# South Essex Outline Water Cycle Study
# **Technical Report**

Final
September 2011




Prepared for:

Basildon Council
BASILDON · BILLERICAY · WICKFORD

castlepoint
benfleet | canvey | hadleigh | thundersley

Rochford District Council

Essex County Council

# Revision Schedule

**South Essex Water Cycle Study**
September 2011

| Rev | Date | Details | Prepared by | Reviewed by | Approved by |
|---|---|---|---|---|---|
| 01 | April 2011 | D132233: S. Essex Outline WCS – First Draft_v1 | **Clare Postlethwaite** Senior Consultant | **Carl Pelling** Principal Consultant | **Carl Pelling** Principal Consultant |
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# Acronyms and Abbreviations

| Abbreviation | Description |
|---|---|
| AMP | Asset Management Plan |
| ASR | Areas of Special Reserve |
| ASTSWF | Areas Susceptible to Surface Water Flooding |
| AWS | Anglian Water Services |
| BBC | Basildon Borough Council |
| BGS | British Geological Society |
| BOD | Biochemical Oxygen Demand |
| CAMS | Catchment Abstraction Management Strategy |
| CBA | Cost Benefit Analysis |
| CDA | Critical Drainage Area |
| CFMP | Catchment Flood Management Plan |
| CPBC | Castle Point Borough Council |
| CSH | Code for Sustainable Homes |
| CLG | Communities and Local Government |
| DEFRA | Department for Environment, Food and Rural Affairs |
| DG5 | Water company's register of properties/areas affected by sewer flooding |
| DO | Dissolved Oxygen |
| DWF | Dry Weather Flow |
| DWI | Drinking Water Inspectorate |
| EEP | East of England Plan (the RSS for the East of England) |
| ESW | Essex and Suffolk Water |
| FEH | Flood Estimation Handbook |
| FFT | Flow to Full Treatment |
| GWMU | Groundwater Management Unit |
| HA | Highways Agency |
| HMWB | Heavily Modified Water Body (under the Water Framework Directive) |
| l/h/d | Litres/head/day (a water consumption measurement) |
| LDDs | Local Development Documents |
| LDF | Local Development Framework |
| LLFA | Lead Local Flood Authority |
| LoWS | Local Wildlife Site |
| LPA | Local Planning Authority |
| Mld | Mega Litre (a million litres) |
| NE | Natural England |
| $NH_4$ | Ammonia |
| NRA | National Rivers Authority |
| NWA | No Water Available (in relation to CAMS) |

| Abbreviation | Description |
|---|---|
| OFWAT | The Office of Water Services |
| O-A | Over Abstracted (in relation to CAMS) |
| O-L | Over Licensed (in relation to CAMS) |
| P | Phosphorous |
| PE | Population Equivalent |
| PPS | Planning Policy Statement |
| PR | Periodic Review |
| RBD | River Basin District |
| RBMP | River Basin Management Plan |
| RDC | Rochford District Council |
| RQP | River Quality Planning |
| RSS | Regional Spatial Strategy (East of England Plan) |
| SAC | Special Area for Conservation |
| SFRA | Strategic Flood Risk Assessment |
| SHLAA | Strategic Housing Land Availability Assessment |
| SPA | Special Protection Area |
| SPD | Supplementary Planning Document |
| SPZ | Source Protection Zone |
| SS | Suspended Solids |
| SSSI | Site of Special Scientific Interest |
| SUDS | Sustainable Drainage Systems |
| TSS | Total Suspended Solids |
| UKTAG | United Kingdom Technical Advisory Group (to the WFD) |
| UWWTD | Urban Wastewater Treatment Directive |
| WCS | Water Cycle Study |
| WFD | Water Framework Directive |
| WRMP | Water Resource Management Plan |
| WRMU | Water Resource Management Unit (in relation to CAMS) |
| WRZ | Water Resource Zone (in relation to a water company's WRMP) |
| WwTW | Waste Water Treatment Works |

# Executive Summary

The administrative areas of Basildon Borough Council (BBC), Castle Point Borough Council (CPDC) and Rochford District Council (RDC) are planning for an increase in housing and employment provision over the period until 2031. This growth represents a challenge to all three areas in ensuring that both the water environment and water services infrastructure have the capacity to sustain this level of proposed growth and development. The aim of the South Essex Outline Water Cycle Study (WCS) is to identify any key constraints on housing and employment growth planned for the study area up to 2031 that may be imposed by the water cycle and how these can be resolved i.e. by ensuring that appropriate water infrastructure is provided to support the proposed development.

The Outline WCS assessed the impacts of the proposed growth levels within the three council areas on the key water cycle elements of: wastewater treatment and transmission, water resources, flood risk and sustainable drainage systems (SuDS), and ecology.

The assessment of wastewater transfer and treatment capacity identified that Wickford, Basildon and Southend-on-Sea have no capacity to accept and treat additional flows. Canvey Island, Benfleet, Rayleigh West, Rochford and Shenfield and Hutton have adequate capacity to accept and treat the additional flows from the proposed level of growth. Billericay has within the existing discharge consent capacity for the level of growth proposed, but growth above the levels proposed which may require increases to consented volumes would not be possible without compromising downstream water quality. The level of growth within the catchments of Rayleigh east and Pitsea wastewater treatment works was not known for the purposes of this study, but it is felt that the capacity available should be adequate for the levels of growth likely within the area. The assessment of the ecological impacts of the increased wastewater discharges from the proposed growth concluded that there would be no adverse effects on designated conservation sites.

Essex and Suffolk Water is responsible for supplying potable water to the study area. The company's Water Resource Management Plan concluded that the future water resources needs of the area will be met by the implementation of the Abberton Reservoir scheme in 2014. The Appropriate Assessment of the Abberton scheme concluded that there would be no adverse effect on designated conservation sites from the Abberton scheme, and the same can therefore be concluded for the increased water resource demands of the proposed growth.

In order to meet the requirements of PPS25, the 2006 TGSE SFRA was updated by Scott Wilson in 2010 and 2011. The mapping for this is extensive and it has therefore not been included within this WCS; instead reference should be made to the SFRA. In addition to the SFRAs, for an overview of flood risk to the study area, reference should be made to the Surface Water Management Plan, which Scott Wilson were appointed to carry out in 2010, in conjunction with this Outline WCS.

Opportunities for providing SuDS for the proposed developments are limited by the largely impermeable geology underlying the majority of the study area; new development within Castle Point and Basildon should provide attenuation of surface water run-off, although infiltration may be possible in some areas of Rochford. Outline calculations have been provided of the sizes of SuDS required, although these should be re-assessed on a site by site basis once the details of the proposed developments are know.

A summary of the constraints and infrastructure upgrades or mitigation measures required for each of the proposed development areas has been provided. This indicates that while some of the proposed development areas could not support the levels of growth proposed at the current time, with the provision of additional infrastructure it may be possible to support the new

development. However, funding and regulatory approval could delay this provision, which must be taken into account when planning new development. Only one of the proposed development areas, Basildon Area 21 has an absolute constraint to development, as the area is located within Flood Zone 3, in which residential development would not be considered appropriate under PPS25. Development within Star Lane Great Wakering, West Great Wakering, Hadleigh and Thundersley would be restricted by the capacity issues within Southend-on-Sea WwTW and network. This is the subject of a separate Detailed WCS, due for delivery in late 2011, and development within these areas will therefore be subject to the recommendations of the Southend Detailed WCS.

# 1 Introduction

## 1.1 Growth in South Essex

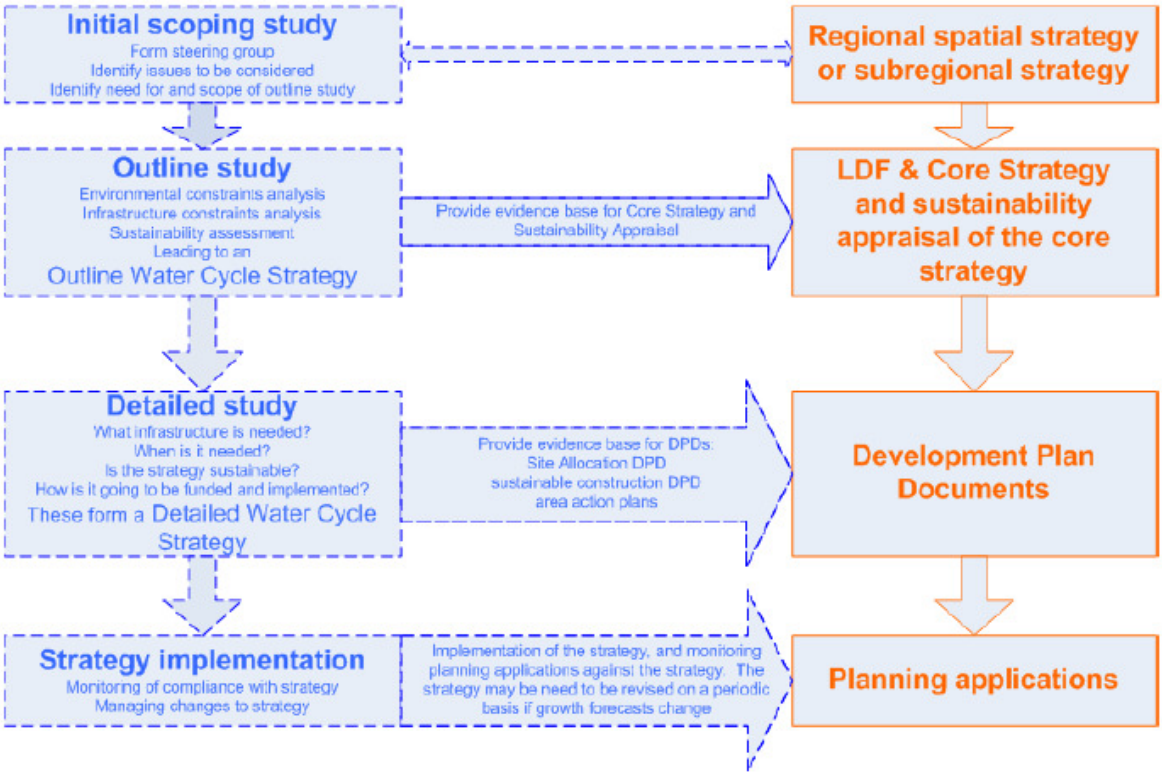
The administrative areas of Basildon Borough Council (BBC), Castle Point Borough Council (CPDC) and Rochford District Council (RDC) are planning for an increase in housing and employment provision over the period until 2031. This growth represents a challenge to all three areas in ensuring that both the water environment and water services infrastructure have the capacity to sustain this level of proposed growth and development.

It is therefore key that the South Essex Outline Water Cycle Study (WCS) identifies any key constraints on housing and employment growth planned for the study area up to 2031 that may be imposed by the water cycle and how these can be resolved i.e. by ensuring that appropriate water infrastructure is provided to support the proposed development. Furthermore, it should provide a strategic approach to the management and use of water, which ensures that the sustainability of the water environment in the region is not compromised.

## 1.2 Study History

The South Essex WCS is being undertaken in stages, as recommended by the Environment Agency Guidance for WCS[1]. The WCS stages are shown in Figure 1-1 below.

**Figure 1-1: Water Cycle Study stages**




The Thames Gateway South Essex (TGSE) Scoping Study[2] was produced by Scott Wilson in March 2009, on behalf of Basildon Borough Council, Castle Point Borough Council, Rochford

[1] Environment Agency (2009), Water Cycle Study Guidance
[2] Thames Gateway South Essex (TGSE) Scoping Water Cycle Study, Scott Wilson 2009, http://www.basildon.gov.uk/CHttpHandler.ashx?id=2232&p=0

District Council, Southend-on-Sea Borough Council and Essex County Council. Following the publication of the Scoping Study, Southend-on-Sea Council moved directly to a Detailed WCS given that its Core Strategy had already been adopted.

This report represents the Outline WCS, commissioned by the remaining Authorities, and follows on from the TGSE Scoping Study.

## 1.3 TGSE Scoping WCS 2009

The Scoping WCS described the existing condition in the Essex Thames Gateway area and established the requirements of the Outline stage of the WCS. The Scoping WCS identified the following key water cycle areas which required further assessment.

### 1.3.1 Water Resources & Supply

The study area does not have sufficient raw water resources to supply existing development. As a result, the area is reliant on transfer of raw and treated water to the area from the Thames Region and from Norfolk and Suffolk. This means that there is limited water available for further abstraction from local surface or groundwater sources and therefore further transfer of water resources will be required to supply water to new developments.

Future water demand is expected to be met through the proposed increase in storage at Abberton Reservoir and the commensurate increase in abstraction and transfer from the Ely-Ouse transfer scheme, which if approved will come online in 2014. Until the scheme is in place and operational, there will be a deficit in available water resources during drought years.

There are no immediate limitations on supply infrastructure pipelines, reservoirs, water treatment works or pumping stations. The next stage of the WCS will need to confirm this relative to the location of development options.

### 1.3.2 Wastewater Treatment, Collection and Water Quality

For the majority of Wastewater Treatment Works (WwTWs) within the study area, there is sufficient treatment and transmission capacity to allow planned development in the study area up to 2015. Development beyond this in most cases will require upgrades to the treatment capacity of several of the WwTW and the construction of new strategic sewer mains to service new development.

The water quality of watercourses in the Essex Thames Gateway varies from good to poor. As well as wastewater discharges, runoff from development will need to be managed to ensure that increases in developed land does not lead to an increase in urban pollution and further impacts on water quality.

### 1.3.3 Ecology

The Ecological and Biodiversity assessment identified water dependent ecological sites both within and hydraulically linked to the South Essex Authorities of Castle Point, Rochford and Basildon. It then scoped whether any of these sites could be affected by either:

- abstraction for the Public Water Supply required for the proposed development within the study area; or
- wastewater discharges associated with the proposed development.

The Scoping Study identified that there is unlikely to be any increase in existing abstractions from surface or groundwater sources and as such it is possible to screen out impacts to the

sites within the study area as a result of water resources, but discharges of wastewater still have the potential to impact on these sites.

Sixteen European sites outside of the study area are considered to have the potential to be impacted by increased water demand up to and post 2014. The sites associated with the Abberton abstraction and transfer scheme will continue to be affected by development in the study area.

## 1.4 Study Contributors

### 1.4.1 Working Group

This Outline Study has been carried out with the guidance of the Working Group, comprising the following organisations:

- Basildon Borough Council (BBC);
- Castle Point Borough Council (CPDC);
- Rochford District Council (RDC);
- Essex County Council (ECC);
- Anglian Water Services Ltd (AWS);
- Essex and Suffolk Water (ESW);
- Natural England; and
- the Environment Agency.

### 1.4.2 Other Consultees

The various consultees, including the Working Group, were arranged into five levels, to reflect the level of input and consultation required into the WCS. The tiers were defined as shown below in Table 1-1.

**Table 1-1: Consultee groupings**

| Stakeholders | Definitions |
|---|---|
| Client Group:<br>(Basildon Borough Council<br>Castle Point Borough Council<br>Rochford District Council<br>Essex County Council) | Budget and scope setters, key decision makers |
| Client Group<br>Technical Advisory Group:<br>(Environment Agency<br>Anglian Water<br>Essex and Suffolk Water<br>Natural England<br>Essex Resilience Forum) | Essential data providers, project contributors or sign off essential to sign up to findings of the study and finalise reports |
| Neighbouring authorities (Thurrock Council, Southend on Sea Borough Council)<br>Highways Agency<br>Emergency Planning<br>Developers<br>Key Land Owners | Data (and information) contribution required, need to be aware of study findings to inform own planning work and studies and to be able to raise issues (during study production) that might influence the WCS direction/findings |

| Stakeholders | Definitions |
|---|---|
| Parish Councils<br>Essex Wildlife Trust<br>RSPB<br>Local wildlife groups<br>Wider Public | Need to be informed of study findings through targeted communication. It is anticipated that this will be carried out in conjunction with public events for the South Essex SWMP. |

## 1.5 Aims and Objectives

The overall aim of the study is to identify a clear programme of required water services infrastructure and its implementation to support the delivery of sustainable growth up to 2031. The Outline WCS tests the impact of the proposed development on the water cycle, defines the existing baseline capacity for growth without the need for new infrastructure and determines where new infrastructure or further investigation is required to overcome constraints that may limit the required growth levels in the study area as a result of new water services infrastructure.

The objectives of the Outline WCS are to:

I. define the existing capacity of the water environment and infrastructure and hence define how much development could be implemented without significant new investment;

II. outline where there are key 'water' constraints to further development for each potential allocation (or group of allocations);

III. produce a short list of strategic level infrastructure or mitigation options that would be required to facilitate development beyond the defined 'capacity' and when approximately this would need to be in place (a timeline of infrastructure delivery) i.e. flood defence works or when a wastewater treatment works may need to be expanded, for consideration in the Detailed Study (where one is required);

IV. determine whether any ecologically sensitive sites would be impacted by development, what the most likely causes of impact are and whether there are any actions which could mitigate impact;

V. determine what measures need to be implemented to be compliant with the Code for Sustainable Homes Level 4 requirement for water consumption (105 litres per person per day); and

VI. produce a summary assessment of which of the potential scenarios for different growth levels is least constrained and will have the least impact on the water cycle.

## 1.6 Study Area

The administrative areas of Basildon, Castle Point and Rochford are shown in Figure 1-2 below. Whilst the geographic scope of the Outline Study is limited to growth within the three authorities, the wider area will also be considered where it has the capacity to impact on growth within the study area. In addition, where the catchment of a WwTW extends to neighbouring authorities' area, all growth within the assessment will be assessed in relation with that particular WwTW. This will ensure that the WCS does not falsely report capacity within a WwTW, which could be taken up by development and growth outside of the study area. This will apply to the following WwTW:

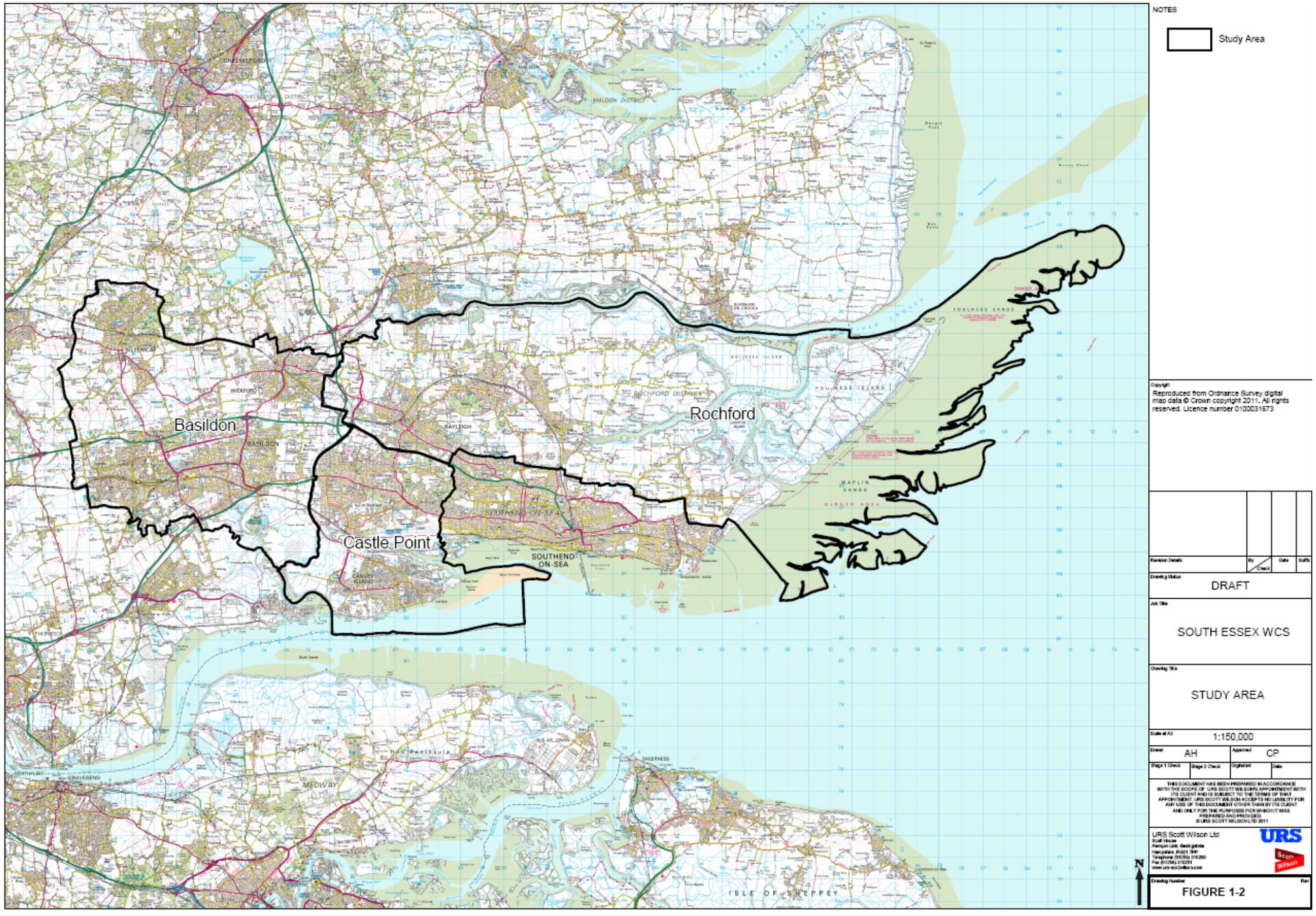
- Wickford WwTW;
- Billericay WwTW;

- Shenfield & Hutton WwTW;
- Southend WwTW; and
- Rochford WwTW.

