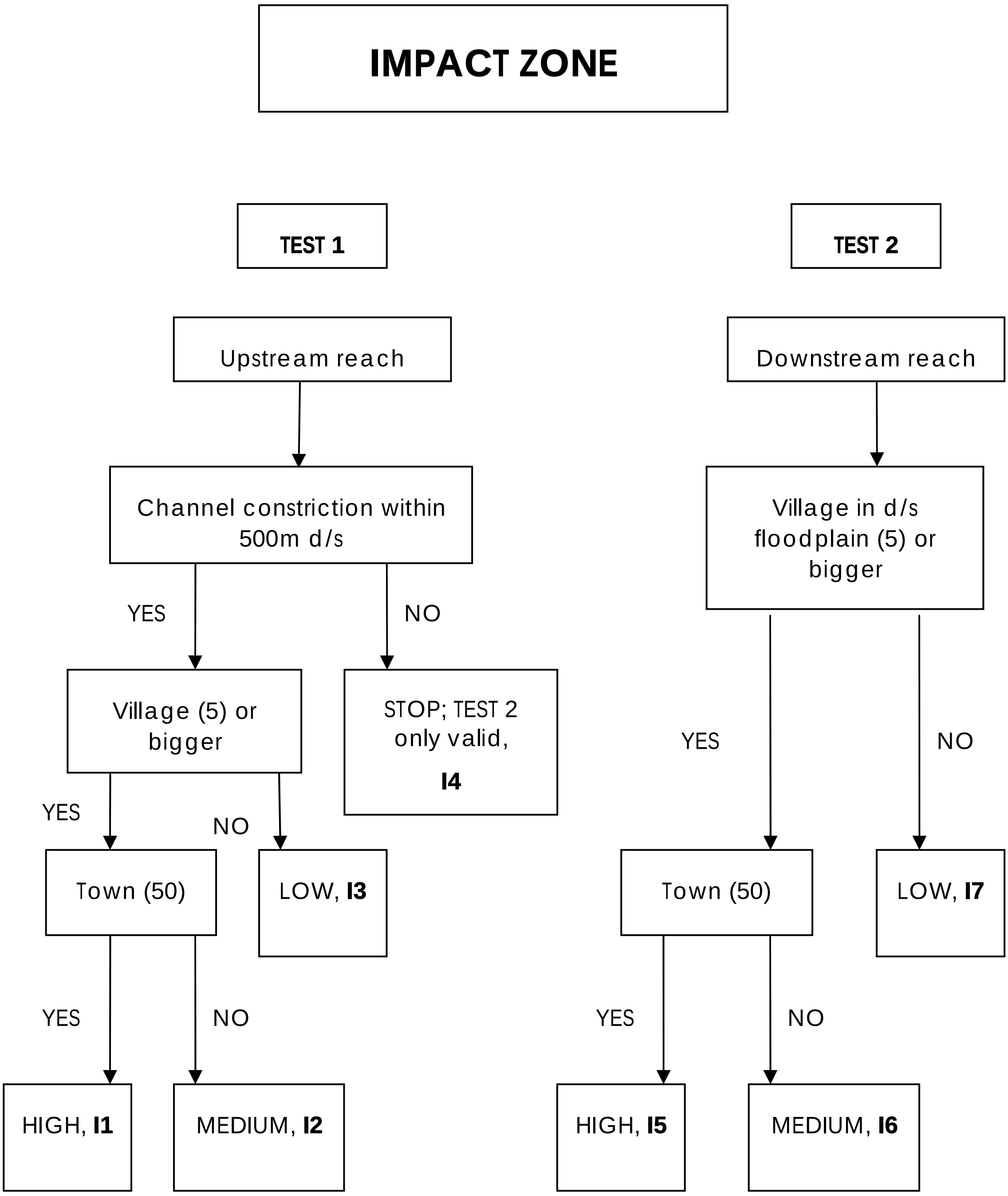
4.1 Appendix A Decision Trees

CALCULATE REACH LENGTHS

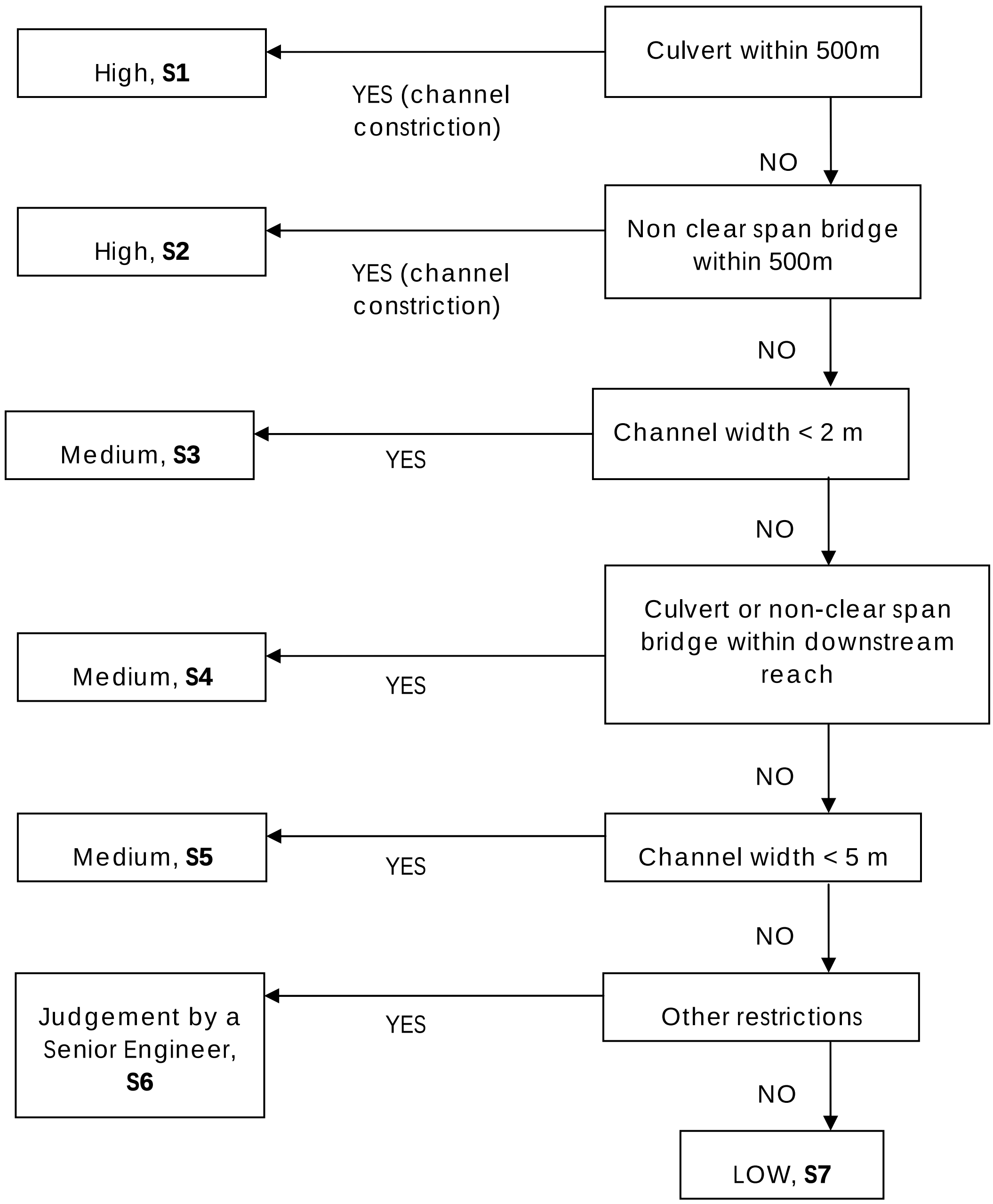


MULTIPLIER NOMOGRAPH




IMPACT ZONE
TEST 1
TEST 2
Upstream reach
Downstream reach
Channel constriction within 500m d/s
Village in d/s floodplain (5) or bigger
YES
NO
Village (5) or bigger
STOP; TEST 2 only valid, I4
YES
NO
YES
NO
Town (50)
LOW, I3
Town (50)
LOW, I7
YES
NO
YES
NO
HIGH, I1
MEDIUM, I2
HIGH, I5
MEDIUM, I6