Other large towns and settlements outside of the study area will also be considered, even if they do not directly impact on one of the WwTW being assessed. This is because some of the watercourses within the study area receive wastewater flow from outside of the catchment (e.g. The Thames and The Crouch).

Within the study area, Anglian Water Services (AWS) provide wastewater treatment and drinking water is supplied by Essex and Suffolk Water (ESW).

**Figure 1-2: Study area**



# 2 Policy and Supporting Information

National, regional, sub-regional and local planning policy and guidance documents provide both requirements and guidance for delivering sustainable development. The following is a summary of the main legislative, policy and guidance drivers which have informed and shaped the development of this WCS and its deliverables, and have been considered at all stages in the WCS process.

## 2.1 Legislation and Policy

### 2.1.1 International and National

**Table 2-1: Water Related European and National Legislation, Policy and Guidance**

| Directive/Legislation/ Guidance | Description |
|---|---|
| Code for Sustainable Homes | The Code for Sustainable Homes has been introduced to drive a step-change in sustainable home building practice, providing a standard for key elements of design and construction which affect the sustainability of a new home. It will become the single national standard for sustainable homes, used by home designers and builders as a guide to development and by home-buyers to assist their choice of home.<br>It will form the basis for future developments of the Building Regulations in relation to carbon emissions from, and energy use in homes, therefore offering greater regulatory certainty to developers. The Code sets out a minimum water demand per person as a requirement for different code levels. CLG is currently in consultation on proposals to make certain code levels mandatory for all new homes. At present, only affordable homes must reach a certain code. |
| Environment Act 1995 | Sets out the role and responsibility of the Environment Agency. |
| Environmental Protection Act 1990 | Integrated Pollution Control (IPC) system for emissions to air, land and water. |
| Future Water, February 2008 | Sets the Government's vision for water in England to 2030. The strategy sets out an integrated approach to the sustainable management of all aspects of the water cycle, from rainfall and drainage, through to treatment and discharge, focusing on practical ways to achieve the vision to ensure sustainable use of water. The aim is to ensure sustainable delivery of water supplies, and help improve the water environment for future generations. |
| Groundwater Directive 80/68/EEC | To protect groundwater against pollution by 'List 1 and 2' Dangerous Substances. |
| Habitats Directive 92/44/EEC | To conserve the natural habitats and to conserve wild fauna and flora with the main aim to promote the maintenance of biodiversity taking account of social, economic, cultural and regional requirements. In relation to abstractions and discharges, the Directive can require changes to these through the Review of Consents (RoC) process if they are impacting on designated European Sites. In addition, the key requirement of the Directive is the need (or a screening exercise to determine the need) for an Appropriate Assessment of any new plan or permit. |
| Making Space for Water, 2004 | Outlines the Government's strategy for the next 20 years to implement a more holistic approach to managing flood and coastal erosion risks in England. The policy aims to reduce the threat of flooding to people and property, and to deliver the greatest environmental, social and economic benefit. |
| Planning Policy Statements and Planning Policy Guidance | Planning policy in the UK is set by Planning Policy Statements (PPSs) and Planning Policy Guidance (PPGs). They explain statutory guidelines and advise local authorities and others on planning policy and operation of the planning system.<br>PPSs also explain the relationship between planning policies and other policies |

| Directive/Legislation/ Guidance | Description |
|---|---|
| | which have an important bearing on issues of development and land use. These must be taken into account in preparing development plans.<br>A WCS helps to balance the requirements of various planning policy documents, and ensure that land-use planning and water cycle infrastructure provision is sustainable.<br>The most relevant PPSs to WCS are:<br>• PPS1 – Delivering Sustainable Development;<br>• PPS3 – Housing;<br>• PPS4 – Planning for Sustainable Economic Growth<br>• PPS9 – Biodiversity and Geological Conservation<br>• PPS12 – Local Development Frameworks;<br>• PPS23 – Planning and Pollution control; and<br>• PPS25 – Development and Flood Risk. |
| National Planning Framework | Current planning policy for planning and the environment is set out in PPS and PPGs. The Government has committed to publish and present to Parliament a simple and consolidated national planning framework covering all forms of development and setting out national economic, environmental and social priorities. The new National Planning Framework draft version is now out for consultation on the DCLG website and it id due to be published by April 2012. |
| Pollution Prevention and Control Act (PPCA) 1999 | Implements the IPPC Directive. Replaces IPC with a Pollution Prevention and Control (PPC) system, which is similar but applies to a wider range of installations. |
| Water Act 2003 | Implements changes to the water abstraction management system and to regulatory arrangements to make water use more sustainable. |
| Water Framework Directive (WFD) 2000/60/EC | The WFD was passed into UK law in 2003. The overall requirement of the directive is that all river basins must achieve 'Good ecological status' by 2015, or by 2027 if there are grounds for derogation. The WFD, for the first time, combines water quantity and water quality issues together. An integrated approach to the management of all freshwater bodies, groundwaters, estuaries and coastal waters at the river basin level has been adopted. It effectively supersedes all water related legislation which drives the existing licensing and consenting framework in the UK.<br><br>The Environment Agency is the body responsible for the implementation of the WFD in the UK. The Environment Agency have been supported by UKTAG[3], an advisory body which has proposed water quality, ecology, water abstraction and river flow standards to be adopted in order to ensure that water bodies in the UK (including groundwater) meet the required status[4]. These have recently been finalised and issued within the River Basin Management Plans (RBMP). |
| Bathing Waters Directive 76/160/EEC | To protect the health of bathers and maintain the aesthetic quality of inland and coastal bathing waters. Sets standards for variables and includes requirements for monitoring and control measures to comply with standards for bacterial levels within designated bathing waters. |
| Shellfish Waters Directive | To protect or improve shellfish waters in order to support shellfish life and growth, thereby contributing to the high quality of shellfish products directly edible by man. Sets physical, chemical and microbiological water quality requirements that designated shellfish waters must either comply with ('mandatory' standards) or endeavour to meet ('guideline' standards). |
| Water Resources Act 1991 | Protection of the quantity and quality of water resources and aquatic habitats. Parts have been amended by the Water Act 2003. |

[3] The UKTAG (UK Technical Advisory Group) is a working group of experts drawn from environment and conservation agencies. It was formed to provide technical advice to the UK's government administrations and its own member agencies. The UKTAG also includes representatives from the Republic of Ireland.
[4] UK Environmental Standards and Conditions (Phase I) Final Report, April 2008, UK Technical Advisory Group on the Water Framework Directive

| Directive/Legislation/ Guidance | Description |
|---|---|
| Flood & Water Management Act 2010 | The Flood and Water Management Act 2010 is the outcome of a thorough review of the responsibilities of regulators, local authorities, water companies and other stakeholders in the management of flood risk and the water industry in the UK. The Pitt Review of the 2007 flood was a major driver in the forming of the legislation. Its key features relevant to this WCS are:<br>• To give the Environment Agency an overview of all flood and coastal erosion risk management and unitary and county councils the lead in managing the risk of all local floods.<br>• To encourage the uptake of sustainable drainage systems by removing the automatic right to connect to sewers and providing for unitary and county councils to adopt SUDS for new developments and redevelopments.<br>• To widen the list of uses of water that water companies can control during periods of water shortage, and enable Government to add to and remove uses from the list.<br>• To enable water and sewerage companies to operate concessionary schemes for community groups on surface water drainage charges.<br>• To make it easier for water and sewerage companies to develop and implement social tariffs where companies consider there is a good cause to do so, and in light of guidance that will be issued by the SoS following a full public consultation. |

**River Basin Management Plans**

Implementation of the WFD is carried out through a process of River Basin Management Planning, which is coordinated by the Environment Agency. Plans are developed for each waterbody within a River Basin. The first draft River Basin Management Plans (RBMP) for England and Wales were published by the Environment Agency in December 2008 and finalised in 2010. Basildon, Castle Point and Rochford lie within the Anglian River Basin District (RBD) although the tidal Thames lies within the Thames RBD[5]. The Anglian RBMP[6] identifies the following key issues for water quality in the study area:

- point source pollution from WwTW treatment works;
- the physical modification of water bodies;
- diffuse pollution from agricultural activities;
- water abstraction; and
- diffuse pollution from urban sources.

In the Anglian RBD, 18 per cent of surface waters meet Good status or better; 82 per cent do not meet Good status (681 water bodies). 65 per cent of groundwater bodies are at Good status with the rest being Poor status. The majority of surface water bodies that fail to meet good status fail because of the phosphate, fish and invertebrate elements of classification. The implications of these classifications for the watercourses within the study area are discussed further in sections 4.5 and 5.6.

[5] http://publications.environment-agency.gov.uk/pdf/GETH0910BSWA-E-E.pdf
[6] http://wfdconsultation.environment-agency.gov.uk/wfdcms/en/humber/Intro.asp

### 2.1.2 Regional Planning Issues

**Regional Spatial Strategy for the East of England (to be revoked)[7]**

The RSS for the East of England was published in May 2008 and set targets to guide the scale and location of growth within Basildon, Castle Point and Rochford up to 2021. It should be noted that as of the 6th July 2010, the Secretary of State for Communities and Local Government announced the Government's intention to revoke Regional Strategies with immediate effect[8]. Regional Strategies were to be revoked under s79(6) of the Local Democracy Economic Development and Construction Act 2009 and will thus would no longer form part of the development plan for the purposes of s38(6) of the Planning and Compulsory Purchase Act 2004.

However, a legal challenge to the abolition was brought in November 2010 by a developer (Cala Homes), which was upheld by the High Court. The Court's ruling effectively reversed the Secretary of State's decision to abolish the RSS, although it should be noted that this is only a short term reversal, as the government announced in 2010 its intention to continue with the formal abolition via new legislation laid before Parliament in 2011.

The 'Decentralisation and Localism Bill', proposed to devolve greater power to local government over housing and planning decisions. However, in the absence of a replacement for the RSS, the previous housing figures will be used for the purposes of this study for the South Essex area, alongside any others the LPAs may wish to test as part of growth scenario planning.

### 2.1.3 Local Planning Issues

**Local Development Frameworks**

***Basildon Borough Council***

BBC's Local Development Scheme (LDS) is to be revised in 2011 to accelerate the programme for the preparation and adoption of the LDF Core Strategy. The Council anticipates that it will publish its Preferred Options Report in winter 2011/ spring 2012, followed by a Submission Report submitted to the Planning Inspectorate & Government later in 2012. The LDS would also include at least a Site Allocations DPD, Development Management DPD and Gypsies & Travellers DPD to complete the suite of Development Plan Documents. Work on these DPDs would be programmed to follow the adoption of the Core Strategy in 2013.

***Castle Point Borough Council***

CPBC's LDS was adopted in March 2009. The Core Strategy (CS) Examination in Public (EiP) started June 2010, but was later suspended due to changes emerging from the Government regarding national policy on Housing (PPS3), and the revocation of the RSS (see section 2.1.2 above). The Inspector held a procedural meeting on the 28th October 2010 to set out how the EiP would continue and was satisfied that the examination can continue once further consultation of the revised document has taken place. A 6 week period of consultation in late 2010 followed. In May 2011 the Inspector asked for the Council to consider identifying additional housing land on the mainland part of Castle Point in order to improve the distribution of homes, and also to improve the flexibility of the housing land supply. It is expected that the examination will resume in winter 2011 once this work has been completed.

[7] East of England Plan, Government Office for the East of England, 2008
[8] http://www.communities.gov.uk/documents/planningandbuilding/pdf/1631904.pdf

Strategic Planning Documents have been produced and are ongoing for the Canvey Town Centre Masterplan and Hadleigh Town Centre Masterplan, which set out regeneration proposals for the two areas, reflecting the Council's recognition that they supply a major element of housing supply. The Canvey Town Centre Masterplan[9] indicates that there is a potential capacity of about 400 units in that location. The Hadleigh Town Centre Masterplan[10] indicates that there is a potential capacity of about 500 units in that location.

***Rochford District Council***

RDC's CS was submitted to the Secretary of State for independent examination in January 2010. Following the changes in government policy and statements by the Secretary of State in May and July 2010 (in particular those pertaining to the revocation of the RSS, see section 2.1.2 above), the Inspector carrying out the examination into RDC's CS wrote to participants in the examination process, including the Council, asking for their views on how these changes may impact on the CS. The Council consequently proposed changes to the submitted Core Strategy in October 2010. These amendments did not entail changes to the spatial distribution or quantum of development, but did impact upon phasing, with the proposed development occurring over a longer timeframe.

This study has been conducted on the basis of the Core Strategy as amended However, following Court rulings in respect of statements issued by the Secretary of State regarding the revocation of RSS, the Council resolved to revert back to the Core Strategy as originally submitted (with some minor changes) in September 2011. These changes will be subject to consultation until 7 October 2011. If implemented and enacted, the changes would have an impact on a temporal aspects of this study.

The above has resulted in significant delays to the Core Strategy examination, but the Core Strategy is now expected to be adopted in December 2011[11].

## 2.2 Guidance

The Environment Agency has issued a National Guidance document (The Water Cycle Study Manual[12]) to ensure that WCS are carried out in a consistent way. This guidance outlines the required approach for the Scoping, Outline and Detailed phases of WCS and is intended to assist local authorities, developers and others involved in commissioning or carrying out a water cycle study. It provides non-prescriptive guidance on the purpose, scope and best-practice process for undertaking such studies, as it recognises that WCS need to be adapted to suit local conditions. The approach set out in the guidance forms current best practice and the basis for the methodology followed in this study.

## 2.3 Supporting Documents

In addition to the legislation and guidance set out in Tables 3-1 and 3-2 and above, the following studies and reports are relevant and, where available, have been used within the South Essex Outline WCS:

- Essex Thames Gateway Scoping Water Cycle Study[13];
- Essex Thames Gateway Strategic Flood Risk Assessment (SFRA)[14];

[9] http://www.canveycomesalive.co.uk/index.html
[10] http://www.heartinhadleigh.org.uk/
[11] Samuel Hollingworth, Planning Policy Team Leader, Rochford District Council, Personal Communication, 20th April 2011
[12] http://publications.environment-agency.gov.uk/pdf/GEHO0109BPFF-e-e.pdf
[13] Essex Thames Gateway Scoping Water Cycle Study, Scott Wilson, 2009

- South Essex Strategic Flood Risk Assessment[15];
- South Essex Catchment Flood Management Plan[16];
- North Essex Catchment Flood Management Plan[17];
- Thurrock Scoping Water Cycle Study[18];
- Environment Agency Combined Essex Catchment Abstraction Management Strategy (CAMS)[19];
- The Environment Agency's Review of Consent Process;
- Anglian Region River Basin Management Plan[20];
- Anglian Water Service's Water Resources Management Plan[21];
- The SuDS Manual (Ciria C697)[22];
- TGSE Sub-regional housing strategy 2008-2011[23];
- TE2100 Plan[24]; and
- Thames Estuary Coastal Habitat Management Plan[25]

[14] Essex Thames Gateway Strategic Flood Risk Assessment, Scott Wilson, 2006, http://floodrisk.tgessex.co.uk/documents/Final%20SFRA%20Main%20Report.pdf
[15] South Essex SFRA, Scott Wilson Ltd, 2010 and 2011
[16] South Essex Catchment Flood Management Plan Final Plan, August 2008
[17] North Essex Catchment Flood Management Plan Final Plan, December 2009
[18] Thurrock Scoping Water Cycle Study, Scott Wilson, 2009, http://www.thurrock.gov.uk/planning/strategic/pdf/ldf_tech_water_2010.pdf
[19] The Combined Essex Catchment Abstraction Management Strategy, February 2007, http://publications.environment-agency.gov.uk/pdf/GEAN0207BLXJ-E-E.pdf
[20] http://wfdconsultation.environment-agency.gov.uk/wfdcms/en/anglian/Intro.aspx
[21] Anglian Water, Water Resource Management Plan, Main Report, February 2010
[22] The SuDS Manual (Ciria 697), http://www.ciria.org.uk/suds/publications.htm ID=10559&TPPID=4334&AspNetFlag=1&Section=content_by_themes
[23] TGSE Sub-Regional Housing Strategy, Thames Gateway South Essex, 2008-2011
[24] Thames Estuary 2100, Managing flood risk through London and the Thames estuary, Environment Agency, 2009, http://www.environment-agency.gov.uk/research/library/consultations/106100.aspx
[25] Thames Estuary Coastal Habitat Management Plan, Environment Agency, 2009

# 3 Proposed Growth

## 3.1 Introduction

The Department of Communities and Local Government's (CLG) 2010 National Household Projections (for period 2008 to 2033) show that the number of households in England is projected to grow to 27.5 million, an increase of 27% over 2008 or 232,000 households per year. Population growth is the main driver of this household growth, accounting for around 75% of the increase in households between 2008 and 2033. It is predicted that by 2033:

- 19% of household population will live alone, a rise of 5% since 2008; and
- 33% of households will be headed by those aged 65 or over, up from 26% in 2008.

The South East will see the largest rise in household numbers (4.5 million), London will see the second largest increase (4.1 million) and the East the third largest increase (3.2 million). However the total change in numbers between 2008 and 2033 will be greatest in the East, with a 34% rise, of which single person households are projected to make up approximately two thirds of the increase[26].

## 3.2 Basildon

### 3.2.1 Potential growth

Work underway to prepare BBC's Core Strategy Preferred Options Report is testing the appropriateness of four options for housing growth and three options for employment growth to deliver sustainable development up to 2031. These are:

**Housing**

- Option 1: Restrict housing growth to 4,500 new homes which can be accommodated within the existing urban areas;
- Option 2: Deliver 9-11,000 new homes, located in the urban area at higher densities and more intensively and using Areas of Special Reserve (ASR) land[27];
- Option 3: Deliver 9-11,000 new homes, located in the urban area and on ASR land along with some limited release of land from the Green Belt; and
- Option 4: Aim to deliver 25,000 new homes, with the majority located on land released from the Green Belt.

**Jobs**

- Option A: Deliver 5,000 new jobs on existing employment sites and in the Regional and Town Centres (to go alongside housing Option 1);
- Option B: Deliver 10,000-12,000 new jobs on existing employment sites and in the Regional and Town Centres (to go alongside housing Options 2 & 3); and
- Option C: Accommodate 27,500 new jobs: on existing sites and in town centres; and designate new land for employment generating uses to deliver the balance (to go alongside housing Option 4).

[26] http://www.communities.gov.uk/housing/housingresearch/housingstatistics/housingstatisticsby/householdestimates/
[27] Areas of Special Reserve, defined as land that is protected until such time as it is needed to meet future development requirements

Options 2 and 3 are the most likely to be selected as the Housing Growth Preferred Option, as Option 1 is too low a figure to meet local needs and Option 4 would not be reasonable owing to rates of construction necessary for supporting infrastructure and Green Belt impact.

The only geographic split known relates to the following assumptions:

- for all options - the draft Strategic Housing Land Availability Assessment (SHLAA) identified space for up to about 4,500 new dwellings in the three urban areas of Basildon (4,000), Wickford (400) and Billericay (100), the majority which would be most appropriate for one and two bed apartments. Whilst this would meet a recognised need, there would still be a shortfall of sites for larger, higher value homes;
- two ASRs within the urban area could be re-allocated for development at Barn Hall in Wickford and Dry Street in Basildon; and
- the remaining development locations would be sourced from the most sustainable alternatives in the Borough's Green Belt.

At the time this Outline WCS was being prepared, the SHLAA had not been completed to an extent that the WCS was able to appraise the suggested locations that the determined to be the most sustainable, suitable and available for future development needs. Therefore the Outline WCS has been used instead to examine the potential of large Urban Sites and Areas of Search (AS) to accommodate future growth, so that it can be used alongside the final SHLAA to inform future development locations. All sites tested are shown in Figure 3-1.

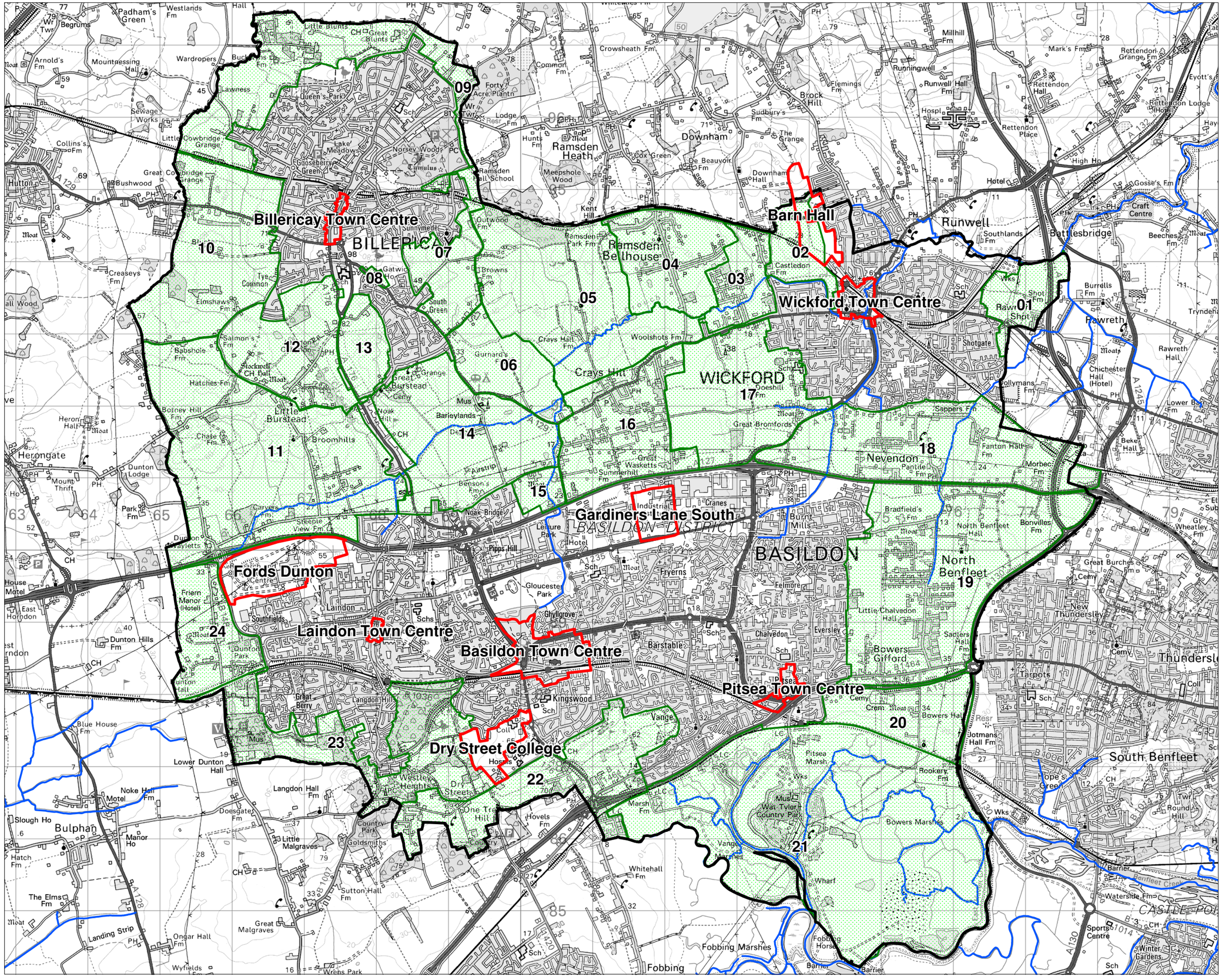
**Preferred Option for Housing and Job Growth in Basildon to 2031**

The preferred option would be to deliver 9,000 new homes in urban areas and on ASR land over the Plan period (the lower end of Option 2). This would provide housing for the projected population growth and allow for reduced household size. Some 450 new homes would need to be completed per annum to 2031, which is still ambitious when compared to historical completion rates of the last 10 years[28]. Infrastructure improvements would probably be needed and the Borough would need to be reasonably sure that these could be achieved and coordinated alongside new development.

Option 3, 9-11,000 new homes, could be accommodated within the urban and on ASR land with limited releases of land from the Green Belt. (Accommodating this number only within the urban area and the ASRs would mean development at higher densities and more intensive development.) Whilst improvements to existing physical infrastructure would probably be needed to support this level of growth, development could be phased so as not to put undue pressure on existing resources. As improvements to social and community infrastructure would also be needed, the Borough would need to be reasonably sure that these could be achieved in tandem with new development.

In pursuing one of the two options for 9-11,000 new homes and 10-12,000 jobs, the Borough would avoid imbalances being created between Basildon Borough and surrounding areas in South Essex.

[28] Average New Dwelling Completions over period 2001/2002 – 2009/2010 was 296 per annum - Basildon Borough Council, Annual Monitoring Report 2010




NOTES

- Basildon Borough Boundary
- Urban sites
- Areas of Search
- Main Rivers



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Drawing Status: FINAL

Job Title: SOUTH ESSEX WATER CYCLE STUDY

Drawing Title: PROPOSED GROWTH SITES IN BASILDON

Scale at A3: 1:50,000

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## 3.3 Castle Point

### 3.3.1 Proposed growth

Castle Point's submitted Core Strategy was published in March 2010 and was subject to further hearing sessions in March 2011. The Inspectors report is due in July 2011. The Core Strategy gives a target of 5,000 homes to be delivered between 2001 and 2026, of which 35% should be affordable to local people who do not have access to market value homes. The Strategic Housing Land Availability Assessment (SHLAA) was published in June 2009 and updated in April 2010, to reflect housing land availability in the Borough as of the 1st April 2010. In addition, there are a number of Green Belt Sites that are being promoted by developers to the Council. It is expected that these will have capacity for up to 400 homes on Canvey and 500 homes on the mainland.

In order to assess comparable timescales for each of the three authorities, CPDC's housing targets to 2026 have been extended to 2031 and three options will therefore be assessed for the WCS, as follows:

**Option 1 – High**

Option 1 gives a growth target of 4,550. This equates to the Core Strategy target of 5,000 dwellings, minus delivery to date. This equates an average of 200 dwelling units per hectare from 2001 to 2031. The spatial distribution of the development would be as follows:

- Canvey Island 30% (1,365 dwellings); and
- Mainland 70% (3,185 dwellings).

**Option 2 – Medium**

Option 2 gives a growth target of 4,000. This equates an average of 200 dwelling units per hectare from 2011 to 2031. The spatial distribution of the development would be as follows:

- Canvey Island 43% (1,720 dwellings); and
- Mainland 57% (2,280).

**Option 3 – Low**

Option 3 gives a growth target of 3,000. This equates an average of 150 dwelling units per hectare from 2011 to 2031. The spatial distribution of the development would be as follows:

- Canvey Island 43% (1,290 dwellings); and
- Mainland 57% (1,710).

**Table 3-1: Summary of geographical split of development across Castle Point**

| Delivery Rate | Canvey | Mainland | Total 2011-31 |
|---|---|---|---|
| Option 1 - High | 1,365 | 3,185 | 4,550 |
| Option 2 - Medium | 1,720 | 2,280 | 4,000 |
| Option 3 - Low | 1,290 | 1,710 | 3,000 |

## 3.4 Rochford

### 3.4.1 Proposed growth

The Council's target for growth is 3,800 new dwellings by 2031, which has been broken down by the submitted Core Strategy into the following sites:

- North of London Road, Rayleigh;
- West Rochford;
- West Hockley;
- South Hawkwell;
- East Ashingdon;
- South East Ashingdon;
- South Canewdon;
- South West Hullbridge; and
- West Great Wakering.

It is proposed that development within these settlements would be divided as follows:

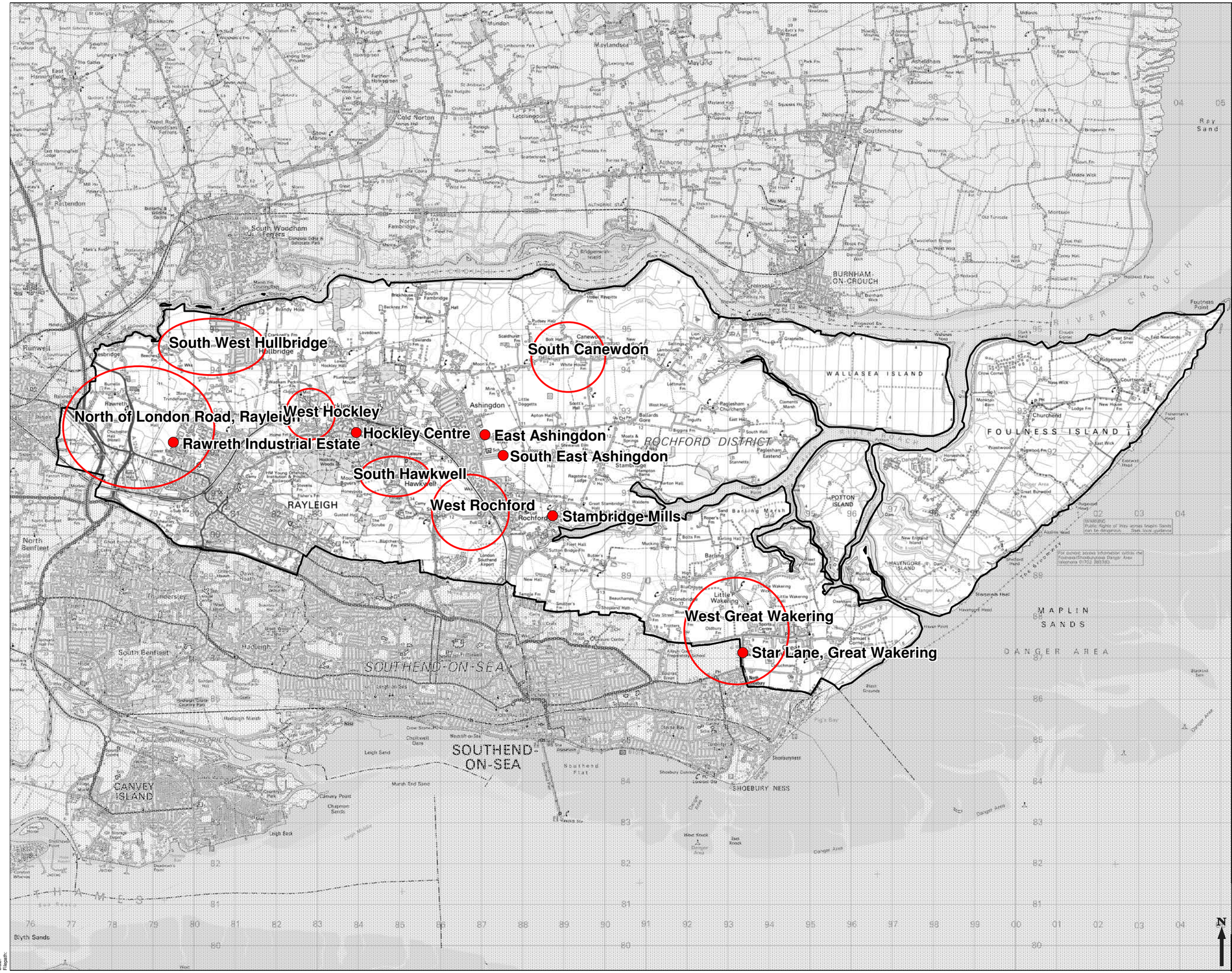
**Table 3-2: Geographical split and phasing of development across Rochford**

| Site | 2011-2021 | 2021-2026 | Post 2026 |
|---|---|---|---|
| North of London Road, Rayleigh | 0 | 400 | 150 |
| West Rochford | 500 | 100 | 0 |
| West Hockley | 50 | 0 | 0 |
| South Hawkwell | 175 | 0 | 0 |
| East Ashingdon | 100 | 0 | 0 |
| South East Ashingdon | 0 | 450 | 50 |
| South Canewdon | 20 | 40 | 0 |
| South West Hullbridge | 0 | 0 | 500 |
| West Great Wakering | 0 | 0 | 250 |
| **Brownfield sites** | | | |
| Stambridge Mills | 163 | 0 | 0 |
| Rawreth Industrial Estate | 220 | 0 | 0 |
| Star Lane, Great Wakering | 175 | 0 | 0 |
| Hockley centre | 150 | 0 | 0 |
| **Total** | **1,553** | **990** | **950** |

This gives a total of 2,785 new dwellings across the above sites; an additional 921 dwellings will be located on brownfield sites, as identified on page 13 of the Schedule of Changes (Appendix H2)[29]. Of these brownfield sites, four have been identified under RDC's submitted Core Strategy and are listed in Table 3-2 above[30]:

Figure 3-2 below shows the locations of the potential development sites in Rochford tested within this WCS.

[29] Rochford Core Strategy Schedule of Changes, Samuel Hollingworth, Rochford Borough Council, Personal Communication, January 2011.
[30] Samuel Hollingworth, Planning Policy Team Leader, Rochford District Council, Personal Communication, 20th April 2011




Potential Development Sites

Potential Development Areas

Rochford Council Extent



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Drawing Status: FINAL

Job Title: SOUTH ESSEX WATER CYCLE STUDY

Drawing Title: POTENTIAL DEVELOPMENT SITES WITHIN ROCHFORD DISTRICT

Scale at A3: 1:85,000

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# 4 South Essex Wastewater Strategy 2011-2031

## 4.1 Introduction

The wastewater assessment addresses two key areas for wastewater: the baseline with respect to treatment of wastewater and how much 'spare' capacity is available in existing WwTW; and, the baseline with respect to wastewater or sewer network and whether there is scope to use the existing and/or planned network system before upgrades are required.

An important aspect of the spare capacity of the existing wastewater treatment facilities is the assessment of the environmental capacity of the receiving watercourses. Discharge of additional treated wastewater from new development could have a detrimental impact on:

- the water quality of receiving waters;
- the hydrological/hydraulic regime of receiving waters and associated habitats; and
- flood risk downstream of the discharge.

In conjunction with the findings of the Flood Risk, Water Quality and Ecology constraints assessments, the constraints of future wastewater treatment have been identified. This section presents a summary of the methodology for, and the results of developing, the outline wastewater strategy.

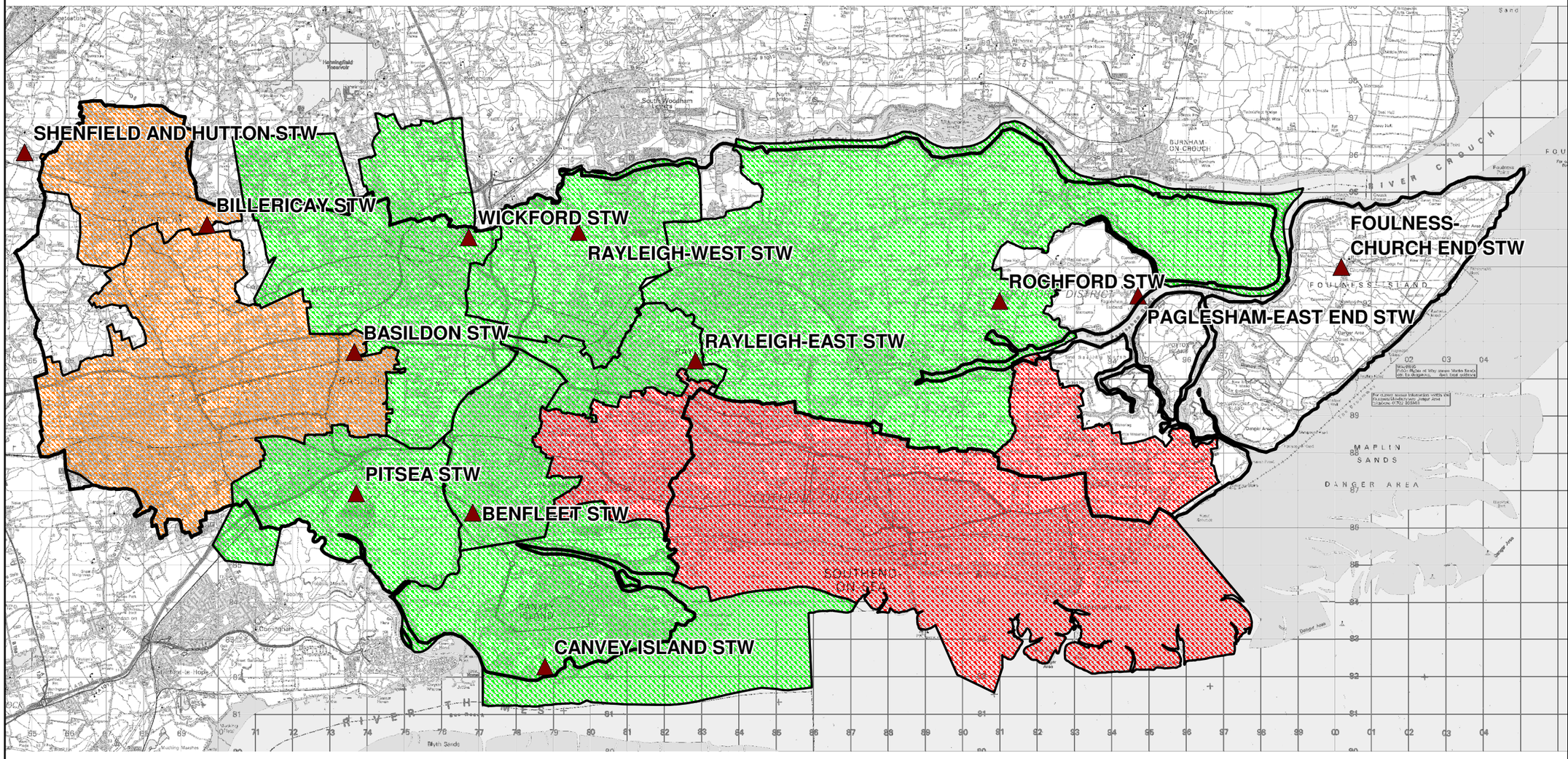
## 4.2 Baseline

### 4.2.1 WwTW Capacity Assessment

Two WwTW were excluded from the assessment, either because no significant growth is planned to drain to the catchment, or the WwTW is too small and does not have numeric values for its consented discharge (i.e. has a descriptive consent only). Foulness Church End WwTW and Paglesham East End WwTW (both in Rochford) have not been included as they have descriptive consents. In order to focus the assessment, only WwTW catchments where proposed growth is greater than 50 dwellings have been assessed (if more than one settlement lies within a catchment the cumulative growth figure has been assessed)[31].

The WwTWs shown below in Table 4-1 were taken forward for assessment within the WCS. The locations of these WwTW are shown in Figure 4-1 below.

[31] For this level of assessment, it is felt that a cut off of 50 houses is an appropriate level of detail as this does not represent a significant flow increase in a particular WwTW's catchment.




Sewage treatment works

Volumetric capacity at WwTW

Increase in flow consent required, quality conditons a chievable within LCT

Increase in flow consent required, quality conditions not achievable within LCT



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Drawing Status: FINAL

Job Title: SOUTH ESSEX WATER CYCLE STUDY

Drawing Title: Sewer Catchments

Scale at A3: 1:120,000

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**Table 4-1: Wastewater treatment works to be assessed**

| Wastewater Treatment Works | Dry Weather Flow consent ($m^3$/d) | Measured flow* ($m^3$/d) | Biochemical Oxygen Demand (mg/l) | Total Suspended Solids (mg/l) | Ammonia (mg/l) |
|---|---|---|---|---|---|
| Wickford | 8,214 | 7,258 | 22A | 45 | 10 |
| Basildon | 31,095 | 21,808 | 30A | 45 | 10 |
| Billericay | 1,417 | 855 | 28A | 37 | 13 |
| Shenfield & Hutton | 12,650 | 7,807 | 10A | 20 | 3 |
| Pitsea | 6,060 | 3,276 | 40A | N/A | 20 |
| Canvey Island | 13,000 | 5,773 | 120A | N/A | N/A |
| Southend | 68,274 | 65,257 | 100A | 150 | N/A |
| Benfleet | 6,970 | 5,100 | 40A | 80 | 20 |
| Rayleigh East | 4,600 | 4,116 | 10A | 20 | 3 |
| Rayleigh West | 5,827 | 3,893 | 23A | 39 | 28 |
| Rochford | 8,630 | 6,165 | 35A | 60 | N/A |

* Figures provided by AWS

## 4.3 Assessment Methodology

The assessment methodology for this WCS is based on discussion and agreement with the Environment Agency on the best process to assess the impacts of growth on WFD targets and statuses.

**Basildon**

For the potential growth in Basildon Borough, whilst Areas of Search and Urban Locations have been identified, proposed housing numbers and the distribution of future growth is not known. The WCS will therefore assess the baseline capacity at the works within Basildon Borough (or WwTWs which may receive flows from growth within the Borough if they lie outside the Borough boundary) and provide an estimate of the maximum growth that could be accommodated at each works, assuming that treatment standards, and therefore also discharge quality, could be improved to the limits of conventional wastewater treatment technology[32].

**Castle Point**

For the assessment of the effects of the proposed growth within Castle Point on WwTW capacity, no exact growth locations have been supplied by CPBC. Therefore for Benfleet and Southend WwTW, the capacity of the works has been assessed on a worst-case basis; that is assuming that all of the proposed growth on the 'mainland' area of Castle Point could drain to either works. However for Rayleigh East WwTW, which drains a small area to the north of the Borough, it is not sensible to assume that all the growth on the mainland would be directed to this works and the worst-case assessment carried out for Benfleet and Southend has not been

[32] The limit of conventional wastewater treatment technology is currently considered to be the at the following limits for the following determinands 5 mg/l BOD, 1 mg/l NH4 and 1 mg/l P

applied here. Rather, the remaining capacity at Rayleigh East WwTW has been calculated to inform the Council of the level of growth that could be accommodated within the work's catchment. This information can then be used by CPBC to inform its decisions allocating potential development sites in the north of Thundersley. For Canvey Island, it has been assumed that all the proposed growth will drain to Canvey Island WwTW, as this is a discrete catchment.

**Rochford**

For Rochford, both locations and proposed growth numbers have been supplied and an assessment of the capacity of the proposed sites has been possible.