SENSITIVITY OF WATER LEVELS



4.2 Appendix B Multi-Criteria Scoring

1) Sensitivity and impact assessment, the risk will be marked as followed:

- Low risk: 1
- Medium risk: 3
- High risk: 5

2) Percentage increase in flood flow due to growth:

- Flow increase between 0 and 1%: 1
- Flow increase between 1 and 3%: 2
- Flow increase between 3 and 10%: 3
- Flow increase between 10 and 20%: 4
- Flow increase greater than 20%: 5

3) Weights were given to each criterion as followed:

- Sensitivity assessment: 0.3
- Impact assessment: 0.3
- Percentage of increased flow: 0.4

UA004462- Uttlesford Water Cycle Study-FFT Calculations

1 in 2 year Peak Flows m3/s			Existing FFT		Future Total 2030 FFT		Current Total Flow with ppl growth (River Peak + FFT)		Predicted Future Total Flow (River Peak CC +		New FFT due to growth	
Site	**1 in 2**	**1 in 2 CC**	**m3/s**	**%**	**m3/s**	**%**	**m3/s**	**m3/s**	**m3/s**	**m3/s**	**%**	**% with CC**
Saffron Waldon	2.17	2.60	0.098	4.53%	0.110	4.22%	2.26	0.012	2.70	0.012	**0.51%**	**0.43%**
Great Dunmow	8.21	9.85	0.051	0.62%	0.066	0.67%	8.26	0.015	9.90	0.015	**0.18%**	**0.15%**
Takeley	2.30	2.76	0.010	0.44%	0.013	0.46%	2.31	0.003	2.77	0.003	**0.11%**	**0.09%**
Great Easton	0.50	0.60	0.020	3.94%	0.021	3.42%	0.52	0.001	0.62	0.001	**0.15%**	**0.13%**
Newport	5.42	6.50	0.017	0.31%	0.022	0.34%	5.44	0.005	6.52	0.005	**0.09%**	**0.07%**
Stansted Mountfitchet	5.49	6.59	0.054	0.98%	0.060	0.91%	5.54	0.006	6.64	0.006	**0.12%**	**0.10%**
Great Chesterford	8.61	10.33	0.019	0.22%	0.020	0.19%	8.62	0.001	10.35	0.001	**0.02%**	**0.01%**

Statistical Method

Site	**QMED**	**QMED CC**
Saffron Waldon	2.17	2.60
Great Dunmow	8.21	9.85
Takeley	2.30	2.76
Great Easton	0.50	0.60
Newport	5.42	6.50
Stansted Mountfitchet	5.49	6.59
Great Chesterford	8.61	10.33

Multi-Criteria Scoring (Halcrow, 2009)

Percentage increase in flood flow due to growth: **Risk Score**

Flow increase between 0 and 1%:	**1**	**1**	Low
Flow increase between 1 and 3%:	**2**		
Flow increase between 3 and 10%:	**3**	**3**	Medium
Flow increase between 10 and 20%:	**4**		
Flow increase greater than 20%:	**5**	**5**	High

UA004462- Uttlesford Water Cycle Study- Site Scoring

WwTW	Receiving Watercourse	Existing Flow	Increase in Flow	Percentage of Increased flow		Sensitivity		Impact		Total Risk Value (various weightings used)			Combined
		(m^3/s)	(m^3/s)	Percentage	Risk Value	Assessment	Risk Value	Assessment	Risk Value	Sensitivity 0.3	Impact 0.3	Water Levels 0.4	Risk Score
Saffron Waldon	Madgate Slade/ Kings Slade	0.10	0.012	0.51%	1	Medium	3	Low	1	0.9	0.3	0.4	**1.6**
Great Dunmow	Tributary of River Chelmer, Ash (	0.05	0.015	0.18%	1	Medium	3	Low	1	0.9	0.3	0.4	**1.6**
Takeley	Pincey Brook	0.01	0.003	0.11%	1	High	5	Low	1	1.5	0.3	0.4	**2.2**
Great Easton	Tributary of River Chelmer	0.02	0.001	0.15%	1	Medium	3	Medium	3	0.9	0.9	0.4	**2.2**
Newport	River Cam	0.02	0.005	0.09%	1	Medium	3	Medium	3	0.9	0.9	0.4	**2.2**
Stansted Mountfitchet	Stansted Brook	0.05	0.006	0.12%	1	Medium	3	Low	1	0.9	0.3	0.4	**1.6**
Great Chesterford	River Cam	0.02	0.001	0.02%	1	Medium	3	Low	1	0.9	0.3	0.4	**1.6**

The colour coding used is red for a combined risk value greater than 3, amber greater than 2.5 and green for less than 2.5.

Appendix E

Water Quality Calculations

WFD Assessment Datasheet

Catchment	**Newport STW**
Date	08.05.2012
Receiving Water	River Cam
WFD Waterbody ID	GB105033037520
Upstream Sample Point	none
Downstream Sample Point	27M03

STW Permit limits

Variable	Unit	Limit	Statistic
DWF	m3/day	**738**	-
BOD	mg/l	**20**	95 %ile
Ammonia	mg/l	**10**	95 %ile
Phosphate	mg/l	**-**	AA

Post-growth DWF - m3/day

Upstream River data

Variable	Unit	Mean	SD	Comments/Assumptions
Flow	m3/day	**24192**	**3456**	**Q95** river flow. Estmated using Low Flows Enterprise, August 2009.
BOD	mg/l	**0.86**	**0.52**	No monitoring data upstream of discharge.
Ammonia	mg/l	**0.09**	**0.05**	Assume mid-High status quality for all parameters.
Phosphate	mg/l	**0.025**	**0.025**	

STW discharge data

Variable	Unit	Mean	SD	Comments/Assumptions
Pre-growth Flow	m3/day	**923**	**308**	Based on current (AMP5) DWF of 738 m3/day
Post-growth Flow	m3/day	**0**	**0**	
BOD	mg/l	**5.2**	**2.68**	01.01.2009 to 27.02.2012 (last step change)
Ammonia	mg/l	**1.27**	**0.96**	01.01.2010 to 27.02.2012 (last step change)
Phosphate	mg/l	**4.72**	**0.91**	12.12.2006 to 25.03.2009 (EA data prior to OSM)

Downstream WFD Targets

Salmonid Fishery (Y/N) ? **Y**

1. No Deterioration

Variable	Status	90 %ile (mg/l)	AA (mg/l)
BOD	High	**3.00**	**-**
Ammonia	High	**0.30**	**-**
Phosphate	Bad	**-**	**1.00**

2. Improve to Good Status

Variable	Status	90 %ile (mg/l)	AA (mg/l)
BOD	Good	**-**	**-**
Ammonia	Good	**-**	**-**
Phosphate	Good	**-**	**0.12**

Comments/Assumptions

Targets for River Cam (waterbody GB1050033037520)

No Deterioration

RBMP status (based on 2006-2008 data at sample point 27M03):

BOD - High

Ammonia - High

Phosphate - Bad

N.B. Bad status has no upper boundary, therefore to ensure 'no deterioration' in downstrean river phosphate quality, permit limits would be set to **maintain the current effluent load.**

Improve to Good Status

Applies to Phosphate only (Ammonia and BOD are already at, or better than, Good status.)