### 4.3.1 Changes to Dry Weather Flow consent limits

Dry Weather Flow (DWF) is a unit of measure, used by the Environment Agency in a discharge consent to describe the volume that can be discharged from wastewater treatment works under normal operating conditions. Until recent changes were made to how DWF is measured and reported, DWF was defined as "the average daily flow of sewage during seven consecutive days without rain following seven days during which the rainfall did not exceed 0.25 mm on any one day, averaged over a summer and winter period". In industrial towns the seven days are replaced by five working days. Essentially it is supposed to represent the proportion of flow treated by a WwTW that is made up of foul (or waste) water and not surface water which is generated from rainfall events.

However, it is widely recognised that the previous definition of DWF had a number of shortcomings, including the lack of qualifying periods without rainfall across an entire sewerage catchment. A UKWIR project WW21/D to develop an alternative measure of DWF was carried out in 2006, which concluded that the measure of DWF that would be the most appropriate replacement for DWF was the 20th percentile (Q80)[33].

As a result of the redefinition of DWF and the installation of flow measurement at the majority of AWS's treatment works, discrepancies have been noted between consented and measured DWF values in some cases. To rectify these discrepancies, AWS applied to vary all discharge consents where the measured flows were higher than the consented DWF. These variations are now in place and represent the maximum flow that a WwTW is consented to discharge under dry weather flow conditions. Effectively, this means that there is no consented capacity at the WwTW to discharge any further flow from proposed growth without applying for a further increase in consented flow.

### 4.3.2 Proposed changes to discharge consents

Key actions have been identified in the River Basin Management Plan (RBMP) for the Anglian region to begin the process of ensuring that all waterbodies in the Anglian region move towards achieving 'Good' status as required under the WFD. Most of these key actions are aimed at reducing phosphorus discharges. An improvement scheme was put forward under the AMP programme for Wickford WwTW.

[33] An Improved Definition of Sewage Treatment Works Dry Weather Flow, Manuel Starr, 2006

## 4.4 Wastewater Treatment Capacity Assessment

### 4.4.1 Calculated consented volumetric capacity

Of the WwTW assessed, the following works were identified during the AWS flow audit as operating at or above DWF capacity, as demonstrated by the recent increase in consented DWF:

- Wickford WwTW;
- Basildon WwTW; and
- Southend-on-Sea WwTW.

They are therefore deemed to have no capacity in their consented DWF for any further discharge from growth, as shown below in Table 4-2. The volumetric capacity at all the works can be calculated as the difference between the measured flow and the consented DWF, which is shown below in Table 4-2.

**Table 4-2: Calculated DWF capacity at assessed works**

| WwTW | DWF consent | Actual flow | Measured DWF capacity (m3/day) | Dwelling capacity (households)[34] |
|---|---|---|---|---|
| Wickford | 8,214 | 8,214 | 0 | 0 |
| Basildon | 31,095 | 31,095 | 0 | 0 |
| Southend-on-Sea | 1,417 | 1,417 | 0 | 0 |
| Billericay | 1,417 | 855 | 562 | 2,150 |
| Pitsea | 6,060 | 3,276 | 2,784 | 10,600 |
| Canvey Island | 13,000 | 5,773 | 7,227 | 27,550 |
| Benfleet | 6,970 | 5,100 | 1,870 | 7,124 |
| Rayleigh East | 4,600 | 4,116 | 484 | 1,850 |
| Rayleigh West | 5,827 | 3,893 | 1,934 | 7,350 |
| Rochford | 8,630 | 6,165 | 2,465 | 9,390 |
| Shenfield and Hutton | 12,650 | 7,807 | 4,843 | 18,450 |

### 4.4.2 Castle Point & Rochford - Calculated future flow to each works for each of the growth scenarios

The growth scenarios are presented in Section 3. For each growth scenario, additional wastewater generated in each catchment has been calculated using the following assumptions:

- an occupancy rate of 2.1[35] for all new dwellings; and
- a per capita water consumption figure of 125 litres[36] per day.

[34] This is the theoretical number of additional houses that could be built within the WwTW catchment area before consent/capacity is exceeded
[35] A standard assumed occupancy rate, as agreed with AWS for previous WCS.
[36] This is taken to be the Building Regulations minimum for new homes plus 5 litres for garden watering. It should be noted that this figure is not particularly precautionary when compared to ESW's current average water consumption of 152 l/h/d.

The values for 'post growth' wastewater flow are provided below in Tables 4-3 and 4-4.

**Table 4-3: Calculated future flow and capacity at treatment works for Castle Point**

| WwTW | Scenario 1 Housing allocation | | Scenario 2 Housing allocation | | Scenario 3 Housing allocation | |
|---|---|---|---|---|---|---|
| | Post growth flow (m3/d) | Capacity post growth (m3/d) | Post growth flow (m3/d) | Capacity post growth (m3/d) | Post growth flow (m3/d) | Capacity post growth (m3/d) |
| Canvey Island | 6,221 | 6,779 | 6,337 | 6,663 | 6,196 | 6,804 |
| Benfleet | 6,145* | 825 | 5,848 | 1,122 | 5,661 | 1,309 |
| Rayleigh East | Cannot be assessed as the proportion of growth to be directed to the Rayleigh WwTW is not known at this point. | | | | | |

**Table 4-4: Calculated future flow and capacity at treatment works for Rochford**

| WwTW | Dwellings 2011-2021 | | Dwellings 2021-2026 | | Dwellings post 2026 | |
|---|---|---|---|---|---|---|
| | Post growth flow (m3/d) | Capacity post growth (m3/d) | Post growth flow (m3/d) | Capacity post growth (m3/d) | Post growth flow (m3/d) | Capacity post growth (m3/d) |
| Rayleigh West | 3,965 | 1,862 | 4,096 | 1,731 | 4,310 | 1,517 |
| Rochford | 6,545 | 2,085 | 6,999 | 1,631 | 7,311 | 1,319 |

* This includes an assessment of all wastewater flows from proposed mainland growth being directed to Benfleet WwTW, rather than the actual split between Benfleet and Southend WwTWs.

Where the analysis indicates that there is sufficient consented volumetric capacity, the flow generated as a result of growth can be accommodated for that catchment within the limits of the WwTW's current consent conditions.

The current consents for all WwTW are assessed by the Environment Agency for each water company 5 year asset planning period (AMP), and hence, unless the Environment Agency have highlighted that consent conditions need to change in the current AMP (AMP5 running from 2010 to 2015) in order to meet the requirements of the WFD, Habitats Directive or another local driver, then the assumption used in this assessment is that the consent is considered to be fully usable (up to its maximum) without affecting the ability of the downstream waterbody to meet its statutory water quality standards.

The analysis shows that there are no WwTWs where the volumetric capacity will be exceeded by the proposed growth. Therefore, unless additional growth above and above that which has been proposed goes ahead, no changes will be required to the discharge consents for the above WwTWs.

For Rayleigh East WwTW, where the proposed level of growth within the catchment is not known, the assessment shows that there is capacity for approximately 1,850 new houses within the catchment (see Table 4-2 above). As long as the proposed growth is within this limit, no increase to the consented DWF will be required. However should the level of growth exceed this, an increase to DWF may be required. See Section 4.4.3 below for an assessment of the theoretical maximum flow that Rayleigh WwTW could discharge without compromising downstream water quality.

**Southend-on-Sea WwTW**

The sewer networks within the south east of Rochford District and the east of Castle Point Borough drain to Southend-on-Sea WwTW. Therefore an assessment has been carried out for the works, despite the fact that it lies outside of the study boundary. As can be seen from Section 4.4.1 above, a revised DWF consent has been issued for Southend WwTW, which is therefore deemed to have no capacity and would require expansion to accept and treat additional flows.

However, the works occupies a very constrained site with no room to expand the treatment process. A Detailed WCS is currently being carried out by URS Scott Wilson for Southend Borough Council, for which AWS are modelling the sewer network within Southend to determine possible flow reductions that could result from removing surface water flows from areas of new infill development, such as the proposed town centre regeneration. It is not expected that the results of this modelling, and therefore the conclusions of the Southend Detailed WCS, will available for inclusion within this Outline WCS, but, in time, it will be able to inform spatial planning in Castle Point and Rochford areas.

### 4.4.3 Maximum WwTW capacity for Rayleigh East

Rayleigh East WwTW discharges to the Nobles Ditch and Eastwood Brook, fluvial a tributary of the River Roach, and RQP modelling was therefore used to calculate the theoretical maximum flows that could be discharged from the works, should the 1,850 capacity within the existing DWF be exceeded and a variation to the consented DWF be required.

Using a target value of 4 mg/l for downstream water quality (i.e. High status under the WFD) and a treatment standard of 5 mg/l (the current limit of conventional treatment) a discharge of 10,000 $m^3$/day from the works would ensure a downstream water quality of 4 mg/l BOD. This equates to approximately 5,200 additional households, over and above the 1,850 capacity within the existing DWF consent.

For ammonia, the current status of the waterbody is Poor, for which the class boundary is 2.5 mg/l. Any discharges from the WwTW must therefore be of sufficient quality to ensure that ammonia levels within the downstream waterbody do not exceed 2.5 mg/l. However, as the limit of conventional wastewater treatment technology is currently considered to be 1 mg/l for ammonia, which is a higher standard than the target water quality, it can be concluded there would theoretically be no limit on the volume that could be discharged from the WwTW without breaching water quality standards and Environment Agency policy for ammonia. There may however be a constraint placed on the discharge by the volumetric capacity of the channel, which would need to be assessed separately.

For phosphate, the current status of the water body is Bad. Where a water body is already at bad status, no further significant deterioration is permitted as any deterioration would undermine efforts to improve the water body status, although improvements towards 'good status' will need to be progressed through AMP. However, as the limit of conventional wastewater treatment technology is currently considered to be 1 mg/l for phosphate, which is equal to the target water quality (1 mg/l for Bad status for phosphate), it can be concluded there would theoretically be no limit on the volume that could be discharged from the WwTW without breaching water quality standards and Environment Agency policy for phosphate. There may however be a constraint placed on the discharge by the volumetric capacity of the channel, which would need to be assessed separately.

The limit on future discharges from Rayleigh East should therefore be considered to be limited to 10,000 m3/day (total), which equates to approximately 5,200 additional households, over and above the 1,850 capacity within the existing DWF consent.

### 4.4.4 Maximum WwTW capacities for Basildon Borough

In order to inform the selection of Urban Locations and Areas of Search that could be best taken forward for development, modelling has been carried out to calculate the theoretical maximum flows that each WwTW could discharge without compromising downstream water quality, assuming the WwTW is operating at the limits of conventional wastewater treatment technology[37]. This has been undertaken to allow BBC to determine how much growth could be located in each WwTW catchment before it would be constrained by wastewater treatment. This will form part of the assessment of the maximum capacity of each of the assessed Urban Locations and Areas of Search.

The modelling has been carried out using the three key parameters of BOD, $NH_4$, P, RQP and load standstill methodologies, depending on if the receiving watercourse is tidal (Pitsea, Basildon and Wickford) or fluvial (Billericay and Shenfield and Hutton). There is no phosphorus target for transitional waters and no future required phosphate limit has therefore been calculated for Pitsea, Basildon and Wickford WwTWs.

**Basildon WwTW**

Basildon WwTW discharges to the tidal Pitsea Creek and RQP modelling therefore could not be used. Load standstill calculations were used to calculate the maximum flows that could be discharged from the works at the limits of conventional treatment, to ensure that there would be no increase in the overall load of BOD and ammonia discharged. The results of this modelling were as follows:

- for BOD the maximum discharge volume would be 185,000 $m^3/d$ (approximately an additional 586,300 houses within the catchment); and
- for ammonia $NH_4$ it would be 300,000 $m^3/d$ (approximately an additional 1,257,500 houses within the catchment).

The current discharge consent standards for Basildon WwTW (30 mg/l BOD and 10 mg/l ammonia) are relatively relaxed compared to the limits of conventional wastewater treatment technology[38], which gives the potential for the consent standards to be tightened to allow large increases to flows discharged from the works without increasing the polluting load from the WwTW and therefore affecting the downstream water quality. However, this could require significant upgrades to the WwTW to enable the discharge quality to be improved and the actual consent limits required should be more accurately determined once the proposed number of houses within the work's catchment is known. Any works upgrades would be funded by AWS through the AMP process, which would limit the timescale for development, as discussed below.

In addition, the capacity of the work's effluent outfall is limited and should a significant increase in discharge volume be required, a new outfall with additional capacity would be needed. This would need to be funded through the AMP funding programme, the next round of which is currently being appraised by AWS ready for submission to OFWAT in 2014. The timing of this

[37] i.e. The limit of conventional wastewater treatment technology is currently considered to be the at the following limits for the following determinands 5 mg/l BOD, 1 mg/l NH4 and 1 mg/l P

[38] The limit of conventional wastewater treatment technology is currently considered to be the at the following limits for the following determinands 5 mg/l BOD, 1 mg/l NH4 and 1 mg/l P

investment could delay the provision of a new outfall and therefore any expansion of the works, or development growth in its catchment.

**Wickford WwTW**

Wickford WwTW discharges to the tidal river Crouch and RQP modelling therefore could not be used. Load standstill calculations were used to calculate the maximum flows that could be discharged from the works at the limits of conventional treatment, to ensure that there would be no increase in the overall load of BOD and ammonia discharged. The results of this modelling were as follows:

- for BOD the maximum discharge volume would be 36,000 $m^3$/d (approximately an additional 105,850 houses within the catchment); and
- for ammonia it would be 80,000 $m^3$/d (approximately an additional 273,450 houses within the catchment).

The current discharge consent standards for Wickford WwTW (22 mg/l BOD and 10 mg/l ammonia) are relatively relaxed compared to the limits of conventional wastewater treatment technology[39], which gives the potential for the consent standards to be tightened to allow large increases to flows discharged from the works without increasing the polluting load from the WwTW and therefore affecting the downstream water quality. However, this could require significant upgrades to the WwTW to enable the discharge quality to be improved and the actual consent limits required should be more accurately determined once the proposed number of houses within the work's catchment is known.

Wickford WwTW also receives flows from Chelmsford, including the proposed development of 624 new houses at the former Runwell Hospital site. Therefore of the approximate 3,600 house capacity within the Wickford catchment, 624 would be taken up by the Runwell development.

**Pitsea WwTW**

Pitsea WwTW discharges to the tidal Vange Creek and RQP modelling therefore could not be used. Load standstill calculations were used to calculate the maximum flows that could be discharged from the works at the limits of conventional treatment, to ensure that there would be no increase in the overall load of BOD and ammonia discharged. The results of this modelling were as follows:

- for BOD the maximum discharge volume would be 48,500 $m^3$/d (approximately an additional 9,300 houses within the catchment); and
- for ammonia it would be 30,000 $m^3$/d (approximately an additional 91,200 houses within the catchment).

The current discharge consent standards for Pitsea WwTW (40 mg/l BOD and 20 mg/l ammonia) are relatively relaxed compared to the limits of conventional wastewater treatment technology[40], which gives the potential for large increases to flows discharged from the works without affecting the downstream water quality. However, this could require significant upgrades to the WwTW to enable the discharge quality to be improved and the actual consent limits required should be more accurately determined once the proposed number of houses within the work's catchment is known.

[39] The limit of conventional wastewater treatment technology is currently considered to be the at the following limits for the following determinands 5 mg/l BOD, 1 mg/l NH4 and 1 mg/l P
[40] The limit of conventional wastewater treatment technology is currently considered to be the at the following limits for the following determinands 5 mg/l BOD, 1 mg/l NH4 and 1 mg/l P

However, it should be noted that as shown above in Table 4-2, the current volumetric capacity of Pitsea WwTW is 2,784 $m^3$/day, which is roughly equivalent to 10,600 households. Only if the proposed growth within the Pitsea WwTW catchment exceeds this figure will an increase to the consented DWF be required.

**Billericay WwTW**

RQP modelling carried out for Billericay WwTW for BOD demonstrated that there is capacity for high growth levels within the catchment of Billericay WwTW without affecting the downstream water quality for BOD. As an example, using a target value of 5 mg/l for downstream water quality (i.e. Good status under the WFD) and a treatment standard of 5 mg/l (the current limit of conventional treatment) a discharge of 1 Ml/d from the works would ensure a downstream water quality of 4.55 mg/l BOD. This is comfortably within the class boundary for Good status and far in excess of the level of growth proposed for the Borough and could equate to an additional 3,348,700 houses within the catchment. There is therefore no constraint to growth from the discharge of BOD from Billericay WwTW, assuming that upgrades could be undertaken to treat to the limit of conventional treatment.

For ammonia, the receiving watercourse (the River Crouch) is at Moderate status. However, this is reported as 'uncertain' in the RBMP. The Environment Agency's WFD investigation into this failure to meet the Good status has shown that the 90%ile value for ammonia is 0.48mg/l, which is actually equivalent to Good ammonia status[41]. The status reported in the RBMP is therefore deemed to be incorrect and Good status has been used as a target for ammonia for the purposes of this Outline WCS modelling exercise. In the absence of upstream water quality data, the mid-class value for Good status was used as a surrogate for modelling purposes.

For ammonia, the results of the RQP modelling indicate that it is not possible to meet Good status downstream with the current discharge volume, even if the treatment standard were improved to 1 mg/l ammonia, considered to be the limit of conventional wastewater treatment technology. It would therefore not be possible to increase the discharge volume from Billericay within the limits of conventional treatment without breaching the WFD standards for ammonia.

For phosphate, the River Crouch is classed as being at Bad status and therefore no further deterioration is permitted, as it would undermine efforts to improve the water body status. Therefore the actual downstream water quality (for the classification period 2006 - 2009, mean = 1.52mg/l SD = 0.8mg/l 90%ile= 2.56) is used as a target, as reported in the River Basin Plan[42]. However, as the limit of conventional wastewater treatment technology is currently considered to be 1 mg/l for phosphate, which is a higher standard than the current water quality, it can be concluded there would theoretically be no limit on the volume that could be discharged from the WwTW without breaching water quality standards and Environment Agency policy. There may however be a constraint placed on the discharge by the volumetric capacity of the channel, which would need to be assessed separately. The results of this modelling are shown in Table 4-6 below.

However, it should be noted that as shown above in Table 4-2, the current volumetric capacity of Billericay WwTW is 562 $m^3$/day, which is roughly equivalent to 2,100 households. Only if the proposed growth within Billericay exceeds this figure would a solution be required to allow additional flow to be treated.

[41] Rachel Rees, Senior Environment Planner (WQ)/ Water Framework Directive Co-ordinator, Environment Agency, personal communication, 29/03/2011.
[42] Rachel Rees, Senior Environment Planner (WQ)/ Water Framework Directive Co-ordinator, Environment Agency, personal communication, 29/03/2011.

It was suggested by the Scoping WCS[43] that additional flows within the Billericay catchment could be treated by the adjacent Mountnessing WwTW, which was to be explored further by this Outline WCS. However, discussions with AWS[44] have identified that the works adjacent to Mountnessing village is actually called the Shenfield and Hutton WwTW.

**Table 4-6: Summary of modelling results to show maximum discharge volumes at WwTW within Basildon Borough**

| Treatment works | Maximum flow possible while achieving downstream water quality target/load standstill[45] | | |
|---|---|---|---|
| | BOD ($m^3$/d) | Ammonia ($m^3$/d) | Phosphate ($m^3$/d) |
| **Basildon** | 185,000 | 300,000 | * |
| **Wickford** | 36,000 | 80,000 | * |
| **Pitsea** | 48,500 | 30,000 | * |
| **Billericay** | No immediate risk to water quality standards from even large quantities of growth | Downstream water quality target is not achievable within the limits of conventional wastewater treatment; although there is capacity for an additional 562 m3/d within the current consented DWF. | No immediate risk to water quality standards from even large quantities of growth |

* There is no phosphorus target for transitional waters and no future required phosphate limit has therefore been calculated for these WwTWs.

**Shenfield and Hutton WwTW**

Shenfield and Hutton WwTW lies to the west of Billericay, within the adjacent Brentwood Borough. The WwTW has the following limits on its discharge consent:

- BOD 10 mg/l;
- TSS 20 mg/l;
- ammonia 3 mg/l; and
- phosphate 2 mg/l.

The volumetric capacity within the consented DWF at the works can be calculated as the difference between the measured flow and the consented DWF, which is shown below in Table 4-5.

**Table 4-5: Volumetric capacity at Shenfield and Hutton WwTW**

| Dry Weather Flow consent ($m^3$/d) | Measured flow ($m^3$/d) | Measured DWF capacity (m3/day) | Dwelling capacity (households) |
|---|---|---|---|
| 12,650 | 7,807 | 4,843 | 18,450 |

In combination with the capacity of 2,100 households within the existing consented DWF at Billericay WwTW, this would allow for an additional approximately 20,550 houses to be built within Billericay (or within areas allocated in Brentwood Council's LDF, which also lie within the Billericay WwTW catchment).

[43] Essex Thames Gateway Scoping Water Cycle Study, Scott Wilson, 2009
[44] Rob Morris, Strategic Planning Engineer, Anglian Water Ltd, personal communication, 11th July 2011.
[45] Assuming the standard of treatment could be improved to the limits of conventional wastewater treatment.