N.B. Assume mid-high status upstream for this assessment (0.025 mg/l mean, 0.025 mg/l sd)

WFD Assessment Datasheet

Catchment	**Great Chesterford STW**
Date	08.05.2012
Receiving Water	River Cam
WFD Waterbody ID	GB105033037580
Upstream Sample Point	27M04
Downstream Sample Point	27M07

STW Permit limits

Variable	Unit	Limit	Statistic
DWF	m3/day	**1284**	-
BOD	mg/l	**9**	95 %ile
Ammonia	mg/l	**5**	95 %ile
Phosphate	mg/l	**-**	AA

Post-growth DWF - m3/day

Upstream River data

Variable	Unit	Mean	SD	Comments/Assumptions
Flow	m3/day	**58752**	**9504**	**Q95** river flow. Estmated using Low Flows Enterprise, Aug 2009.
BOD	mg/l	**1.95**	**0.71**	08.03.2001 to 26.03.2007 (last step change)
Ammonia	mg/l	**0.11**	**0.07**	24.01.2000 to 26.03.2007 (no step change)
Phosphate	mg/l	**0.7**	**0.5**	Calculated following P-removal at Saffron Walden STW.

STW discharge data

Variable	Unit	Mean	SD	Comments/Assumptions
Pre-growth Flow	m3/day	**1605**	**535**	Based on current consented DWF of 1284 m3/day
Post-growth Flow	m3/day	**0**	**0**	
BOD	mg/l	**0.95**	**0.63**	17.04.2009 to 27.02.2021 (from last step change)
Ammonia	mg/l	**0.19**	**0.12**	24.06.2003 to 27.02.2012 (from last step change)
Phosphate	mg/l	**5.09**	**0.85**	09.02.2004 to 25.03.2009 (EA data prior to OSM)

Downstream WFD Targets

Salmonid Fishery (Y/N) ? **Y**

1. No Deterioration

Variable	Status	90 %ile (mg/l)	AA (mg/l)
BOD	High	**3.00**	**-**
Ammonia	High	**0.30**	**-**
Phosphate	Poor	**-**	**1.00**

2. Improve to Good Status

Variable	Status	90 %ile (mg/l)	AA (mg/l)
BOD	Good	**-**	**-**
Ammonia	Good	**-**	**-**
Phosphate	Good	**-**	**0.12**

N.B. Assume mid-Good status upstream for this assessment (0.085 mg/l mean, 0.085 mg/l sd)

Comments/Assumptions

Targets for River Cam (Waterbody GB105033037580)

No Deterioration
RBMP status (based on 2006-2008 data at sample point 27M07):
BOD - High
Ammonia - High
Phosphate - Bad

However, UWWTD P-removal scheme installed at the end of 2008 at Saffron Walden STW (a measure quoted in the RBMP) has resulted in an improvement to Poor status for Phosphate. As this measure is planned and accounted for in the RBMP, **Poor (i.e. current) status should be used as the No Deterioration target for phosphate.**

Improve to Good Status
Applies to Phosphate only (Ammonia and BOD are already at, or better than, Good status.)

WFD Assessment Datasheet

Catchment	**Saffron Walden STW**
Date	08-May-12
Receiving Water	Assume direct discharge to River Cam
WFD Waterbody ID	GB105033037580
Upstream Sample Point	27M03- R.CAM WENDONS AMBO RD.BR.B1052
Downstream Sample Point	27M04

STW Permit limits

Variable	Unit	Limit	Statistic	
DWF	m3/day	**3700**	-	**Post-growth DWF - m3/day**
BOD	mg/l	**11**	95 %ile	
Ammonia	mg/l	**3**	95 %ile	
Phosphate	mg/l	**2**	AA	as required by UWWTD

Upstream River data

Variable	Unit	Mean	SD	Comments/Assumptions
Flow	m3/day	**39916**	**8900**	**Q95** river flow.
BOD	mg/l	**1.77**	**1.43**	24.01.2000 to present (no step changes)
Ammonia	mg/l	**0.06**	**0.04**	17.02.2006 to 25.03.2010 (last time step change)
Phosphate	mg/l	**0.64**	**0.57**	17.11.2006 to 25.05.2010 (combined last 3 step changes)

STW discharge data

Variable	Unit	Mean	SD	Comments/Assumptions
Pre-growth Flow	m3/day	**4625**	**1542**	Based on current consented DWF of 3700 m3/day
Post-growth Flow	m3/day	**0**	**0**	
BOD	mg/l	**5.92**	**2.55**	24.01.2000 to 27.2.2012 (no step changes)
Ammonia	mg/l	**0.68**	**0.79**	07.02.2012 to 27.02.2012 (last step change)
Phosphate	mg/l	**1.03**	**0.3**	16.11.2011 to 30.2011(based OSM data only)

Downstream WFD Targets

Salmonid Fishery (Y/N) ? **Y**

1. No Deterioration

Variable	RBMP Status	90 %ile (mg/l)	AA (mg/l)
BOD	Good	**4.00**	**-**
Ammonia	High	**0.30**	**-**
Phosphate	Poor	**-**	**1.00**

2. Improve to Good Status

Variable	Status	90 %ile (mg/l)	AA (mg/l)
BOD	Good	**-**	**-**
Ammonia	Good	**-**	**-**
Phosphate	Good	**-**	**0.12**

Comments/Assumptions

Targets for River Cam (waterbody GB1050033037590)

No Deterioration

RBMP status (based on 2006-2008 data at sample point 27M04):

BOD - Good

Ammonia - High

Phosphate - Bad. However, UWWTD P-removal scheme was installed at the end of 2008 (a measure quoted in the RBMP) and river quality is now predicted to be Poor status.

Phosphate - Poor.

Improve to Good Status

Applies to Phosphate only (Ammonia and BOD are already at, or better than, Good status.)

N.B. Assume mid-Good status upstream for this assessment (0.085 mg/l mean, 0.085 mg/l sd)

WFD Assessment Datasheet

Catchment	**Felsted STW**
STW Sample Point	FELSNEW
STW Permit Number	AW2NF911
Date of Data Collation	30.05.2012
Receiving Water	Stebbing Brook/ main river chelmer downstream
WFD Waterbody ID	GB105037041190/ GB105037033950
Upstream Sample Point	CH0910 (WFD sample point for 2006, sampling now ceased).
Downstream Sample Point	CH08 (WFD sample point) in main river Chelmer, d/s of the confluence with the Stebbing Brook

STW Permit limits

Variable	Unit	Limit	Statistic	Comments/Assumptions
DWF	m3/day	**1630**	-	
BOD	mg/l	**20**	95 %ile	
Ammonia	mg/l	**10**	95 %ile	
Phosphate	mg/l	**-**	AA	

Upstream River data

Variable	Unit	Mean	SD	Comments/Assumptions
Flow	m3/day	**12110**	**2543**	**Q95** river flow. Estmated using Low Flows Enterprise, Aug 2009.
BOD	mg/l	**1.00**	**0.76**	13.01.2000 to 15.02.2007 (no step changes) sampling ceased in 2007
Ammonia	mg/l	**0.02**	**0.02**	13.01.2000 to 15.02.2007 (no step changes) sampling ceased in 2007
Phosphate	mg/l	**0.05**	**0.04**	13.01.2000 to 15.02.2007 (no step changes) sampling ceased in 2007

STW discharge data

Variable	Unit	Mean	SD	Comments/Assumptions
Pre-growth Flow	m3/day	**2038**	**679**	Based on current consented DWF of 1509m3/day
Post-growth Flow	m3/day			Please clearly set out in the WCS, or an Appendix, the figures used to calculate the post-growth DWF.
BOD	mg/l	**4.48**	**2.3**	16.03.2009 to 14.03.2012 (last 2 step changes)
Ammonia	mg/l	**0.36**	**0.65**	14.01.2009 to 07.03.2012 (no step change)
Phosphate	mg/l	**5.6**	**0.93**	09.12.2004 to 16.03.2009 (last step change) (EA data prior to OSM)

Downstream WFD Targets

Salmonid Fishery (Y/N) ? **N**

1. No Deterioration

Variable	Status	90 %ile (mg/l)	AA (mg/l)
BOD	High	**4.00**	**-**
Ammonia	High	**0.30**	**-**
Phosphate	Poor	**-**	**1.00**

2. Improve to Good Status

Variable	Status	90 %ile (mg/l)	AA (mg/l)
BOD	Good	**-**	**-**
Ammonia	Good	**-**	**-**
Phosphate	Good	**-**	**0.12**

Comments/Assumptions

Targets for Pant (Waterbody GB105037041180)

Both the no deterioration and improve to good status scenarios need to be tested with the existing permitted flow and the future post-growth flow, and the results presented alongside eachother in the WCS. This is to make it clear whether the growth makes acheiving the WFD objectives any more difficult than the current permitted situation.

It would also be helpful to consider the post-growth outputs of the calculations for Great Easton and Great Dunmow as upstream quality.

No Deterioration of downstream quality

RBMP status (based on 2006-2008 data at sample point CH08, the main river Chelmer downstream of the confluence with the Stebbing Brook):
BOD - High (0.77mg/l, SD = 0.75, n=24 in 2006-2007)
Ammonia - High (0.045mg/l, SD = 0.065, n=36 in 2006-2008)
Phosphate - Poor (0.47mg/l, SD = 0.25, n=36 in 2006-2008).

Improve to Good Status

Applies to Phosphate only (Ammonia and BOD are already at, or better than, Good status). Upstream quality can be assumed as being of midpoint good status (0.085mg/l mean and 0.085mg/l SD).

WFD Assessment Datasheet

Catchment	**Great Dunmow STW**
STW Sample Point	DUNMOW
STW Permit Number	ASENF12255
Date of Data Collation	30.05.2012
Receiving Water	Chelmer
WFD Waterbody ID	GB105037033950
Upstream Sample Point	CH10 (WFD sample point)
Downstream Sample Point	CH0860 (WFD sample point, closed 2006)

STW Permit limits

Variable	Unit	Limit	Statistic	Comments/Assumptions
DWF	m3/day	**1509**	-	
BOD	mg/l	**13**	95 %ile	
Ammonia	mg/l	**20**	95 %ile	
Phosphate	mg/l	**-**	AA	

Upstream River data

Variable	Unit	Mean	SD	Comments/Assumptions
Flow	m3/day	**34773**	**7361**	**Q95** river flow. Estmated using Low Flows Enterprise, Aug 2009.
BOD	mg/l	**0.94**	**0.48**	16.02.2005 to 28.11.2007 (last step change)
Ammonia	mg/l	**0.05**	**0.05**	06.01.2000 to present (no step changes)
Phosphate	mg/l	**0.43**	**0.26**	18.10.2006 to present (from last step change)

STW discharge data

Variable	Unit	Mean	SD	Comments/Assumptions
Pre-growth Flow	m3/day	**1886**	**629**	Based on current consented DWF of 1509m3/day
Post-growth Flow	m3/day			Please clearly set out in the WCS, or an Appendix, the figures used to calculate the post-growth DWF. It would be helpful if the WCS could also incorporate scenarios relating to the closure of Felsted STW and the transfer of flows to Great Dunmow STW.
BOD	mg/l	**2.94**	**2.39**	25.01.2005 to 14.03.2012 (last step change)
Ammonia	mg/l	**0.38**	**0.48**	17.11.2005 to 14.03.2012 (last step change)
Phosphate	mg/l	**6.21**	**1.43**	05.04.2000 to 16.03.2009 (no step change) (EA data prior to OSM)

Downstream WFD Targets

Salmonid Fishery (Y/N) ? **Y**

1. No Deterioration

Variable	Status	90 %ile (mg/l)	AA (mg/l)
BOD	High	**3.00**	**-**
Ammonia	High	**0.30**	**-**
Phosphate	Poor	**-**	**1.00**

2. Improve to Good Status

Variable	Status	90 %ile (mg/l)	AA (mg/l)
BOD	Good	**-**	**-**
Ammonia	Good	**-**	**-**
Phosphate	Good	**-**	**0.12**

Comments/Assumptions

Targets for Chelmer (Waterbody GB105037033950)

Both the no deterioration and improve to good status scenarios need to be tested with the existing permitted flow and the future post-growth flow, and the results presented alongside eachother in the WCS. This is to make it clear whether the growth makes acheiving the WFD objectives any more difficult than the current permitted situation.

It would also be helpful to consider the post-growth outputs of the calculation for Great Easton as upstream quality.

<u>No Deterioration of downstream quality</u>

RBMP status (based on 2006-2008 data at sample point CH0860):
BOD - High (0.5mg/l, SD = 0.6, n=12 in 2006)
Ammonia - High (0.03mg/l, SD = 0.04, n=12 in 2006)
Phosphate - Poor (0.77mg/l, SD = 0.7, n=12 in 2006)

<u>Improve to Good Status</u>
Applies to Phosphate only (Ammonia and BOD are already at, or better than, Good status). Upstream quality can be assumed as being of midpoint good status (0.085mg/l mean and 0.085mg/l SD).

WFD Assessment Datasheet

Catchment	**Newport STW**
Date	08.05.2012
Receiving Water	River Cam
WFD Waterbody ID	GB105033037520
Upstream Sample Point	none
Downstream Sample Point	27M03

STW Permit limits

Variable	Unit	Limit	Statistic
DWF	m3/day	**738**	-
BOD	mg/l	**20**	95 %ile
Ammonia	mg/l	**10**	95 %ile
Phosphate	mg/l	**-**	AA

Post-growth DWF - m3/day

Upstream River data

Variable	Unit	Mean	SD	Comments/Assumptions
Flow	m3/day	**24192**	**3456**	**Q95** river flow. Estmated using Low Flows Enterprise, August 2009.
BOD	mg/l	**0.86**	**0.52**	No monitoring data upstream of discharge. Assume mid-High status quality for all parameters.
Ammonia	mg/l	**0.09**	**0.05**	
Phosphate	mg/l	**0.025**	**0.025**	

STW discharge data

Variable	Unit	Mean	SD	Comments/Assumptions
Pre-growth Flow	m3/day	**923**	**308**	Based on current (AMP5) DWF of 738 m3/day
Post-growth Flow	m3/day	**0**	**0**	
BOD	mg/l	**5.2**	**2.68**	01.01.2009 to 27.02.2012 (last step change)
Ammonia	mg/l	**1.27**	**0.96**	01.01.2010 to 27.02.2012 (last step change)
Phosphate	mg/l	**4.72**	**0.91**	12.12.2006 to 25.03.2009 (EA data prior to OSM)

Downstream WFD Targets

Salmonid Fishery (Y/N) ? **Y**

1. No Deterioration

Variable	Status	90 %ile (mg/l)	AA (mg/l)
BOD	High	**3.00**	**-**
Ammonia	High	**0.30**	**-**
Phosphate	Bad	**-**	**1.00**

2. Improve to Good Status

Variable	Status	90 %ile (mg/l)	AA (mg/l)
BOD	Good	**-**	**-**
Ammonia	Good	**-**	**-**
Phosphate	Good	**-**	**0.12**

Comments/Assumptions

Targets for River Cam (waterbody GB1050033037520)

No Deterioration
RBMP status (based on 2006-2008 data at sample point 27M03):
BOD - High
Ammonia - High
Phosphate - Bad
N.B. Bad status has no upper boundary, therefore to ensure 'no deterioration' in downstrean river phosphate quality, permit limits would be set to **maintain the current effluent load.**

Improve to Good Status
Applies to Phosphate only (Ammonia and BOD are already at, or better than, Good status.)