However, the sewer networks of the two catchments are not currently joined and a connection would be required before flows could be transferred from Billericay to Shenfield and Hutton. The above assessment calculates that there is theoretical capacity within the consented DWF at Shenfield and Hutton only; it does not give any indication of the feasibility of a network connection. Should levels of growth higher than the 100 houses currently proposed for Billericay become a target, to such a degree that the capacity of 2,100 households within the existing consented DWF at Billericay be exceeded, then an assessment should be carried out of the feasibility of connecting to Shenfield and Hutton WwTW.

It should be noted that the timing of this proposed connection may be dependent on funding through the AMP programme, depending on whether it would be funded by AWS, developer contributions or a combination of the two. Water companies' funding runs in five-year cycles called the Asset Management Programme or AMP. The current AMP period (AMP5) runs from 2010 to 2015 and funding for schemes to be completed within this period was fixed by AWS's Business Plan, as published in 2009. Any new scheme would therefore need to be funded through one of the subsequent AMP periods, i.e. AMP6 from 2016 to 2020 or AMP7 from 2021 to 2025. The timing of the development within Billericay and therefore the timing of the possible required connection to Shenfield and Hutton WwTW would determine in which AMP cycle AWS sought funding for the scheme. Possible delays caused by this should be factored into the planning and phasing of the development.

### 4.4.5 Bathing and Shellfish Waters Directives standards

The above assessment of required discharge consent limits uses the water quality standards set by the WFD. However, as discussed in Table 2-1 above, the Bathing Water Directive (BWD) and Shellfish Waters Directive (SWD) also set standards for discharges to designated waters. The TGSE Scoping WCS identified the following WwTW as being at risk of not meeting standards set by the BWD and SWD:

- Canvey Island WwTW – significant growth may represent a constraint in terms of BWD requirements;
- Rayleigh East WwTW – microbial reduction to be considered as a PR09 scheme; and
- Wickford WwTW – microbial reduction to be considered as a PR09 scheme.

The Pollution Reduction Plans (PRPs) for the relevant shellfish waters in the vicinity of Canvey Island[46,47,48,] do not list Canvey Island WwTW as having the potential to affect the shellfish waters. Only one intermittent discharge is noted as possibly affecting the shellfish waters, but this is associated with the Rochford depot pumping station rather than Canvey Island WwTW. Canvey Island WwTW has capacity for the level of growth proposed and so no increases to the discharge from the WwTW which could have an effect on the shellfish waters would result from the proposed growth. it can therefore be concluded that the requirements of the BWD and SWD will be met for Canvey Island WwTW.

During the AMP3 period, Anglian Water carried out investigations to identify which of their discharges had a potential to impact on shellfish harvesting areas, the investigations for the Roach and Crouch estimated that by far the greatest impact was caused by Rayleigh East STW discharge (95%). Improvement works to Rayleigh East WwTW will be carried out during AMP5 (2010 to 2015) and AWS have accounted for projected population growth within their planning for this period. As the WwTW has capacity for the level of growth proposed and so no

[46] Directive (2006/113/EC) on the Quality Required of Shellfish waters, Article 5 Programme, Roach And Lower Crouch, EA, 2008
[47] Directive (2006/113/EC) on the Quality Required of Shellfish waters, Article 5 Programme, Upper Roach, EA, 2008
[48] Directive (2006/113/EC) on the Quality Required of Shellfish waters, Article 5 Programme, Upper Crouch, EA, 2008

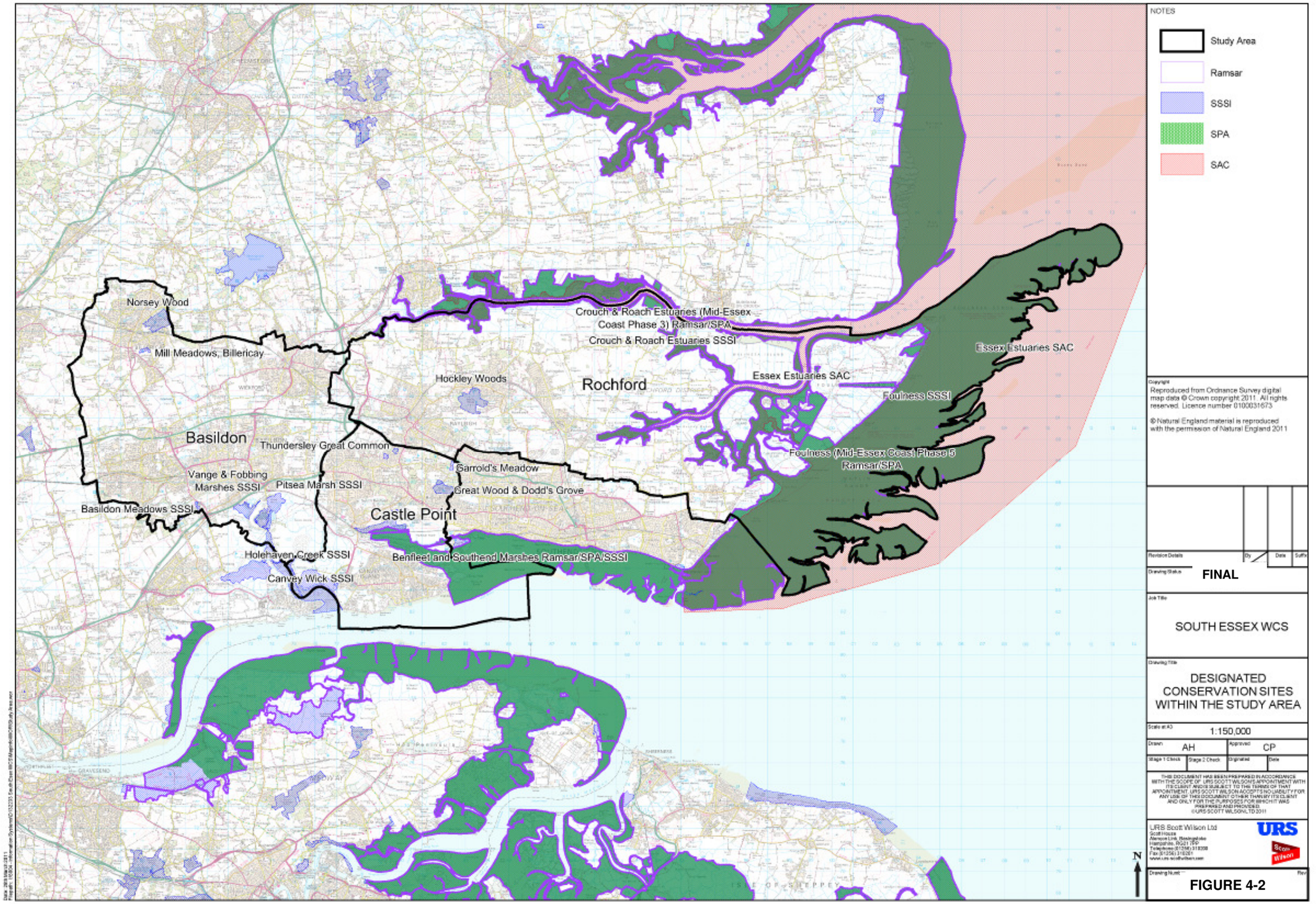
increases to the discharge from the WwTW would result from the proposed growth, it can therefore be concluded that the requirements of the BWD and SWD will be met for Rayleigh East WwTW.

Similarly, the scheme identified by the Scoping WCS for Wickford WwTW will be carried during AMP5 (2010 to 2015) and it can be concluded that no impact on BWD and SWD targets will result from growth within the Wickford catchment.

## 4.5 Environmental and Ecological Impact

### 4.5.1 International sites

There are no international sites (Special Areas of Conservation, Special Protection Areas or Ramsar sites) within Basildon Borough, although Benfleet & Southend Marshes SPA/Ramsar site lies within 1 km of the Borough boundary. Benfleet & Southend Marshes SPA/Ramsar site lies within the boundary of Castle Point Borough. The Crouch & Roach Estuaries SPA/Ramsar site, Foulness SPA/Ramsar site and Essex Estuaries SAC all lie within the boundary of Rochford District. See Figure 4-2 for the locations of designated sites within the study area.


Norsey Wood
Mill Meadows, Billericay
Basildon
Thundersley Great Common
Vange & Fobbing Marshes SSSI
Pitsea Marsh SSSI
Basildon Meadows SSSI
Hockley Woods
Rochford
Crouch & Roach Estuaries (Mid-Essex Coast Phase 3) Ramsar/SPA
Crouch & Roach Estuaries SSSI
Essex Estuaries SAC
Foulness SSSI
Foulness (Mid-Essex Coast Phase 5 Ramsar/SPA
Sarrold's Meadow
Great Wood & Dodd's Grove
Castle Point
Holehaven Creek SSSI
Canvey Wick SSSI
Benfleet and Southend Marshes Ramsar/SPA/SSSI
NOTES
Study Area
Ramsar
SSSI
SPA
SAC
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### 4.5.2 National sites

**Basildon Borough**

Other than those covered by the previously mentioned SPAs and Ramsar sites, there are five SSSIs wholly or partly in Basildon Borough:

- Norsey Wood SSSI – not particularly hydrologically sensitive;
- Basildon Meadows SSSI - not particularly hydrologically sensitive;
- Pitsea Marsh SSSI – hydrologically sensitive; Pitsea Marsh SSSI comprises a mosaic of habitats, including scrub, grassland, reedbed and fen, open water and saltmarsh;
- Vange and Fobbing Marshes SSSI - hydrologically sensitive; the unimproved coastal grassland and associated dykes and creeks support a diversity of maritime grasses and herbs. Many of these species are nationally uncommon or rare, and together form an outstanding assemblage of plants; and
- Holehaven Creek SSSI – hydrologically sensitive; partly within Basildon Borough, the tidal creek system acts as the principal drain for the surrounding grazing marshes and forms a confluence at Holehaven with the River Thames. The intertidal mudflats and saltmarsh habitats of Holehaven Creek support a nationally important number of black-tailed godwit *Limosa limosa islandica* as well as many other birds.

**Castle Point Borough**

Other than those covered by the previously mentioned SPAs and Ramsar sites, there are five SSSIs wholly or partly within Castle Point Borough:

- Garrold's Meadow SSSI – not particularly hydrologically sensitive;
- Great Wood & Dodd's Grove SSSI – not particularly hydrologically sensitive;
- Thundersley Great Common SSSI – not particularly hydrologically sensitive;
- Holehaven Creek SSSI – hydrologically sensitive; partly within Castle Point, the tidal creek system acts as the principal drain for the surrounding grazing marshes and forms a confluence at Holehaven with the River Thames. The intertidal mudflats and saltmarsh habitats of Holehaven Creek support a nationally important number of black-tailed godwit *Limosa limosa islandica* as well as many other birds; and
- Canvey Wick SSSI – hydrologically sensitive; the site is dominated by free-draining grassland and wetland features that support a nationally important assemblage of invertebrates, chiefly associated with herb-rich grassland, disturbed bare ground, open sward, scrub edge, and brackish (coastal wetland) habitats. The brackish wetland habitats include ditches, shallow temporary pools and ponds. These provide aquatic habitat for several rare invertebrates.

**Rochford District**

Other than those covered by the previously mentioned SPAs and Ramsar sites, there is one SSSI in Rochford, Hockley Woods SSSI, but this site is not particularly hydrologically sensitive.

### 4.5.3 Local sites

**Basildon Borough**

Not including those that overlap with the European sites or SSSIs discussed in this report, there are two Local Nature Reserves (LNR) in Basildon, Mill Meadow LNR and Vange Hill LNR, but neither is particularly hydrologically sensitive.

There are fifty-four non-statutory Local Wildlife Sites (LoWS) in the Borough. Fifteen of these have an aquatic ecology component:

- Little Burstead Common – this site includes a pond which has been enlarged in recent years;
- The Wilderness – this site contains a pond complex and is the source of the River Crouch;
- Langdon Complex – this site contains a lake and several ponds;
- St Nicholas Church Complex – this site contains a pond;
- Dry Street Pastures – the southern end of this site is a washland linked to a small stream/ditch;
- Moses' Spring/Barrenleys/Claypittshills Woods – a small spring has its origin in this wood;
- Vange Creek Marshes – this is connected to Vange & Fobbing Marshes SSSI;
- Pitsea Landfill – this site includes some intertidal habitat along the Vange and Pitsea Creeks;
- Nevedon Bushes – this site contains a pond;
- Wickford Riverside – the River Crouch falls within the boundary of this site;
- Burnt Mills Washland –this site includes areas of wet grassland, designed to flood as a washland in times of high rainfall, which is currently being relocated north of the A127 to be enable development;
- Bowers Marshes – this site includes a lake and a range of ditches and grazing marsh;
- Southfields Washlands – this site is a washland linked to a concrete channel which periodically overflows;
- Bluntswall Shaws – this site contains a pond; and
- Wick Country Park – this site contains a lake and part of the course of the North Benfleet Brook.

**Castle Point Borough**

Not including those that overlap with the European sites or SSSIs discussed in this report, there is one LNR in Castle Point, Canvey Lake LNR, but although hydrologically sensitive it is not connected to watercourses used to treat effluent discharge.

There are thirty-four non-statutory LoWS in the Borough. Eleven of these have an aquatic ecology component:

- Rushbottom Lane Flood Pound – this site has poor drainage and therefore a marsh component;

- West Canvey Marshes – this site is an extensive area of grazing marsh and drainage ditches;
- Canvey Village Marsh – this is a smaller area of relict grazing marsh and drainage ditches;
- Shipwrights Wood – this woodland has some marshy areas;
- The Lake, Canvey Island – this site is a large lake;
- Wall Wood/ Nine Acre Wood – this site contains a pond;
- Castle Farm/ Hadleigh Castle Grasslands – this site contains a range of ponds and drainage ditches;
- Two Tree Island Lagoon – this site is a lagoon;
- Pound Wood - this woodland has some marshy areas;
- Oakwood Reservoirs – this site consists of a series of reservoirs; and
- Thorneycreek Fleet – this site consists of a flowing ditch.

**Rochford District**

Not including those that overlap with the European sites or SSSIs discussed in this report, there are three LNRs in Rochford, Marylands LNR, Magnolia Fields LNR and Kendall Park LNR, but none are particularly hydrologically sensitive.

There are thirty-nine non-statutory LoWS in the District. Thirteen of these have an aquatic ecology component:

- Brandy Hole Marsh Extension – this is an area of saltmarsh created by managed retreat along the River Crouch;
- The Dome Grasslands – this is an area of periodically inundated relict grazing marsh on the River Crouch;
- Magnolia Nature Reserve & Fields – this site contains a pond;
- Doggett's Pond – this site contains a pond;
- Sutton Ford Bridge Pasture – this is an area of relict grazing marsh;
- River Roach at Rochford – this is a section of the River Roach at Rochford, above the tidal limit;
- Butts Hill Pond – this site contains a pond;
- The Finches – this site contains a pond;
- Barling Pits – this site consists of flooded gravel pits;
- Star Lane Pits – this site consists of flooded gravel pits;
- Paglesham Seawall – this is a seawall on the tidal River Roach;
- Great Wakering Common – this site contains a pond and ditches; and
- Wallasea Island Managed Realignment – this consists of an area of intertidal habitat on the River Crouch.

### 4.5.4 Screening assessment

The focus of the assessment that follows will be on the international sites (Benfleet & Southend Marshes SPA/Ramsar, Thames Estuary & Marshes SPA/Ramsar, Crouch & Roach Estuaries SPA/Ramsar, Foulness SPA/Ramsar and Essex Estuaries SAC) and the Pitsea Marsh SSSI, Vange & Fobbing Marshes SSSI and Holehaven Creek SSSI and those local wildlife sites that are hydrologically sensitive.

**Basildon Borough**

None of Basildon Borough's WwTWs directly discharge into a European site. However, Pitsea WwTW does discharge into a watercourse (Timberman's Creek) that is connected to Pitsea Marsh SSSI, down through the Holehaven Creek SSSI and into the River Thames approximately 5km upstream of Benfleet & Southend Marshes SPA/Ramsar site. In addition, the point of confluence with the River Thames is directly opposite the Kent parts of the Thames Estuary & Marshes SPA/Ramsar site. Of the fifteen non-statutory local wildlife sites in Basildon that are hydrologically sensitive, none are connected to watercourses into which treated sewage effluent is discharged.

In addition to WwTWs within Basildon Borough, there is a single WwTW outside Basildon Borough that services part of Billericay called Shenfield and Hutton WwTW. However, this WwTW has considerable headroom within the existing discharge consent (4,843 m3/day equating to roughly 18,450 houses). Under the East of England Plan the adjacent Brentwood District was required to deliver approximately 2,000 new homes between 2006 and 2021. The Brentwood Core Strategy is still at an early stage so it is not known exactly how many dwellings they intend to deliver or where. However the headroom at Shenfield and Hutton WwTW is such that even if a large amount of housing in Brentwood was connected to it (which is unlikely unless the Green Belt boundaries were reviewed), the low levels of growth (100 houses) possible in Billericay's urban area could be accommodated without a change to the existing discharge consent. As such, impacts will have already been considered in the Review of Consents and discharge consent approval processes and further consideration should not be required for the Water Cycle Study.

**Castle Point Borough**

None of Castle Point's WwTWs discharge into a European designated site. However, Canvey Island WwTW discharges directly into the River Thames at a point approximately 2 km upstream of Benfleet & Southend Marshes SPA/Ramsar site. In addition, the discharge point is directly opposite the Kent parts of the Thames Estuary & Marshes SPA/Ramsar site. Furthermore, Benfleet WwTW discharges into the Benfleet at a point approximately 3.5 km upstream of Management Unit 6 of Benfleet & Southend Marshes SSSI/SPA/Ramsar site. None of Castle Point's WwTWs discharge into Holehaven Creek SSSI, Pitsea Marsh SSSI or Vange & Fobbing Marshes SSSI. Of the eleven non-statutory local wildlife sites in Castle Point that are hydrologically sensitive, none are connected to watercourses into which treated sewage effluent is discharged.

**Rochford District**

Foulness/Churchend WwTW discharges into watercourses that ultimately drain into Foulness SPA. Paglesham-East End WwTW discharges directly into the Crouch & Roach Estuaries SPA, while Rochford WwTW and Rayleigh West also appear to discharge into a watercourse which drains to this SPA. Rayleigh East WwTW also discharges to a watercourse which drains into this SPA, but the distances are larger (approximately 6.5km). None of Rochford's WwTWs discharge into Holehaven Creek SSSI, Pitsea Marsh SSSI or Vange & Fobbing Marshes SSSI,

while Canvey Wick SSSI appears to by hydrologically separated from any surface watercourses into which WwTWs discharge. Of the thirteen non-statutory local wildlife sites in Rochford that are hydrologically sensitive, five (Brandy Hole Marsh Extension, the Dome Grasslands, River Roach at Rochford, Paglesham Seawall and Wallasea Island managed realignment) are connected to watercourses into which treated sewage effluent is discharged.

The most likely possible water quality effects that require consideration are:

- increased total oxidized nitrogen and phosphorus, potential lowering of dissolved oxygen for a stretch and an increase in biological oxygen demand and nitrogen for a given distance; and
- potential increase in velocity and levels, notable at lower to normal flows for a distance downstream as a result of the additional wastewater volumes entering the river.

While nutrient levels within the various European sites covered by this WCS (Benfleet & Southend Marshes SPA/Ramsar, Thames Estuary & Marshes SPA/Ramsar, Crouch & Roach Estuaries SPA/Ramsar, Foulness SPA/Ramsar and Essex Estuaries SAC) are high, a combination of tidal energy, high sediment loading and erosion means that the hyper-nutrification tends not to result in the smothering macroalgal growth that is having an adverse effect upon other European marine sites[49]. As a result, it is considered that these European sites are considerably less vulnerable to adverse effects as a result of an increase in nutrients due to increased volume of effluent discharged from Pitsea WwTW, Canvey Island WwTW, Paglesham-East End WwTW, Rochford WwTW, Wickford WwTW or Rayleigh West WwTW.

The development of significant amounts of housing within Basildon, Castle Point and Rochford will take place at a time when water quality improvements to the Thames Tideway as a whole will be implemented through various Thames Water/Environment Agency schemes including the interception and storage of wastewater from a large number of Combined Sewer Overflows (CSOs) in London which currently discharge directly to the River Thames during periods of heavy rainfall and expansions to the treatment capacity of Thames Water's Crossness, Riverside, Long Reach and Beckton WwTWs which will enable them to treat greater quantities of wastewater to a higher standard than is currently the case. As such, the overall water quality of the River Thames should actually improve over the delivery period due to the cumulative affect of these initiatives. It should also be noted that the trend within the various European sites is a general improvement in water quality and reduction in WwTW inputs, and this will form the background to any new housing delivery within the LPA areas.

It must also be noted that, according to the Foulness RoC, the SPA has an estimated tidal flux over a 12-hour period of over 100 million cubic metres. The corresponding freshwater inputs under flood flow conditions in a 12-hour period based were estimated to be 8,316 $m^3$ under naturalised conditions and 8,308.7 $m^3$ under fully licensed conditions. The estimated freshwater flow input from this overall water balance is thus about 0.008% of the tidal flux for both the natural and fully licensed scenarios. This shows that at a site scale, the inter-tidal areas of the Foulness SPA are virtually entirely marine-dominated and the contribution of freshwater can be considered 'trivial' to the overall water budget as below the generic 1% threshold used for estuary and coastal site assessments.

The Environment Agency Review of Consents for these European sites concluded that there would be no adverse effect in terms of eutrophication as a result of currently consented discharges of treated sewage effluent. If any discharges as a result of additional housing within

[49] Dave Lowthion, Environment Agency Supra-Area Marine Team Leader, Southern Region, personal communication during the preparation of the Appropriate Assessment of the draft South East Plan in 2006

the study area can remain within existing headroom and consent limits there will thus be no need for further assessment.

Given the small amount of new development likely to be delivered in each catchment and the relatively low sensitivity of the European sites in question to nutrient enrichment, it may well be that a significant effect (either alone or in combination) would be unlikely even if discharges were to require an increase in existing consents. However, the impact of any discharges that require a change to existing consents should nonetheless be considered further through a Detailed WCS.

**Sediment regimes**

Increased volumes of effluent being discharged to the River Thames, Crouch/Roach, Benfleet or Foulness may have an effect on local sediment regimes principally through increased erosion. However, this effect is likely to be very locally restricted to the immediate vicinity of the relevant outfalls. This issue does not therefore require further investigation as part of this Outline WCS unless proposals to substantially increase the consented discharge volumes are developed.

There will only be a need to give further consideration to water quality effects if a change in the consented discharge of the following WwTWs is required:

- Pitsea WwTW;
- Canvey Island WwTW;
- Benfleet WwTW;
- Rochford WwTW; and
- Rayleigh West WwTW.

Even here however, it may well be that a significant effect (either alone or in combination) would be unlikely given the small amount of new development likely to be delivered in each catchment and the relatively low sensitivity of the European sites in question to nutrient enrichment, even if discharges were to require an increase in existing consents. This would however need to be established through a Detailed WCS, once the exact numbers and locations of the proposed housing have been determined.

## 4.6 Wastewater Network Capacity Assessment

A high level assessment of the existing wastewater network in catchment areas with significant growth proposed has been carried out in order to identify which catchments have capacity to convey increased flows from new development.

The study area is relatively flat and the majority of the wastewater networks rely on pumping stations to transfer flow to the treatment works. In addition, most of the drainage catchments have records of sewer flooding incidents as recorded in the DG5[50] register to OFWAT (see Table 4-7 below).

[50] As part of an ongoing performance checking process associated with delivery during the AMP Period, each year OFWAT require Water Companies to report on the current number of properties in their areas at risk of flooding. This is reported under a series of returns to the Director General (DG) of OFWAT known as the June Return. OFWAT describe this process as “our main source of information…….in which each company sets out its levels of service to customers, the investment it has made and the outputs delivered”. Sewer flooding is the fifth measure and hence known as the DG5 Register (others include DG2 – Properties affected by low water pressure and DG3 – Properties affected by supply interruptions). The information contained on these returns is critical in terms of assessing company performance.

Some of the key WwTWs considered are combined systems (i.e. they transmit both foul wastewater and surface water) further study will be required to confirm which WwTWs have Settled Storm Sewage Discharge Consents (SSSDC)

**Table 4-7: Catchment Sub Areas with DG5 records of sewer flooding**

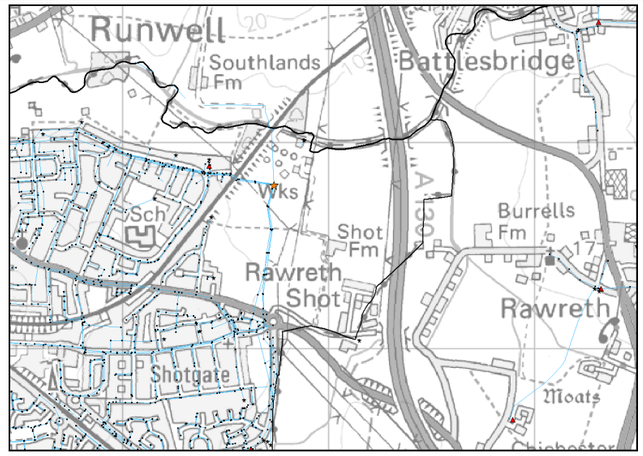
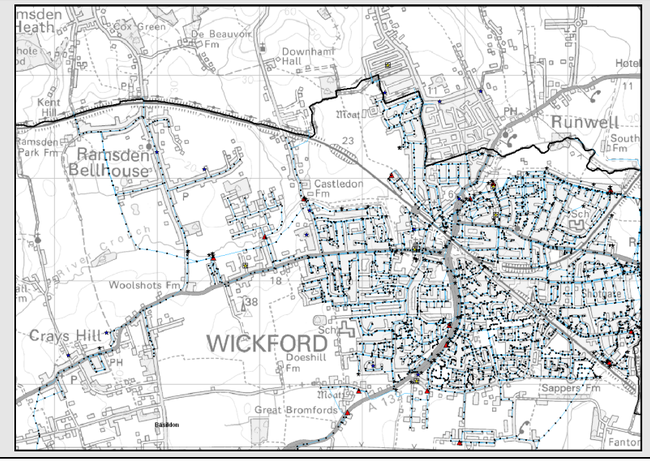
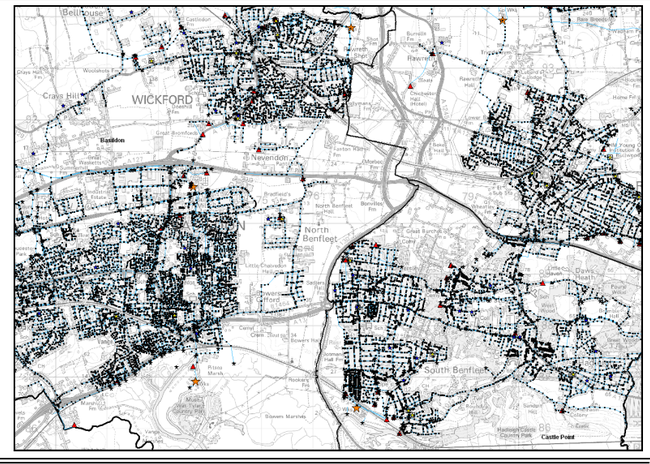
| Catchment Names[51] | Sub Areas within Catchment | DG5 |
|---|---|---|
| Southend | Star Lane (Great Wakering) | ✓ |
| Rochford | Stambridge Mills (Rochford) | ✓ |
| Rayleigh West | Rawreth Industrial Estate (Rawreth) | ✓ |
| Rochford | Hockley Centre (Hockley) | ✓ |
| Billericay | Billericay Town Centre | ✓ |
| Basildon | Fords Dunton | ✓ |
| Basildon | Laindon Town Centre | ✓ |
| Basildon | Dry Street and College | ✓ |
| Basildon | Basildon Town Centre | ✓ |
| Basildon | Gardiners Lane South | ✓ |
| Pitsea (or Basildon) | Pitsea Town Centre | ✓ |
| Wickford | Barn Hall, Wickford | ✓ |
| Wickford | Wickford Town Centre | ✓ |
| Wickford | Area 01 | ✓ |
| Wickford/Basildon | Areas 02, 03, 04 and 17 | ✓ |
| Basildon | Areas 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 18, 19, 23 and 24 | ✓ |
| Pitsea (or Basildon) | Area 20, 21 and 22 | ✓ |

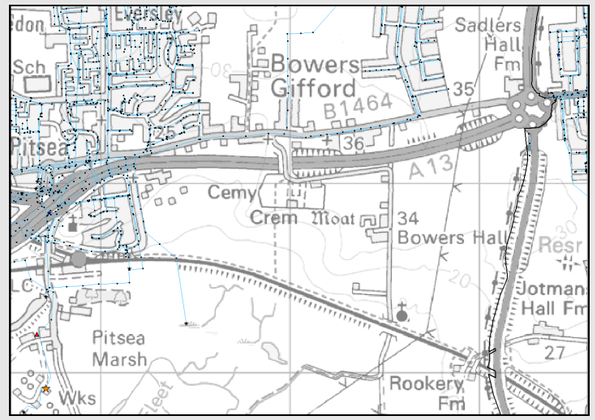
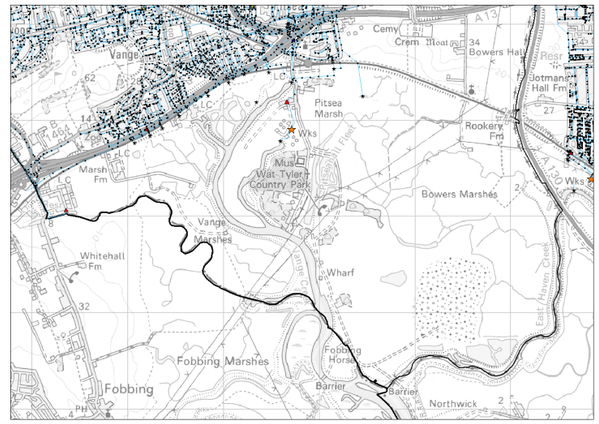
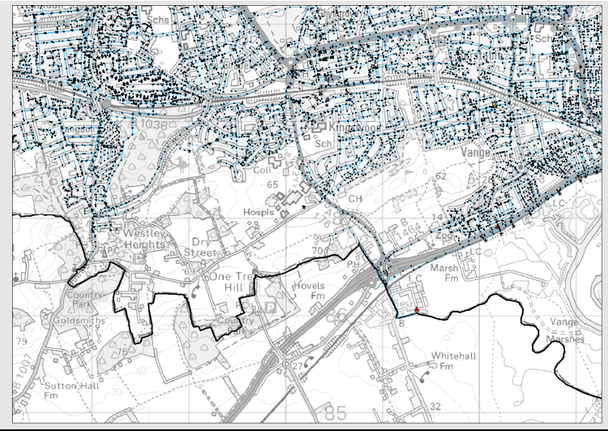
In order to fully assess the capacity within wastewater networks further study and information is required, including development site locations and sizes and likely numbers of housing per site and pumping station details, through a Detailed Water Cycle Study. Additionally, network models are needed for combined or pumped systems to assess the quantities of rainwater and pumped flow in the network, as this will have an effect on available capacity. Network modelling should be undertaken when a preferred set of detailed housing and employment sites is known, through a Detailed Water Cycle Study.

The network layout, including pipe sizes and locations of pumping stations have been used in conjunction with records of sewer flooding and AWS feedback on problem drainage areas, to determine which catchments are likely to have more capacity than others. The assessments have been carried out where there is significant growth proposed of 50 houses or more. The details of this assessment are summarised in Table 4-8 below.

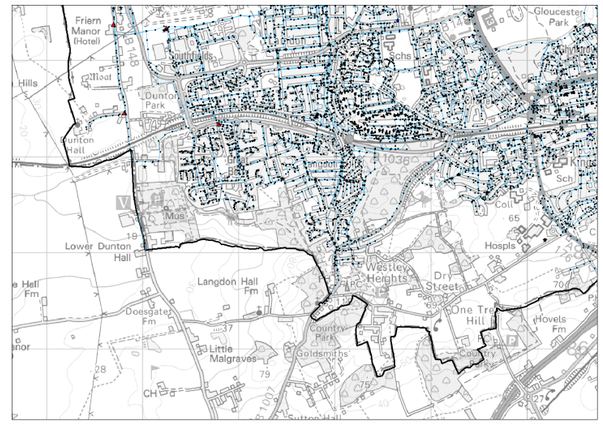
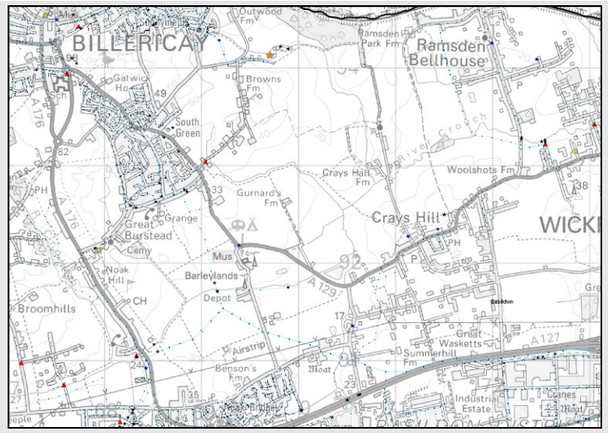
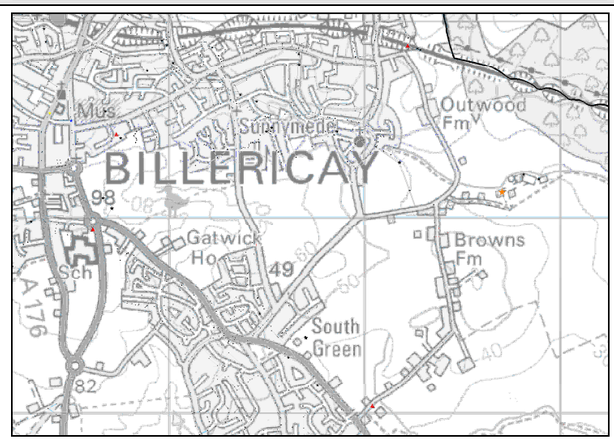
[51] Catchment name reference refers to WwTW it is connected to.

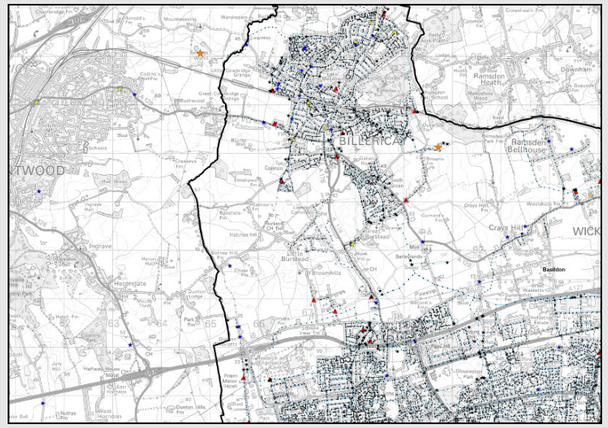
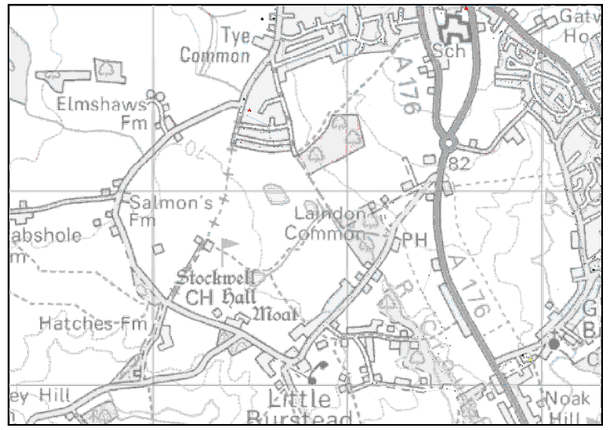
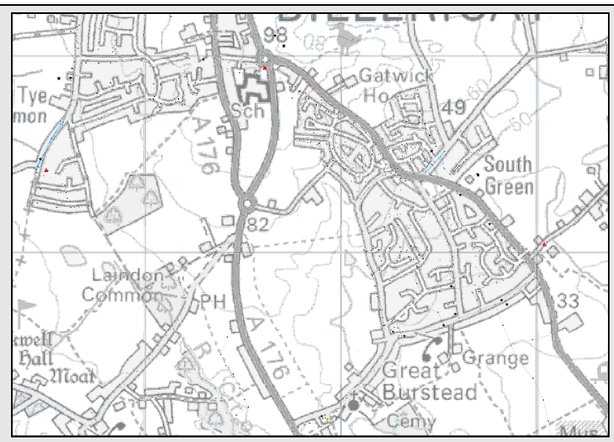
**Table 4-8: Wastewater Network Assessment**

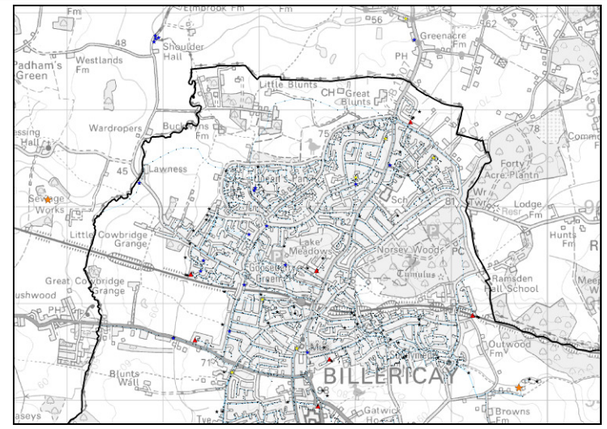
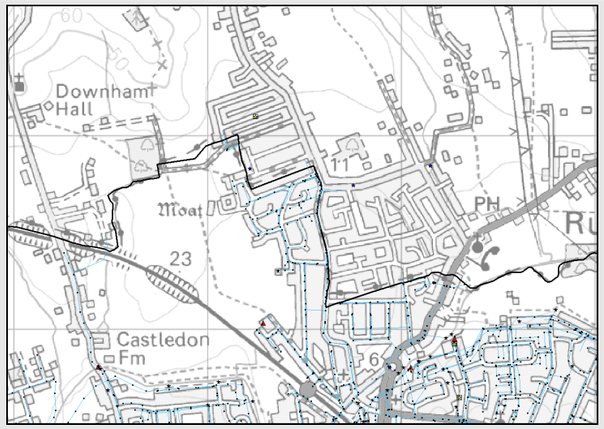
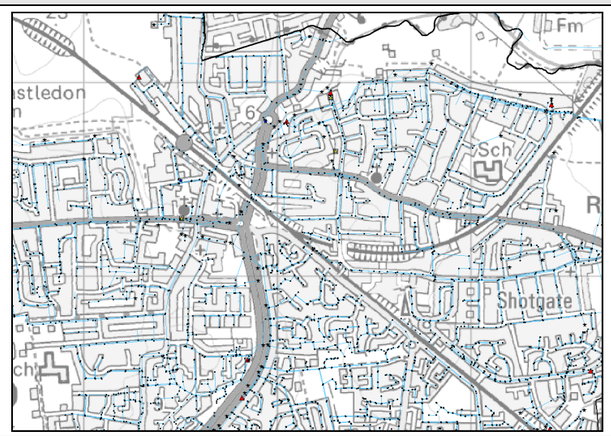
| Town | WwTW | Catchment Description | Location |
|---|---|---|---|
| **Basildon** | | | |
| Area 01 - Basildon | Wickford | The Wickford network consists of a combination of gravity sewers and pumped rising mains. A number of DG5 flood events are recorded in various locations within the network. The network is combined foul and surface water.<br><br>Area 01 consists greenfield land adjacent to the existing Wickford WwTW so could be connected directly to the terminal sewer with no need for upgrade of the sewer network. |  |
| Areas 02, 03, 04, and 17 - Basildon | Wickford | The Wickford network consists of a combination of gravity sewers and pumped rising mains. A number of DG5 flood events are recorded in various locations within the network. The network is combined foul and surface water. Areas 02 and 03 consist of a mix of greenfield and brownfield land. The development is at the head of sewer runs (i.e. furthest from the WwTW) leading to Wickford WwTW, and it is likely that these would need upgrading in order to receive additional flows. Areas 04 and 17 consist mainly of greenfield land. Area 04 has existing sewer infrastructure with combined gravity mains ranging in size from 150mm to 300mm but area 17 has no existing sewer network.<br><br>Review of network models would be required to determine whether the surrounding infrastructure has capacity to take additional flows from housing development without upgrades being required, and to determine the impact on the network in terms of flooding and overflow events. |  |
| Areas 18 and 19 – Basildon | Basildon | Areas 18 and 19 consist largely of greenfield land, but with existing housing developments running through both. The main trunk sewers leaving these areas are 225 mm and 300 mm, which suggests upgrades may be required if significant new development were to be located here. Modelling of the adjacent network is required to determine the number of houses that can be located within these areas. |  |