N.B. Assume mid-high status upstream for this assessment (0.025 mg/l mean, 0.025 mg/l sd)

WFD Assessment Datasheet

Catchment	**Great Easton STW**
STW Sample Point	GEASTON
STW Permit Number	ASENF10268
Date of Data Collation	30.05.2012
Receiving Water	Chelmer
WFD Waterbody ID	GB105037033950
Upstream Sample Point	CH1042 (not a WFD sample point, sampling ceased 2004)
Downstream Sample Point	CH10 (WFD sample point)

STW Permit limits

Variable	Unit	Limit	Statistic	Comments/Assumptions
DWF	m3/day	**874**	-	This flow is the new AMP5 increase in DWF, which means there is no 'headroom' available for any growth in the current permit.
BOD	mg/l	**20**	95 %ile	
Ammonia	mg/l	**6**	95 %ile	
Phosphate	mg/l	**-**	AA	

Upstream River data

Variable	Unit	Mean	SD	Comments/Assumptions
Flow	m3/day	**23874**	**4420**	**Q95** river flow. Estmated using Low Flows Enterprise, Aug 2009.
BOD	mg/l	**1.79**	**1.08**	21.11.2001 to 19.11.2004 (from last step change). Sample point not used for WFD purposes, sampling ceased in 2004.
Ammonia	mg/l	**0.03**	**0.02**	31.05.2001 to 19.11.2004 (from last step change) sampling ceased in 2004
Phosphate	mg/l	**0.09**	**0.03**	15.01.2001 to 19.11.2004 (from last step change) sampling ceased in 2004

STW discharge data

Variable	Unit	Mean	SD	Comments/Assumptions
Pre-growth Flow	m3/day	**1093**	**364**	Based on current consented DWF of 874m3/day
Post-growth Flow	m3/day			This post-growth figure must be based on the 874m3/day DWF as the baseline current flow situation. Please clearly set out in the WCS, or an Appendix, the figures used to calculate the post-growth DWF.
BOD	mg/l	**5.29**	**2.7**	13.01.2000 to 14.03.2012 (no step changes)
Ammonia	mg/l	**1**	**1.1**	17.05.2009 to 14.03.2012 (last step change)
Phosphate	mg/l	**5.92**	**1.34**	12.07.2007 to 16.03.2009 (last step change) (EA data prior to OSM)

Downstream WFD Targets

Salmonid Fishery (Y/N) ? **Y**

1. No Deterioration

Variable	Status	90 %ile (mg/l)	AA (mg/l)
BOD	High	**3.00**	-
Ammonia	High	**0.30**	-
Phosphate	Poor	-	**1.00**

2. Improve to Good Status

Variable	Status	90 %ile (mg/l)	AA (mg/l)
BOD	Good	-	-
Ammonia	Good	-	-
Phosphate	Good	-	**0.12**

Comments/Assumptions

Targets for Chelmer (Waterbody GB105037033950)

Both the no deterioration and improve to good status scenarios need to be tested with the existing permitted flow and the future post-growth flow, and the results presented alongside eachother in the WCS. This is to make it clear whether the growth makes acheiving the WFD objectives any more difficult than the current permitted situation.

No Deterioration of downstream quality

RBMP status (based on 2006-2008 data at sample point CH10):
BOD - High (0.77mg/l, SD = 0.75, n=24 in 2006 - 2007)
Ammonia - High (0.045mg/l, SD = 0.065, n=36 in 2006 - 2008)
Phosphate - Poor (0.47mg/l, SD = 0.25, n=36 in 2006 - 2008).

Improve to Good Status

Applies to Phosphate only (Ammonia and BOD are already at, or better than, Good status). Upstream quality can be assumed as being of midpoint good status (0.085mg/l mean and 0.085mg/l SD).

CONSENTED AND CALCULATED EXISTING AND FUTURE DRY WEATHER FLOW

Existing consent exceeded

DWF = P X G + 25%

EXISTING

		Existing DWF						
		P	G (l/p/day)	I	**Consented DWF (m3/day)**	**Theoretical DWF (m3/day)**	**Measured DWF (m3/day)**	**DWF (m3/day) Calculated**
Saffron Waldon	AWS	18,125	144	25%	**3,700**	**3,037**	**3,147**	**3,263**
Great Dunmow	AWS	9,439	144	25%	**1,509**	**1,777**	**497**	**1,699**
Takeley	TWUL	1,850	144	25%	**667**	-	-	**333**
Great Easton	AWS	3,649	144	25%	**874**	**677**	**260**	**657**
Newport	AWS	3,127	144	25%	**738**	**604**	**548**	**563**
Stansted Mountfitchet	TWUL	9,900	144	25%	**2,650**	-	-	**1,782**
Great Chesterford	AWS	3,467	144	25%	**1,284**	**801**	**849**	**624**
Felsted	AWS	6,469	144	25%	**1,630**	**1,328**	**1,598**	**1,164**

FUTURE

	New DWF							Net DWF change
	Increase in Dwellings	Occupancy rate	New P	Total P	G (l/p/day)	I	**New DWF (m3/day) calculated**	m3/day
Saffron Waldon	**880**	2.43	2,138	20,263	144	25%	**3647**	385
Great Dunmow	**1,150**	2.43	2,795	12,234	144	25%	**2202**	503
Takeley	**200**	2.43	486	2,336	144	25%	**420**	87
Great Easton	**60**	2.43	146	3,795	144	25%	**683**	26
Newport	**370**	2.43	899	4,026	144	25%	**725**	162
Stansted Mountfitchet	**490**	2.43	1,191	11,091	144	25%	**1996**	214
Great Chesterford	**100**	2.43	243	3,710	144	25%	**668**	44
Felsted	**43**	2.43	104	6,573	144	25%	**1183**	19

DRY WEATHER FLOW VALUES USED IN THE WCS

		Existing consented DWF used to represent the existing baseline sceanario in the WCS	**Future Post Growth DWF used in the WCS**
		Consented DWF (m3/day)	***New DWF (m3/day) calculated***
Saffron Waldon	AWS	3,700	3647
Great Dunmow	AWS	1,509	2202
Takeley	TWUL	667	420
Great Easton	AWS	874	683
Newport	AWS	738	725
Stansted Mountfitchet	TWUL	2,650	1996
Great Chesterford	AWS	1,284	668
Felsted	AWS	1,630	1183

NOTE:

The WCS uses the existing consented DWF to represent the existing present day situation.

Future flows have been calculated using the population figures provided for each WwTW catchment, plus the predicted future population post growth. The future DWF has not been added onto the consented DWF as this is not considered to represent the existing population served by each WwTW.

Biochemical oxygen demand (BOD) standards for rivers(i)				
Biochemical Oxygen Demand (mg/l)				
Type	**High**	**Good**	**Moderate**	**Poor**
1,2,4,6 and Salmonid	3	4	6	7.5
3,5 and 7	4	5	6.5	9

Ammonia standards for rivers				
Total Ammonia as nitrogen (mg/l)				
Type	**High**	**Good**	**Moderate**	**Poor**
1,2,4,and 6	0.2	0.3	0.75	1.1
3,5 and 7	0.3	0.6	1.1	2.5

Phosphorus standards for rivers				
Reactive Phosphorus standards	*Concentrations as mg/l as annual means*			
Type	**High**	**Good**	**Moderate**	**Poor**
1n	0.03	0.05	0.15	0.5
2n	0.02	0.04	0.15	0.5
3n & 4n	0.05	0.12	0.25	1

Phosphorus standards for rivers BASE DATA NOT USED				
Reactive Phosphorus standards	*Concentrations as ug/l as annual means*			
Type	**High**	**Good**	**Moderate**	**Poor**
1n	30	50	150	500
2n	20	40	150	500
3n & 4n	50	120	250	1000

Based on the worst case wastewater option and the predicted growth, the RQP tool predicts that the new discharges would have the following effect on downstream water quality, assuming the discharge were at the existing monitored physio chemical standards:

			Effect of Existing Consented Flow from WwTW on Downstream Water Quality				***Effect of Future Post-growth Flow from WwTW on Downstream Water Quality***			
			Effect of No Deterioration Targets			**Effect of Good Status**	**Effect of WFD No Deterioration Targets**			**Effect of Good Status**
STW name	**Existing consented DWF (m3/day)**	**Total calculated 2028 DWF (m3/day)**	**BOD** *(90%-ile)*	**Ammonia** *(90%-ile)*	**Phosphate** *(mean)*	**Phosphate** *(mean)*	**BOD** *(90%-ile)*	**Ammonia** *(90%-ile)*	**Phosphate** *(mean)*	**Phosphate** *(mean)*
			mg/l	**mg/l**	**mg/l**	**mg/l**	**mg/l**	**mg/l**	**mg/l**	**mg/l**
Saffron Walden	3,700	3,647	3.79- *High*	0.29- *Good*	0.70- *Moderate*	0.23- *Good*	3.96- *High*	0.28- *High*	0.70- *Moderate*	0.23- *Good*
Great Dunmow	1,509	2,202	1.72- *High*	0.15- *High*	0.88- *Moderate*	0.56- *Moderate*	1.82- *High*	0.17- *High*	1.05- *Poor*	0.75- *Moderate*
Takeley	667	420	5.92- *Good*	1.29- *Poor*	5.85- *Poor*	3.25- *Poor*	5.29- *Good*	*1.14- Poor*	5.84- *Poor*	2.62- *Poor*
Great Easton	874	683	3.31- *High*	0.20- *High*	0.50- *Moderate*	0.50- *Moderate*	3.25- *High*	0.17- *High*	0.42- *Moderate*	0.41- *Moderate*
Newport	738	725	1.91- *High*	0.30- *Good*	0.35- *Moderate*	0.35- *Moderate*	1.91- *High*	0.30- *Good*	0.34- *Moderate*	0.34- *Moderate*
Stansted Mountfitchet	2,650	1,996	4.09- *Good*	0.63- *Good*	5.11- *Poor*	5.11- *Poor*	4.07- *Good*	0.61- *Good*	4.91- *Poor*	4.91- *Poor*
Great Chesterford	1,284	668	2.75- *High*	0.19- *High*	0.91- *Poor*	0.32- *Moderate*	2.81- *High*	0.19- *High*	0.82- *Moderate*	0.21- *Good*
Felsted	1,630	1,183	2.83- *High*	0.19- *High*	1.15- *Poor*	1.15- *Poor*	2.58- *High*	0.16- *High*	0.91- *Moderate*	0.91- *Moderate*

Table E.1 WwTW RQP downstream status results at current fully consented conditions

The RQP tool was used to calculate the indicative consent standards which would be required to ensure no deterioration in status following the full discharge.

STW name	Existing consented DWF (m3/day)	Total calculated 2028 DWF (m3/day)	*Existing Consented Flow*				*Future Post-growth Flow*			
			To Achieve WFD No Deterioration Targets			To Achieve Good Status	To Achieve WFD No Deterioration Targets			To Achieve Good Status
			BOD *(95%-ile)*	Ammonia *(95%-ile)*	Phosphate *(mean)*	Phosphate *(mean)*	BOD *(95%-ile)*	Ammonia *(95%-ile)*	Phosphate *(mean)*	Phosphate *(mean)*
			mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
Saffron Walden	3,700	3,647	11.10	2.18	3.12	0.32[1]	11.19	2.21	3.15	0.33[1]
Great Dunmow	1,509	2,202	30.33	4.15	7.90	0.53[1]	22.42	3.00	5.78	0.41[1]
Takeley	667	420	3.40	0.11[2]	1.76[2]	0.15[1]	2.50	0.35[2]	2.18[2]	0.16[1]
Great Easton	874	683	3.64	4.77	13.17	0.58[1]	3.65	5.96	16.48	0.70[1]
Newport	738	725	26.55	3.07	14.50	1.43[1]	26.99	3.11	14.67	1.46[1]
Stansted Mountfitchet	2,650	1,996	4.00	0.50	0.12	0.12[1]	3.96	0.53	0.13	0.13[1]
Great Chesterford	1,284	668	10.30	3.31	7.05	0.82[1]	15.66	5.85	12.48	1.45[1]
Felsted	1,630	1,183	15.45	2.09	4.89	0.41[1]	18.78	2.68	6.27	0.51[1]

Table E.2 WwTW RQP indicative consent results at fully consented conditions

[1] Assuming upstream improvements to Mid Good status (0.085) have been achieved discharge would have to be **0.12** mg/l SRP to achieve Good status

[2] The downstream target cannot be met without improving the upstream data to Good for phosphate (0.085). Target for ammonia cannot be met without improving the US data to High (0.20)

Additional Assessment Using the Consented Flow as the baseline

STW name	Existing consented DWF (m3/day)	Total calculated 2031 DWF (m3/day)	*Existing Permitted Flow*				*Future Post-growth Flow*			
			To Achieve WFD No Deterioration Targets			To Achieve Good Status	To Achieve WFD No Deterioration Targets			To Achieve Good Status
			BOD *(95%)*	Ammonia *(95%)*	Phosphate *(mean)*	Phosphate *(mean)*	BOD *(95%)*	Ammonia *(95%)*	Phosphate *(mean)*	Phosphate *(mean)*
			mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
Great Dunmow	1,509	2,012	**30.33**	**4.15**	**7.90**	**0.53**	**24.09**	**3.24**	**6.22**	**0.43**
Great Easton	874	900	3.64	4.77	**13.17**	***0.58***	3.52	4.64	**12.84**	***0.50***
Newport	738	900	26.55	3.07	**14.50**	***1.43***	22.30	2.60	**12.11**	***1.15***

DWF Calculations

Great Dunmow

Consented DWF	1,509
Future Calculated DWF	503
Total	**2,012**

Great Easton

Consented DWF	874
Future Calculated DWF	26
Total	**900**

Newport

Consented DWF	738
Future Calculated DWF	162
Total	**900**

Input to RQP Tool

	Existing	Future	
Mean	1886	2515	Great
SD	629	838	Dunmow

Mean	1093	1125	Great
SD	364	375	Easton

Mean	923	1125	
SD	308	375	Newport

WwTW discharge Implications

Effect of Discharges on Downstream Water Quality

Table E1 shows the effect of the existing consented flow and the future post growth flow from the WwTW on water quality downstream i.e. the predicted water quality downstream of the WwTW discharge location.

At **Saffron Walden** the assessment indicates that BOD and Ammonia are high assuming no deterioration targets downstream for both the existing consented flow and post development flow. Assuming no deterioration targets Phosphate is moderate for the existing permitted flow and the post growth flow. Assuming good mid point values upstream and a good downstream target downstream the downstream water quality improves to good for Phosphate.

As the predicted future DWF is lower than the existing consented flow the future growth makes does not result in the WFD objectives being more difficult to achieve than the current permitted situation. However, this highlights the importance of AWS working to improve the concentrations of SRP in the effluent discharges of upstream WwTW.

At **Great Dunmow** the assessment indicates that BOD and Ammonia are High assuming no deterioration targets downstream for both the existing consented flow and post development flow. Assuming no deterioration targets Phosphate is moderate for the existing permitted flow and poor for the post growth flow. Assuming good mid point values upstream and a good downstream target downstream the downstream water quality improves to moderate for Phosphate post growth.

As the predicted future DWF is higher than the existing consented flow the future growth makes does result in the WFD objectives being more difficult to achieve than the current permitted situation. This highlights the importance of AWS working to improve the concentrations of SRP in the effluent discharges of upstream WwTW

At **Takeley** the assessment indicates that BOD is good assuming no deterioration targets downstream for both the existing consented flow and post development flow. Ammonia is poor assuming no deterioration targets downstream for both the existing consented flow and post development flow. Assuming no deterioration targets Phosphate is poor for the existing permitted flow and the post growth flow. Assuming good mid point values upstream and a good downstream target downstream the downstream water quality remains poor for Phosphate.

As the predicted future DWF is lower than the existing consented flow the future growth makes does not result in the WFD objectives being more difficult to achieve than the current permitted situation. However, the results indicate that the WwTW is having a negative impact on downstream water quality as Ammonia and Phosphate results are classified as poor.

At **Great Easton** the assessment indicates that BOD and Ammonia are High assuming no deterioration targets downstream for both the existing consented flow and post development flow. Assuming no deterioration targets Phosphate is moderate for the existing permitted flow and the post growth flow. Assuming good mid point values upstream and a good downstream target downstream the downstream water quality remains moderate for Phosphate.

As the predicted future DWF is lower than the existing consented flow the future growth makes does not result in the WFD objectives being more difficult to achieve than the current permitted situation. However, this highlights the importance of AWS working to improve the concentrations of SRP in the effluent discharges of upstream WwTW to make good status achievable for phosphate.