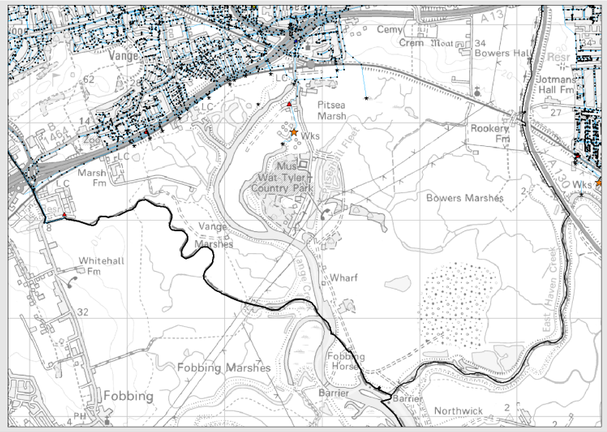
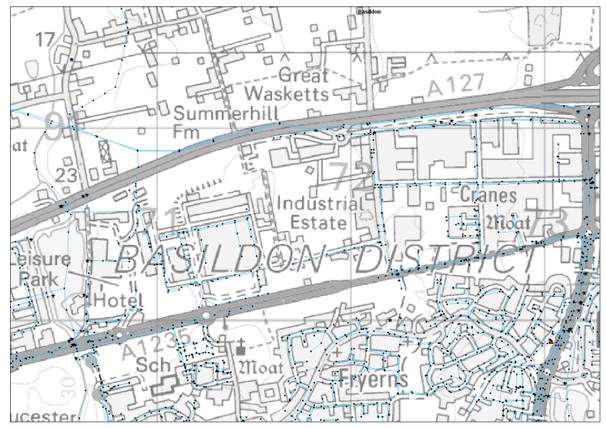
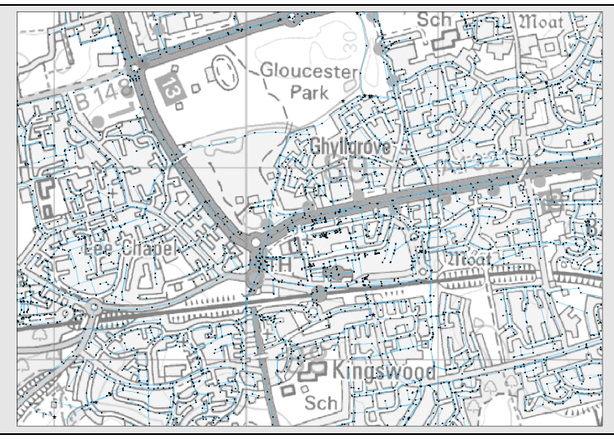
| Town | WwTW | Catchment Description | Location |
|---|---|---|---|
| Area 20 - Basildon | Pitsea | Area 20 drains to Pitsea WwTW and consists largely of greenfield land.<br><br>Model runs will be required to determine the capacity of the network to take additional flows. The network drains principally by gravity to a terminal transfer pumping station close to the Pitsea works. |  |
| Area 21 - Pitsea | Pitsea | Area 21 drains to Pitsea WwTW and consists of greenfield low lying land that is marshy and prone to flooding. There is no sewerage infrastructure aside from Pitsea WwTW and its outfall to Timberman's Creek. Model runs will be required to determine the capacity of the network to take additional flows. The network drains principally by gravity to a terminal transfer pumping station close to the works.<br><br>The majority of area 21 is at a high probability risk of flooding (Flood Zone 3a[52]) and although sewerage infrastructure would meet the requirements of PPS25, any infrastructure in this zone would need adequate pollution control measures in place. |  |
| Area 22 | Pitsea | Area 22 drains to Pitsea WwTW. The area lies to the south of Basildon Hospital and largely consists of farmed greenfield land, encompassing Basildon Golf Course to the east. There is little existing sewage infrastructure within area 22.<br><br>The network drains principally by gravity to a terminal transfer pumping station close to the Pitsea works and model runs will be required to determine the capacity of the network to take additional flows. |  |

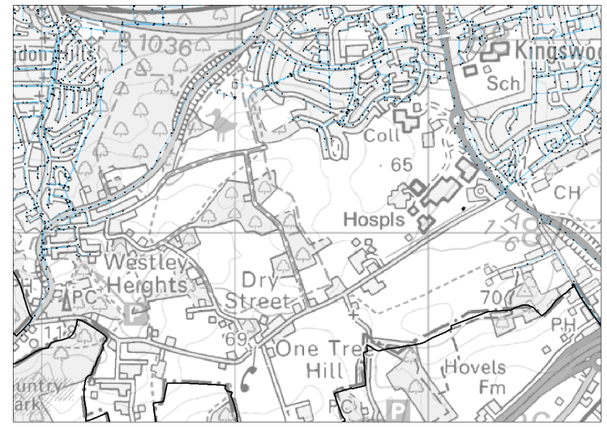
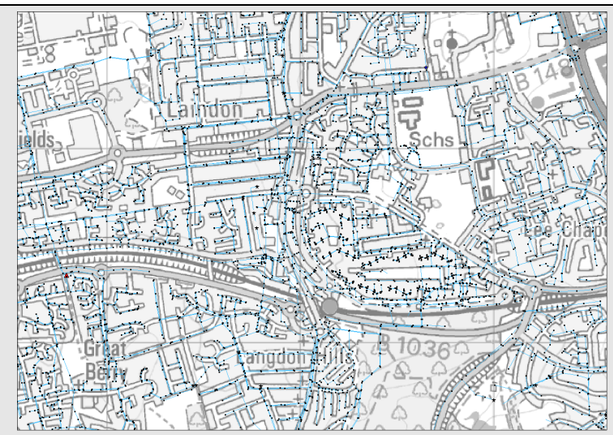
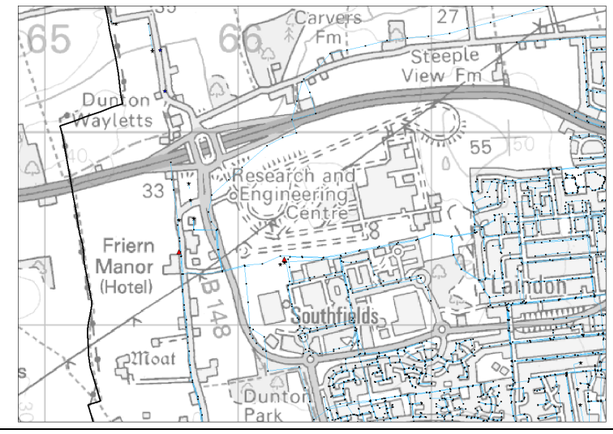
[52] URS Scott Wilson Level 2 SFRA 2011

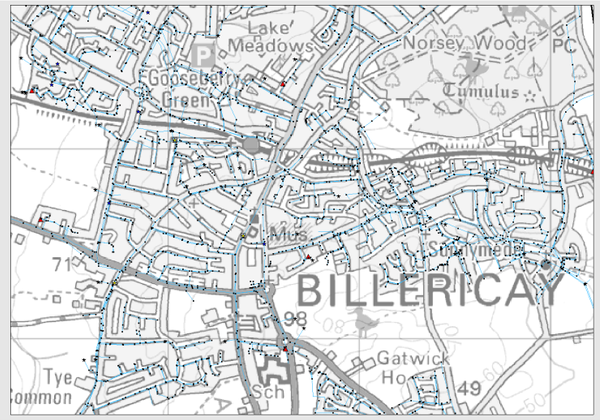
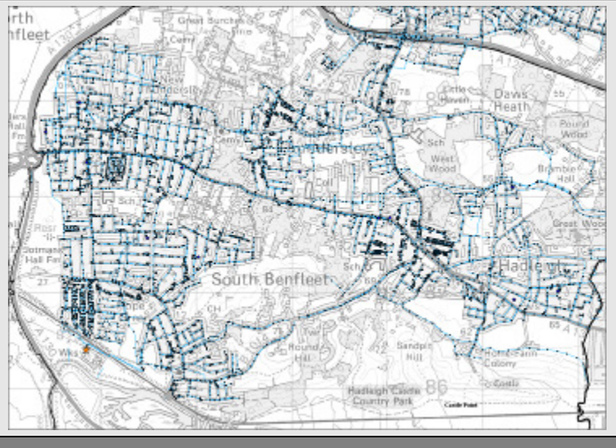
| Town | WwTW | Catchment Description | Location |
|---|---|---|---|
| Areas 23 and 24 - Basildon | Basildon | Area 23 encompasses Willow Park, Westley Heights Country Park and farmland. Area 24 covers Dunton Park, Dunton Hall, Friern Manor and farmland. There is little existing sewage infrastructure in the two areas, but connection could be made along their north and eastern edges. New sewers are likely to connect from area 23 by gravity, but area 24 has a number of transfer pumping stations along the periphery which are likely to need upgrading in the event of receiving additional flows from new development. |  |
| Areas 05, 16, 06, 14, and 15 - Basildon | Basildon | Area 16 has existing housing and sewage infrastructure although modelling would be required to determine whether existing flows could be accepted by the network. No GIS data on existing sewers was available for area 16.<br><br>Areas 05, 06, 14 and 15 consist largely of farmland and have little established sewerage infrastructure, although area 14 does have a 375 mm diameter combined sewer main that passes through centrally. This line has sewer discharge outfalls near a depot, which are thought to be combined sewer overflows). These are likely to need upgrading should there be additional flows from new development and connection is to be made to the sewer. |  |
| Area 07 | Billericay | Area 07 lies to the south east of Billericay and consists of steeply sloped farmland, which could make it suitable for gravity sewer drainage. The Billericay network is combined foul and surface water flows and consists of a combination of gravity sewers and pumped rising mains. A number of DG5 flood events are recorded in various locations within the network.<br><br>However, due to the proximity of the area to Billericay WwTW, it is thought that little upgrade would be required to the existing infrastructure. |  |

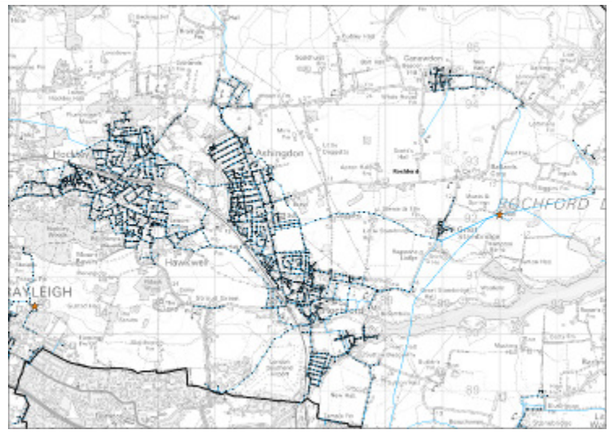
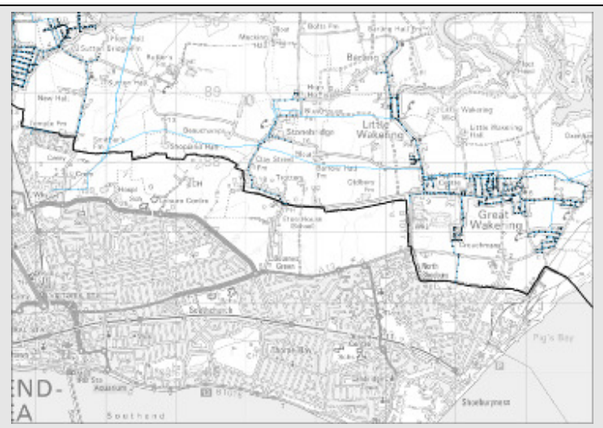
| Town | WwTW | Catchment Description | Location |
|---|---|---|---|
| Areas 10 and 11 | Billericay/Basildon | Areas 10 and 11 are not connected to the existing network and so connection to existing WwTW infrastructure (Basildon, Billericay or Shenfield and Hutton) could require upgrading of existing sewers. |  |
| Area 12 | Billericay | Area 12 consists of greenfield land with a mix between forested and farmed usage, encompasses Burstead Golf Course, and also has a number of residential properties. There is an existing 675 mm sewer at the head of a sewer run to Billericay WwTW which begins in Wiggins Lane and runs along Tye Common Road. This should be earmarked for connection should development in this area be investigated further, however it is of unusually large diameter for a sewer at the head of a run, and is possibly taking significant farming and commercial flows, or has been sized for future development.<br><br>The Billericay network is combined foul and surface water flows and consists of a combination of gravity sewers and pumped rising mains. A number of DG5 flood events are recorded in various locations within the network. Modelling would be required to determine whether the existing network has capacity to take additional flows from this area. |  |
| Areas 13 and 08 | Basildon | The Billericay network is a combined foul and surface water system and consists of a combination of gravity sewers and pumped rising mains. A number of DG5 flood events are recorded in various locations within the network. This is likely to mean that the network is already running at capacity and modelling would be required to determine where new flows can be accepted by the system, or where infrastructure upgrades could be required.<br><br>Area 08 is on the north side of Southend Road, which is at the head of sewers which run to the Basildon catchment. Only relatively small diameter pipes (150 mm – 225 mm) are available for connection, meaning upgrades of the existing infrastructure are likely to be required, should development take place in this location.<br><br>Area 13 consists of largely undeveloped greenfield agricultural land, which would be expected to drain to the Basildon catchment. The available sewer pipe for connection is only 225 mm in diameter and has a DG5 flood record just downstream of the area 13 footprint. |  |

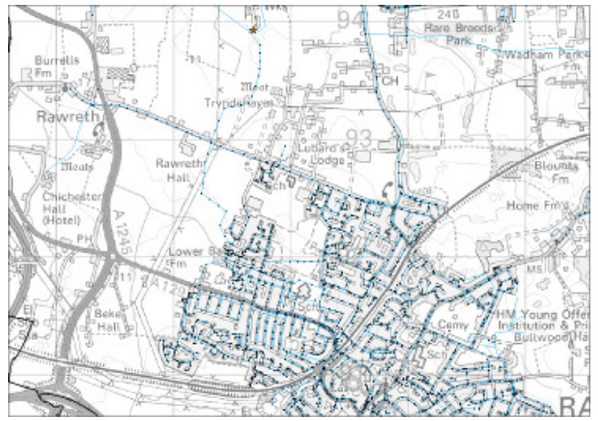
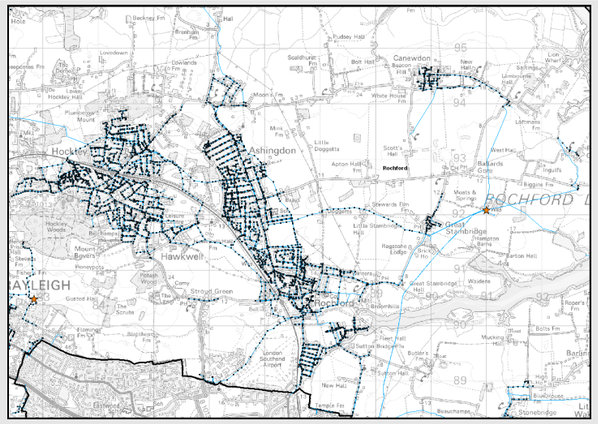
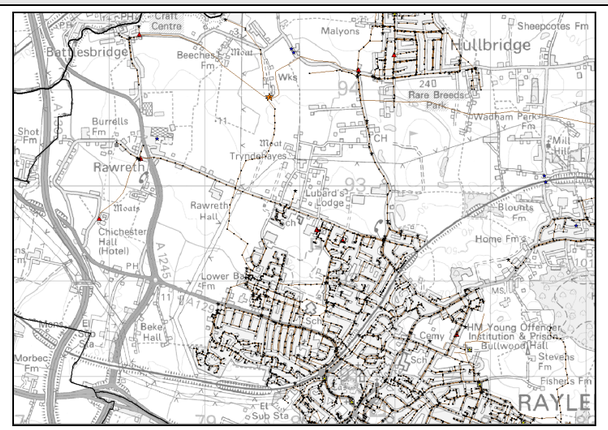
| Town | WwTW | Catchment Description | Location |
|---|---|---|---|
| Area 09 | Billericay | The Billericay network is combined foul and surface water flows and consists of a combination of gravity sewers and pumped rising mains. A number of DG5 flood events are recorded in various locations within the network. This is likely to mean that the network is already running at capacity and modelling would be required to determine where new flows can be accepted by the system, or where infrastructure upgrades could be required.<br><br>Area 9 consists of largely undeveloped greenfield land used for agriculture, but there is also some woodland and a golf course within its footprint. Connection could be made to a number of sewer runs, but as mentioned previously, modelling to determine spare capacity and the impact on the network of additional flows would be required. |  |
| Barn Hall, Wickford | Wickford | The Wickford network consists of a combination of gravity sewers and pumped rising mains. A number of DG5 flood events are recorded in various locations within the network. The network is combined foul and surface water. Analysis of existing network models is required to determine the feasibility of new housing at this location in terms of reviewing the capacity of the existing sewer network to receive additional flows.<br><br>The ASR land at Barn Hall is in a Greenfield area. The adjacent Lindon Road to the northeast has several DG5 records of flooding. The development is at the head of sewer runs leading to Wickford WwTW, and it is likely that these would need upgrading in order to receive additional flows. |  |
| Wickford Town Centre | Wickford | The Wickford network consists of a combination of gravity sewers and pumped rising mains. A number of DG5 flood events are recorded in various locations within the network. The network is combined foul and surface water.<br><br>The area is Wickford's only town centre and includes a High Street, Aldi supermarket, car parks, offices, leisure and community facilities and residential properties. Analysis of network models is required to determine the feasibility of development at this location in terms of reviewing the capacity of the existing sewer network to receive additional flows. |  |

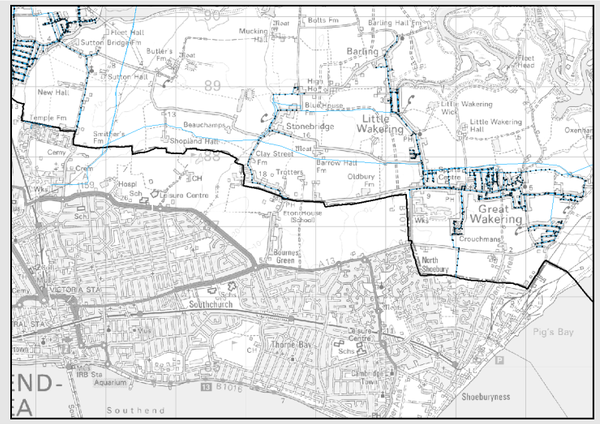
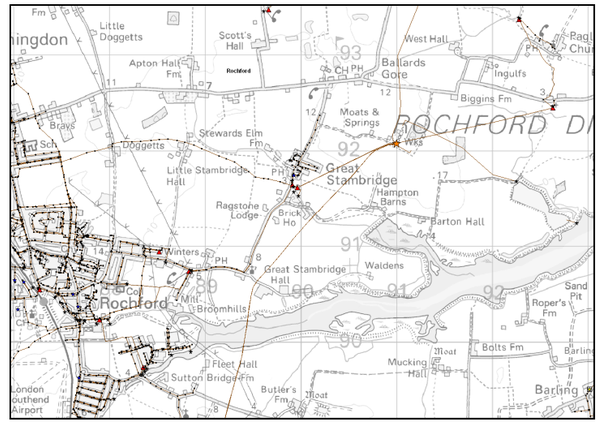
| Town | WwTW | Catchment Description | Location |
|---|---|---|---|
| Pitsea Town Centre | Pitsea | The Pitsea network connects to the larger Basildon STW network to the North. Model runs will be required to determine the capacity of the network to take additional flows. The network drains principally by gravity to a Terminal Transfer Pumping Station close to the Works. |  |
| Gardiners Lane South, Basildon | Basildon | Any potential development in this location would be on a greenfield site consisting of sports pitches, club houses and a small number of residential properties. An existing 150 mm sewer that runs parallel to Gardiners Close will not have sufficient capacity to take any significant additional flows, but a 675 mm sewer to the south of the site parallel to Cranes Farm Road exists, as does a 975 mm sewer to the north of the site running parallel to the A127 Southend Arterial Road. Both are likely to have capacity to take additional flows, but modelling required to determine whether additional capacity is actually available and whether there would be any negative impact on the existing network. |  |
| Basildon Town Centre | Basildon | The area is encompasses the area of Basildon Town Centre, its immediate periphery and the southern extent of Gloucester Park. A 1,550 mm diameter sewer runs through the middle of the development site under Roundacre.<br><br>The Basildon sewer network is a large complicated network consisting of combined sewers, and the potential development area is in a pre-developed area. Detailed network modelling would be required to assess the capacity of the existing system and the impact of additional flows on the network. |  |

| Town | WwTW | Catchment Description | Location |
|---|---|---|---|
| Dry Street and College, Basildon | Basildon | Any potential development in this location would be on a on Greenfield and/ or brownfield land to the north and west of Basildon University Hospital, incorporating the Dry Street ASR. There is no sewage infrastructure within the location, although there are existing sewers to the east. However, information on their diameters was not available at the time of writing. The hospital connects to a large 975 mm diameter sewer to the south east of the location, but a direct connection from the site to this sewer would not be possible due to the presence of the hospital. It is also unknown without reviewing the network model whether this sewer can take additional flows.<br><br>Small diameter sewers to the north of the development site may have limited capacity to take additional flows; again, this requires network modelling to confirm. |  |
| Laindon Town Centre, Basildon | Basildon | Any potential development in this location would be on a brownfield site, which comprises the Laindon Shopping Centre. Principal sewers adjacent to the site have diameters up to 450 mm, suggesting that there may be capacity for increased flows.<br><br>Network modelling is required to inform potential development, as the network is a large combined system and additional flows from new development would need to be assessed both in terms of whether the network can accommodate the additional flows and whether there will be any adverse effect on the existing network due to increased sewer flooding and overflow events. |  |
| Fords Dunton, Basildon | Basildon | Any potential development at Fords Dunton could be on Greenfield or brownfield land. A large proportion of the proposed site consists of the existing Research and Engineering Centre, although land is currently unoccupied to its north, east and west. There is no existing sewage infrastructure in the area (privately owned infrastructure may exist), but it is surrounded by an existing network. The existing network consists of a number of transfer pumping stations and rising mains, with some balancing storage suggesting there may not be much additional capacity within the network to take an increase in flow. |  |