At **Newport** the assessment indicates that BOD and Ammonia are High assuming no deterioration targets downstream for both the existing consented flow and post development flow. Assuming no deterioration targets Phosphate is moderate for the existing permitted flow and the post growth flow. Assuming good mid point values upstream and a good downstream target downstream the downstream water quality remains moderate for Phosphate.

As the predicted future DWF is lower than the existing consented flow the future growth makes does not result in the WFD objectives being more difficult to achieve than the current permitted situation. However, this highlights the importance of AWS working to improve the concentrations of SRP in the effluent discharges of upstream WwTW to make good status achievable for phosphate.

At **Stansted Mountfitchet** the assessment indicates that BOD and Ammonia are good assuming no deterioration targets downstream for both the existing consented flow and post development flow. Assuming no deterioration targets Phosphate is poor for the existing permitted flow and moderate for the post growth flow. Assuming good mid point values upstream and a good downstream target downstream the downstream water quality improves to moderate for Phosphate under the post development sceanario.

As the predicted future DWF is lower than the existing consented flow the future growth makes does not result in the WFD objectives being more difficult to achieve than the current permitted situation. However, this highlights the importance of AWS working to improve the concentrations of SRP in the effluent discharges of upstream WwTW if good status objectives are to be achieved for Phosphate in the catchment.

At **Great Chesteford** the assessment indicates that BOD and Ammonia are High assuming no deterioration targets downstream for both the existing consented flow and post development flow. Assuming no deterioration targets Phosphate is poor for the existing permitted flow and moderate for the post growth flow. Assuming good mid point values upstream and a good downstream target downstream the downstream water quality improves to good for Phosphate under the post development scenario.

As the predicted future DWF is lower than the existing consented flow the future growth makes does not result in the WFD objectives being more difficult to achieve than the current permitted situation. However, this highlights the importance of AWS working to improve the concentrations of SRP in the effluent discharges of upstream WwTW. Development in the catchment will not prevent good status being achieved for phosphate.

At **Felsted** the assessment indicates that BOD and Ammonia are High assuming no deterioration targets downstream for both the existing consented flow and post development flow. Assuming no deterioration targets Phosphate is poor for the existing permitted flow and moderate for the post growth flow. Assuming good mid point values upstream and a good downstream target downstream the downstream water quality improves to moderate for Phosphate under the post development scenario.

As the predicted future DWF is lower than the existing consented flow the future growth makes does not result in the WFD objectives being more difficult to achieve than the current permitted situation. However, this highlights the importance of AWS working to improve the concentrations of SRP in the effluent discharges of upstream WwTW. Development in the catchment will not results in phosphate moving away from poor status.

In general the results in Table E1 highlights that BOD and Ammonia are at Good or High. However, the results highlight the importance of AWS working to improve the concentrations of SRP in the effluent discharges of upstream WwTW in all of the catchments, and on-going strategies to engage all upstream stakeholders in targeting diffuse pollution.

Given the small difference between the current DWF consent, and the worst case DWF by 2028; the results of the RQP modelling for the increased DWF at all WwTW produce results similar to the current consented condition. It can therefore be concluded that the increase from the proposed growth in the study area **will not** make achieving the requirements of the WFD significantly more difficult than the current consented position.

At Takeley the existing consented flow and future flow post growth are predicted to result in 'Poor' quality downstream of the WwTW for ammonia and phosphate. In addition, the downstream targets for ammonia and phosphate could not be met at Takeley WwTW without improving the upstream conditions. In the RQP calculations the upstream conditions were improved to 0.20 (High) for ammonia and 0.085 (Good) for phosphate. The results indicated that efforts should be focused to improve upstream water quality at Takeley. Drainage of Wastewater to Bishops Stortford via Canfield Pumping station may mitigate this issue but the implications of draining wastewater via Takeley, as set out above, should be considered.

The capacity of the WwTW is a key constraint in Great Dunmow. AWS predict that development could exceed the current process capacity, and could require a new volumetric discharge consent to be negotiated with the EA. In order to address this, AWS are planning to upgrade the process capacity at Great Dunmow WwTW at the end of AMP 5 (2014/15), to accommodate a DWF of 2,200 m^3/day; a 46% increase on the existing DWF consent.

Part of the flow from Great Dunmow is currently being transferred to Felsted WwTW. The population numbers provided by AWS are for the existing population served by Great Dunmow WwTW and do not take into account this transfer.

AWS have advised that the transferred flows vary and the calculations should be based on the consented figures. The WCS has therefore concluded that discharging the future DWF from Great Dunmow WwTW to the River Chelmer could be more constrained by WFD water quality requirements than the current consented position. The level of constraint depends on the timing of future upgrades, the processes to be employed, and the volume of flows that are transferred to Felsted in the future.

Indicative Discharge Consent Standards Required

The calculations show that that SRP concentration required to bring the downstream quality 'up to good status' is within the levels that could be currently achieved by enhanced operation of conventional processes at Great Easton, Newport and Great Chesterford (although, as these WwTW do not currently employ phosphorus stripping methods, significant investment may be required to provide the required processes).

The results presented in Table E2 indicate that the SRP concentration required to bring the downstream quality 'up to good status' is beyond the levels currently generally considered to be reliably economically achievable using conventional technology at Saffron Walden, Great Dunmow, Takeley and Stansted Mountfitchet.

Given the small difference between the current DWF consent, and the worst case DWF by 2028; the results of the RQP modelling for the increased DWF at all WwTW produce results similar to the current consented condition. It can therefore be concluded that the increase from the proposed growth in the study area **will not** make achieving the requirements of the WFD significantly more difficult than the current consented position.

At Takeley the existing consented flow and future flow post growth are predicted to result in 'Poor' quality downstream of the WwTW for ammonia and phosphate. In addition, the

downstream targets for ammonia and phosphate could not be met at Takeley WwTW without improving the upstream conditions. In the RQP calculations the upstream conditions were improved to 0.20 (High) for ammonia and 0.085 (Good) for phosphate. The results indicated that efforts should be focused to improve upstream water quality at Takeley. Drainage of Wastewater to Bishops Stortford via Canfield Pumping station may mitigate this issue but the implications of draining wastewater via Takeley, as set out above, should be considered.

The capacity of the WwTW is a key constraint in Great Dunmow. AWS predict that development could exceed the current process capacity, and could require a new volumetric discharge consent to be negotiated with the EA. In order to address this, AWS are planning to upgrade the process capacity at Great Dunmow WwTW at the end of AMP 5 (2014/15), to accommodate a DWF of 2,200 m^3/day; a 46% increase on the existing DWF consent.

Part of the flow from Great Dunmow is currently being transferred to Felsted WwTW. The population numbers provided by AWS are for the existing population served by Great Dunmow WwTW and do not take into account this transfer.

AWS have advised that the transferred flows vary and the calculations should be based on the consented figures. The WCS has therefore concluded that discharging the future DWF from Great Dunmow WwTW to the River Chelmer could be more constrained by WFD water quality requirements than the current consented position. The level of constraint depends on the timing of future upgrades, the processes to be employed, and the volume of flows that are transferred to Felsted in the future.

Appendix F

Grey water & Rainwater Harvesting Techniques

Domestic level rainwater harvesting

Domestic level RWH would involve the installation of a rainwater tank for each property (preferably at basement level or buried in the garden) to collect filtered rainwater from the roof drainage.

It is anticipated that the filtration would be in two stages; a 'first flush' system on the guttering downpipe to exclude any debris which may accumulate during a dry period, followed by a filter with a maximum particle size of < 1.25 mm prior to the inlet to the tank. BSI 8515:2009 states that such a filter provides suitable quality for toilet flushing and laundry in most residential situations.

This filtered and settled rainwater is then pumped from the tank back into the house for use in the toilet and washing machine; hence requiring the inlets of these fittings to be connected to internal non-potable plumbing, separate to other potable water plumbing in the house.

High level design using the 'intermediate approach' from BSI 8515:2009, assuming an occupancy rate of 2.43, implies a tank size of approximately 1,600 l. For costing purposes, a domestic RWH system of this specification has been assumed to have a provision and install cost of approximately £2,000 per house, assuming a mass discount for the developer broadly in line with EA estimates[i].

The UK Climate Projections (2009)[ii] medium emissions scenario predicts that by 2050, the decrease in summer rainfall in the study area is unlikely to be less than 30%. Based on historic data from the gauging station at Arkesden, this would result in average total rainfall for June, July and August decreasing from 228 mm to 160 mm.

It is estimated that a 3,000 l tank would therefore be required for each house to ensure that potable water from the mains is not required to augment non-potable supplies from RWH in the future. The WCS has assumed a cost of £2,500 for such a system, i.e. £8M for all the allocated and additional properties in the study area.

The treatment of rainwater, greywater or black water to potable standards, at a domestic level, has not been considered due to the current public health and regulatory concerns associated with this.

District level rainwater harvesting (potable/ non-potable)

An alternative option for capturing and using local water resources would be the collection of rainwater via a separate drainage network, treatment at a local centre, and then return via a dedicated network if non-potable (or integration with the incoming potable supply to the area).

Centralised treatment and distribution allows better management of technical risks and future process upgrades than domestic level systems, and eradicates the risk that homeowners may let their domestic systems deteriorate, until the failsafe connection of potable water replaces any non-potable supply from their RWH. However, centralised treatment lacks the educational and behavioural change benefits of domestic level RWH, as the association between local rainfall and household water use is less clear to occupants.

There would be a favourable comparison between the potential yield of rainwater from roofs if harvested at the domestic level, and the non-potable demand within the new efficient homes. This roof drainage could be conveyed to a neighbourhood treatment works near the proposed sites, but this would then require pumping for both collection, and then subsequent resupply. Given that the proposed sites within each settlement are often separated by existing properties, this may only be economically viable for large individual sites.

To ensure a reliable supply, and protect against any pollution which may jeopardise the treatment process, a separate piped network would be needed to convey the rainwater from the roofs, reducing the opportunity for integrating SuDS throughout the developments, and the associated water quality and biodiversity benefits. If such an option were proposed, opportunities should be explored to use any surplus rainwater collected to supply local agricultural users, and educational initiatives/ projects within the study area.

Domestic level greywater recycling

Domestic level GWR would involve the installation of a self-contained storage and treatment unit for each property. This system would collect and treat water drained from showers, baths and wash/ hand basins, and then pump this supply of non-potable water for use in toilets and washing machines.

Greywater must be collected separately to wastewater from the toilets or kitchen sink (high levels of grease and food particles make this unsuitable for local recycling). As with RWH, the GWR must be returned to the toilet and washing machine via non-potable plumbing, separate to other potable water plumbing in the house.

The higher biological content of greywater as opposed to rainwater means that long term storage should be avoided, to reduce the risk of bacterial growth. It is assumed that a GWR unit would be sized to treat and store a volume of water equivalent to the daily non-potable demand, and a separate header tank would not be used (the unit would store the required volume to allow better control of quality). Any additional greywater collected would overflow to the conventional wastewater sewers serving the house.

Package systems exist for the domestic markets which utilise a combination of filtration, chemical/ UV disinfection or biological processes to achieve the required treatment.

The EA estimate[iii] that a package MBR GWR system unit would typically cost £3,000 to supply and install i.e. £10M for all the allocated and additional properties in the study area. Developer discounts for mass purchases may not be as apparent as for RWH systems, due to the integrated nature of package systems, more specialised installation, and the smaller marketplace for components.

In addition, the treatment used in GWR systems can be susceptible to shock changes in chemical and biological loading from changes in user behaviour. BS8525-1:2010 gives the example of wash basins in the bathroom being used for hair colouring, or disinfection of cotton nappies, as potential problems if treatment processes are not sufficiently robust. It can therefore be concluded that domestic GWR is more sensitive than domestic RWH in terms of the behavioural changes demanded from occupiers.

Domestic GWR for non-potable use reduces the volume of wastewater received at the WwTW, by around 31 l/p/d, which theoretically allows more properties to be served within the same hydraulic capacity and volumetric discharge consent. However, the wastewater received by the WwTW will be proportionately stronger, as it will be less diluted. The WwTW process will still have to remove the same mass of pollutants to achieve the consent standards (as per Section 10), so savings in terms of process energy are negligible.

District level greywater recycling (potable/ non-potable)

As with District level RWH, this potential solution offers the benefit of centralised control of treatment and redistribution, but incurs the additional costs of providing a separate collection network (and a separate resupply network if only non-potable use is proposed).

Whilst theoretically this option allows more properties to be connected to a WwTW within a given hydraulic capacity and volumetric discharge consent; the same concerns apply as above. A future change in the consenting philosophy of the EA would be required to allow any real advantage, in terms of the numbers of properties which could be accommodated by such a system.

As discussed in above, 67 l/p/d of greywater may be available from the new dwellings. Assuming 90% efficiency in collection, treatment and resupply equates to a possible resource of 60 l/p/d. This exceeds the projected non-potable demand in the proposed houses by 100%; hence there would be no requirement for approximately half of the water collected. Additional separate greywater and distribution networks (with pumping) would be required to collect the greywater and redistribute the non-potable water; with no discernible benefit in water savings versus a domestic GWR system.

Therefore, greywater must be treated and returned as potable water to show any improvement in water efficiency over the domestic RWH or GWR options. This would likely require the installation of an MBR followed by chemical disinfection, and would be unlikely to be economically viable at present on all but the largest of proposed sites.

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[i] Environment Agency, *Assessing the cost of compliance with the code for sustainable homes,* 2007

[ii] Department for Environment Food and Rural Affairs, *UK Climate Projections , East of England - Summer Precipitation – Medium emissions map*, 2009

[iii] Environment Agency, *Greywater for domestic users: an information guide,* 2011

BRE Tool Sensitivity Test

Due to the nature of available plans for the proposed development areas within Uttlesford it has not been possible to measure roof areas to inform the water efficiency calculations. Therefore, an average roof area of 70m² has been used in the calculations, the roof area is based on a typical 3 bedroom Barrett Homes house.

The plans were detailed enough at the villages of Little Canfied and Great Chesterford to calculate the plan roof areas. The average roof size for Little Canfied was 66m² and the average size for Great Chesterford was 51m². However, it is considered that the value of 70m² is suitable for the use in the assessment and a series of sensitivity calculations have been undertaken to test the parameters of the BRE tool.

Roof Area

The below calculations show the variation in daily rainwater collection for different sizes of roof.

- 60m² = 77 litres
- 70m² = 89 litres
- 80m² = 102 litres

The test shows that an increase/decrease in area of 10 m² results in a **difference of about 12 litres.** The test shows that an increase/decrease in area of 20 m² results in a **difference of about 25 litres.**

Rainfall

Inputting different rainfall parameters but leaving all other parameters the same (*collection area 70m², yield coefficient 0.80 and filter efficiency 0.90*).

- 547 mm/yr = 75 litres
- 647 mm/yr = 89 litres (actual data from Arkesden gauge)
- 747mm/yr = 103 litres

The test shows that an increase/decrease in rainfall of 100mm results in a **difference of about 13 litres.** The test shows that an increase/decrease in rainfall of 200mm results in a **difference of about 28 litres.**

Coefficients

Final check was to test the yield coefficient (the loss of volume from rainfall through to stored run-off from wetting of the surface), by keeping all other parameters the same (*collection area 70m², rainfall 647mm and filter efficiency 0.90*) and altering the yield coefficient to 0.7 resulted in the daily rainwater collection reducing to 78 litres (**difference of 11 litres** when compared to using a yield coefficient of 0.8).

Conclusion

All of the parameters used in the BRE water efficiency calculator seem equally sensitive to changes. Due to the relative uncertainty in the other parameters and due to the unavailability of detailed plans at this stage there is sufficient justification for using an average roof area of 70m².