| Town | WwTW | Catchment Description | Location |
|---|---|---|---|
| Billericay Town Centre | Billericay | The Billericay network is combined foul and surface water network, which consists of a combination of gravity sewers and pumped rising mains. A number of DG5 flood events are recorded in various locations within the network.<br><br>Any potential development in this location would be in the town centre on brownfield sites. Existing sewer infrastructure exists in the area and principal mains generally have a diameter of 225mm.<br><br>Model runs are required to determine whether additional flows can be accommodated within the network. |  |
| **Castle Point** | | | |
| Canvey Island | Canvey Island | This is a combined network with a high proportion of transfer pumping stations due to the flat aspect of the catchment. There are records of DG5 flooding incidents in 2 locations, and there are records of inland sewer discharges.<br><br>The network is likely to need upgrading, including pumping stations, gravity sewers and rising mains. Large parts of the catchment will need modelling due to the spread of the proposed housing growth areas. The proposed Northwick development is some distance from the existing sewer network and has no sewerage infrastructure so new infrastructure will be required, including pumping station(s) and rising mains.<br><br>The development area to the east of the A130 has no infrastructure at present, and is bounded by roads to the west and north, and a watercourse to the east which already has sewers discharging to it. There are existing sewers for connection to the south, but these are of small diameter and appear to be near capacity. |  |
| South Benfleet | Benfleet | This is a large combined network with a combination of gravity and pumped sewers. DG5 flooding has been recorded in adjacent to the A130 and one of the proposed development areas, and also next to the B1006 in proximity to Benfleet WwTW.<br><br>Large parts of the catchment will need modelling in order to determine both sewer capacity and the effect of the proposed housing on the existing infrastructure. Both high and low predicted housing growth rates will need extensive upgrades of the sewer network. The proposed development area north west of Great Burches Farm has no existing sewer infrastructure and will need a transfer pumping station and rising main. |  |
| **Rochford** | | | |

| Town | WwTW | Catchment Description | Location |
|---|---|---|---|
| Rochford | Rochford | The principal wastewater network in Rochford is a combined system that drains to Rochford WwTW, which is located in the centre of the district. The catchment is dependent on a network of pumping stations, with the WwTW being served by four rising mains. There are several records of DG5 flood events in the Hockley and Hawkwell areas of the development. Some sewer discharges occur adjacent to the terminal pumping stations to the WwTW.<br><br>Network modelling is required for all new proposed developments as the network is a large combined system and additional flows from proposed developments will have to be assessed both in terms of whether the network can accommodate the additional flows and whether there will be any adverse effect on the existing network due to increased sewer flooding and overflow events.<br><br>The proposed West Rochford development will need modelling as it is at the end of a network taking flows from Ashingdon, Hawkwell and Hockley, which are also proposed to have large numbers of houses over the same timeframe. The downstream transfer pumping station is likely to already be at capacity due to the number of sewer discharges in close proximity. South Hawkwell development will also require network modelling.<br><br>More information is required on the housing location for West Hockley. Depending on the new housing location, the new sewers may drain either through the Ashingdon network through to Rochford sewage treatment works, or to Rayleigh West sewage treatment works. Low number of new housing stock means new flows are likely to be accommodated in the existing network with little adverse affect.<br><br>The East Ashingdon and South East Ashingdon proposed developments are in a catchment with a relatively flat landscape and long sewer runs leading to Rochford WwTWs, which requires the sewerage network to have numerous pumping stations along its route. The principal trunk main is gravity flow to a terminal transfer pumping station. It is probable that the pumping station capacity is already being exceeded due to a number of historic sewer discharge events in close proximity to the pumping station hence upgrades are likely to be required to serve development here.<br><br>Canewdon-Loftmans Corner TPS (the existing transfer pumping station on the principal rising main) is likely to need an upgrade due to the proportional flow increase, as well as the corresponding downstream sewers. The 22" rising main is likely to have sufficient capacity to take the new flows, depending on the surface water volumes entering the system. |  |
| Great Wakering | Southend | Sewage from Great Wakering is conveyed to Southend WwTW to the southwest. Southend WwTW is currently the subject of an individual Water Cycle Study. The sewer network within Southend-on-Sea is a highly complex combined system, which transfers both foul sewage and surface water from the urban catchment to Southend WwTW via single terminal transfer pumping station. There are critical flooding problems within this network, which is operating at, or even above, capacity with numerous DG5 flood events recorded.<br><br>It is therefore not possible that the flows generated by the proposed development in west Great Wakering can be accommodated by the Southend WwTW and sewer network without significant infrastructure upgrades. |  |

| Town | WwTW | Catchment Description | Location |
|---|---|---|---|
| Rayleigh | Rayleigh West | This is a large combined network with flow draining to the WwTW by gravity. Network modelling will be required for all development proposals in the catchment. There are several sewer discharge and DG5 flooding events recorded within the network.<br><br>One proposed development is North of London Road, Rayleigh, near Lower Barn Farm. There are some sewer discharges on the existing 150 mm diameter minor branch sewers, however it is anticipated that a new connection is unlikely to affect existing flooding. Drainage is by gravity sewer to WwTW. The new connection will be a gravity connection, with no pumping stations required. The principal sewer is 675 mm diameter and with no flood events recorded it is probable that the sewer infrastructure will not need upgrading.<br><br>For the proposed development at South West Hullbridge, connection would be close to the existing terminal transfer pumping station. The rising main diameter is unknown and the location of the proposed development is still to be determined. The sewerage infrastructure and transfer pumping station are highly likely to need an upgrade due to large proportionate increase in DWF. New connection will be to the existing gravity sewer near to the existing transfer pumping station which pumps directly to the WwTW. |  |
| Hockley Centre, Hockley | Rochford | The Rochford WwTW catchment is dependent on a network of pumping station, with the WwTW being served by four rising mains. There are several records of DG5 flood events in the Hockley area of the development and some sewer discharges occur adjacent to the terminal pumping stations to Rochford WwTW.<br><br>The proposed Hockley Centre development will need modelling, as it discharges into a network taking flows from Ashingdon, Hawkwell and Rochford. The network is a large combined system and additional flows from the proposed development will have to be assessed both in terms of whether the network can accommodate the additional flows and whether there will be any adverse effect on the existing network due to increased sewer flooding and overflow events. The downstream transfer pumping station is likely to already be at capacity due to the number of sewer discharges in close proximity.<br><br>More information is required on the housing location for Hockley Centre. Depending on the new housing location, the new flows may drain either through the Ashingdon network through to Rochford WwTW, or to Rayleigh West sewage treatment works. The terminal pumping station leading to Rayleigh West WwTW has a number of sewer discharges in close proximity and may be operating near capacity. The low number of new housing stock means new flows are likely to be accommodated in the existing network, but the capacity of terminal and transfer pumping stations will need to be reviewed. |  |
| Rawreth Industrial Estate, Rawreth | Rayleigh West | This is a large combined network with gravity flow to the WwTW. There are several sewer discharge and DG5 flooding events recorded within the network and modelling will be required for the development proposal.<br><br>The new connection would be a gravity connection directly onto the principal final sewer, with no pumping stations required. The flow increase to the final gravity sewer leading to the WwTW is anticipated to be in the order of 60 l/s (at 6DWF), with the sewer having an estimated 450 l/s full bore flow capacity. The final gravity sewer is 675 mm diameter and with no flood events recorded it is possible that the sewer infrastructure will not need upgrading. |  |

| Town | WwTW | Catchment Description | Location |
|---|---|---|---|
| Star Lane, Great Wakering | Southend | Depending on the exact location along Star Lane, the new development will be on greenfield land, but there is existing sewer infrastructure in close proximity. The sewerage from Great Wakering is conveyed to Southend STW to the West. Southend WwTW is currently the subject of an individual Water Cycle Study. The sewer network within Southend-on-Sea is a highly complex combined system, which transfers both foul sewage and surface water from the urban catchment to Southend WwTW via single terminal transfer pumping station. There are critical flooding problems within this network, which is operating at, or even above, capacity with numerous DG5 flood events recorded.<br><br>It is therefore not possible that the flows generated by the proposed development in Star Lane can be accommodated by the Southend WwTW and sewer network without significant infrastructure upgrades. |  |
| Stambridge Mills | Rochford | The catchment is dependent on a network of pumping station, with the WwTW being served by four rising mains. Network modelling is required for the proposed development as the network is a large combined system and additional flows from will have to be assessed both in terms of whether the network can accommodate the additional flows and whether there will be any adverse effect on the existing network due to increased sewer flooding and overflow events.<br><br>The proposed Stambridge Mills development is immediately upstream of a transfer pumping station, which has an adjacent recorded sewer discharge, and leads to a terminal pumping station with a number of associated discharge events. It is therefore likely that the pumping stations and already operating at capacity and may therefore require an upgrade to accommodate new flows. |  |

## 4.7 Conclusions

Assessment has shown that the following WwTW have no capacity in their consented DWF for any further discharge:

- Wickford WwTW;
- Basildon WwTW; and
- Southend-on-Sea WwTW.

It is known from discussions with AWS that an expansion of Southend WwTW, which drains Great Wakering to the east of Rochford District, would not be possible due to spatial constraints on the WwTW site. In addition, the combined sewer network in Southend-on-Sea is already operating above capacity, with flooding events occurring during even moderate rainfall. Increased flows therefore cannot be accommodated at Southend WwTW, unless capacity were to be created by removing a volume of surface water flow from the network equal to, or ideally greater than, the increased foul flows proposed. Consultation with AWS should be carried out as early as possible in the planning process for development in Great Wakering (or any other areas which may drain to Southend WwTW) to ensure that a solution to the current capacity issue can be reached well in advance of the proposed development. This could be developed as part of a detailed WCS solution.

Discussions with AWS have not indicated that there are any other WwTW sites that are similarly constrained and so, subject to planning permission and the acquisition of adjacent land (where necessary) it should be possible to upgrade or expand all the other WwTW within the study area. It should be noted that it is sometimes possible to expand the capacity of a WwTW without the requirement for additional works' footprint, for example replacing old rotating filter beds with an activated sludge treatment process would allow for additional treatment capacity on smaller footprint, as activated sludge lanes are much smaller than rotating filter beds.

Increases to DWF for Basildon and Wickford WwTW would be required for all growth, regardless of the level proposed, as the works were identified during the AWS flow audit as operating at DWF capacity, as demonstrated by the recent increase in consented DWF. The extent to which the consented DWF would need to be increased is dependent on the amount of growth proposed. The volume increase would in turn affect any tightening of discharge standards that may be required and therefore the viability of any proposed growth. However, modelling showed that considerable increases in population could be accommodated at both Basildon and Wickford WwTW, assuming process upgrades could be carried out to achieve tighter discharge standards. Again, if funding for such upgrades were to be sought through the AMP process, early consultation with AWS would be required to ensure that funding and upgrades can be carried out in advance of any proposed development, otherwise development will need to be phased accordingly.

The other two WwTW located within Basildon Borough, namely Pitsea and Billericay WwTW, currently have capacity within the consented DWF. Pitsea could accommodate an estimated 10,600 additional households and Billericay an estimated 2,100 additional households from a wastewater transfer and treatment perspective. However, should the levels of growth proposed within the catchments exceed these figures, then an increase to consented DWF would be required. Modelling carried out for Pitsea WwTW shows that approximately 12,000 new homes could be accommodated without increasing the polluting load from the works (assuming flows could be treated to the limits of conventional wastewater treatment). For Billericay, RQP modelling results indicate that it is not possible to meet downstream water quality targets for

ammonia with the current discharge volume, even if the treatment standard were improved to the limit of conventional wastewater treatment technology (1 mg/l for ammonia). It would therefore not be possible to increase the discharge volume from Billericay within the limits of conventional treatment without breaching the WFD standards for ammonia.

However, a possible solution to this has been identified, should growth in excess of the estimated 2,100 additional household capacity within the existing DWF consent be required. Shenfield and Hutton WwTW lies to the west of Billericay, within the adjacent Brentwood Borough. There is capacity for an additional 18,450 homes within the consent at Shenfield and Hutton WwTW, which in combination with the capacity of 2,100 households within the existing consented DWF, this would allow for an additional approximately 20,550 houses to be built within Billericay.

It should be noted that the timing of this proposed connection may be dependent on funding through the AMP programme, depending on whether it would be funded by AWS, developer contributions or a combination of the two, early consultation with AWS would be required to ensure that funding and upgrades can be carried out in advance of the proposed development.

# 5 South Essex Water Supply Strategy 2011-2031

## 5.1 Water Resources in the Study Area

The climate within the East of England is typified by low rainfall with little variation in the average amount throughout the year, averaging about 600 mm. The annual evapotranspiration averages 380 mm. Most of the evapotranspiration occurs during the summer months and exceeds rainfall totals over this period. However, winter rainfall and recharge provides the water required to offset this seasonal imbalance.

### 5.1.1 Geology and Hydrogeology

**Basildon Borough**

The predominant solid geology underlying the study area is Thames Group Clay. This is impermeable and therefore rapid runoff can be expected. In the north of the Borough around the urban area of Billericay, Bagshot Beds are present. These comprise sand and clays and are frequently present in the Borough capping the hills of London Clay[53].

The majority of the Borough does not have any drift geology overlying the Thames Group Clay. There are however minimal deposits of sand and gravel along the valley of the Upper Crouch and overlying the Bagshot geology around Billericay.

**Castle Point Borough**

The predominant solid geology underlying the Castle Point Borough is London Clay, which is impermeable and therefore rapid runoff can be expected. In the north of the Borough Bagshot Beds are present. These comprise sand and clays and are frequently present capping the hills of London Clay[54]. The majority of the Borough does not have any drift geology overlying the London Clay, although there are some minimal overlying deposits of clay, silt and sand.

**Rochford District**

The predominant solid geology underlying the study area is Thames Group which comprises clay, silt, sand and gravel. Drift deposits are present across approximately half of the district. River terrace deposits are present either side of the River Roach around Little Wakering, Great Wakering and Rochford, which comprise sand and gravel.

Deposits of alluvium are present along the eastern part of the district including Foulness Island and Wallasea Island. In addition, parts of the River Crouch floodplain are characterised by alluvial deposits including Hullbridge, and the area north of Ashingdon and Canewdon.

**Source Protection Zones**

The Environment Agency designates Source protection Zones (SPZs) around groundwater abstraction sources, to protect the abstraction from potentially polluting activities, by limiting discharges to ground (i.e. via soakaway) within the SPZ. Four SPZs are designated:

- SPZ 1 – the area immediately around the source, which represents a 50-day travel time for groundwater from a point on the surface to the abstraction or a 50 m radius;
- SPZ2 - this represents a 400-day travel time for groundwater from a point on the surface to the abstraction;

[53] Environment Agency (August 2008) South Essex Catchment Flood Management Plan
[54] Environment Agency (August 2008) South Essex Catchment Flood Management Plan

- SPZ3 – this represents the entire catchment of the abstraction; and
- SPZ4 – this zone is sometimes designated as a Zone of Special Interest, where activities could impact upon the groundwater, despite lying outside of the catchment (as defined by SPZ3).

The location of SPZs can be viewed using the Environment Agency's SPZ mapping, available at www.environment-agency.gov.uk. However, there are no SPZs within the South Essex WCS area.

### 5.1.2 Hydrology

The largest river within the study area is the tidal Thames, which flows west to east, forming the southern and eastern boundary of the study area. The River Roach flows through Rochford district, in the east of the study area, with numerous small creeks and streams forming its catchment throughout Foulness Island and the surrounding low lying areas.

Canvey Island is separated from the mainland by the Benfleet, East Haven and Holehaven Creeks, which are small, tidal watercourses. There are also smaller, unnamed watercourses to the west of Canvey Island, which are similar to those around Foulness Island, forming part of the extensive saltmarshes in the study area.

### 5.1.3 Water Supply

Potable water in the study area is supplied by Essex and Suffolk Water (ESW). There are two supply areas, the Essex supply area, within which the study area lies, and the Suffolk supply area. These are further divided resource zones, defined as the 'largest possible zone in which all resources, including external transfers, can be shared and hence the zone in which all customers experience the same risk of supply failure from a resource shortfall[55]'. However, the supply network in Essex is highly integrated, with a large degree of flexibility for moving water around the zone to where it is required.

Three of these resource zones lie within the Suffolk supply area; the fourth covers the study area (the Essex Resource Zone) and will therefore be included within this assessment. See Figure 5-1 below for the geographical coverage of the Essex Resource Zone (ERZ).

[55] Final Water Resource Management Plan, Essex and Suffolk Water, January 2010.

**Figure 5-1: the Essex Resource Zone**


(Source: ESW's WRMP[56])

Water within the ERZ is sourced from the rivers Chelmer, Blackwater, Stour and Roman River which support pumped storage reservoirs at Hanningfield and Abberton, and treatment works at Langford, Langham, Hanningfield and Layer. There are also groundwater resources within the ERZ, which supply approximately 3% of the zone's demand from the Chalk well and adit sources in the south and south west of the zone at Linford, Stifford, Dagenham and Roding.

Approximately 30% of the water supplied in the Essex supply area comes from outside Essex, from the following two main sources:

- the Chigwell raw water bulk supply from Thames Water, which is provided via a raw water bulk transfer from the Lea Valley reservoirs; and
- the Ely Ouse to Essex Transfer Scheme (EOETS), which transports water from the Ely Ouse River at Denver in Norfolk to the Hanningfield and Abberton reservoirs.

In dry years the contribution from these two external sources may be up to 50% of the water supplied within the Essex supply area. In addition the Environment Agency operates two river support schemes, which may also operate in dry conditions:

[56] Final Water Resource Management Plan, Essex and Suffolk Water, January 2010.

- the Great Ouse Groundwater Scheme (GOGS); and
- the Stour Augmentation Groundwater Scheme (SAGS).

ESW also operate an effluent recycling scheme at Langford, near Maldon. The scheme intercepts effluent from Chelmsford Wastewater Treatment Works, which is treated and recycled at Langford, before being pumped into the River Chelmer where it augments river flows to allow re-abstraction and transfer to Hanningfield Reservoir, before passing through its treatment works. The scheme can potentially provide an additional 30 Ml/d (average) of water for use within the Essex system during dry periods.

## 5.2 The Abberton Reservoir Scheme

Due to current pumping and storage constraints, ESW cannot always fully utilise water when it is available in the River Stour. The Abberton Reservoir Scheme involves enlarging the reservoir at Abberton to allow for the capture and storage of an increased volume of water. The scheme will raise the main dam and top water level of the reservoir by 3.2 metres to provide an additional 60% of raw water storage. The surface area will be increased from 4.7 $km^2$ to 6.7 $km^2$. This enlargement to the reservoir, combined with the additional intake from the River Stour at Wormingford will provide the opportunity to abstract and store additional water from the River Stour during high flow conditions.

ESW started the planning, environmental studies and consultation process for additional water in 1993[57] and construction is currently underway and the scheme is on track to become operational by 2014.

## 5.3 Water Demand Calculations

For all three Councils, all proposed growth and housing figures will be assessed for their impact on water resources. As discussed above, the supply network in Essex is highly integrated, with a large degree of flexibility for moving water around the zone to where it is required. The effect on water resources can therefore be considered for all the proposed growth within the study area, regardless of location.

In order to assess the water resources implications of the proposed growth in the study area, five water use projections have been assessed, as follows:

- Projection 1 - ESW's average metered consumption[58] of **152 l/h/d**, this has been calculated to give a point of comparison, but it should be noted that ESW does not use this figure for future resources planning;
- Projection 2 – Part G of the Building Regulations[59] requirement of **125 l/h/d** (equivalent to the Code for Sustainable Homes[60] (CfSH) Level 1/2 rating of 120 l/h/d plus 5 l/h/d for outdoor use), which should be considered to be the 'business as usual' projection against which the other water saving projections will be measured;
- Projection 3 - the suggested policy projection of **105 l/h/d**, equivalent to the CfSH Level 3/4 rating;

[57] Water Resources for the Future – the Abberton Scheme, Essex and Suffolk Water, October 2006.
[58] Final Water Resource Management Plan, Essex and Suffolk Water, January 2010.
[59] http://www.communities.gov.uk/planningandbuilding/buildingregulations/
[60] Code for Sustainable Homes - a step-change in sustainable home building practice, Communities and Local Government, 2006, http://www.planningportal.gov.uk/uploads/code_for_sust_homes.pdf

- Projection 4 - Thames Gateway Water neutrality study recommendation[61] of **95 l/h/d**; and
- Projection 5 – CfSH Level 5/6 rating of **80 l/h/d**.

The above water consumption figures have been applied to the population figures for each of the proposed housing growth figures given in Section 3 and the anticipated water demand has been calculated for each of the five water demand projections. In addition to this, the water savings that could be achieved by applying projections 3, 4 and 5 have been calculated, compared to the 'business as usual' scenario of Part G of the Building Regulations (Projection 2). For all growth scenarios it has been assumed that employment water consumption is 28 litres per day per job created[62].

## 5.4 Water Efficiency

### 5.4.1 Basildon Borough water demand strategies

The calculations, shown below in Figures 5-2 to 5-9, indicate that the current metered water consumption (Projection 1) would require between 1.8 Ml/d (for growth Option 1) and 10 Ml/d (for growth Option 4) of additional supply by 2031, depending on the level of growth within the Basildon Borough. The Part G of the Building Regulations projection (Projection 2) would require between 1.48 Ml/d (for growth Option 1) and 8.22 Ml/d (for growth Option 4). This compares with the recommended policy projection (Projection 3), which would require between 1.25 Ml/d (for growth Option 1) and 6.91 Ml/d by 2031. These figures, and the water requirements and saving of the other water consumption strategies are displayed graphically below in Figures 5-2 to 5-9.

Figures 5-2 to 5-9 below display the anticipated water saving from Projections 3, 4 and 5, as compared to the Part G of the Building Regulations projection (Projection 2). Demand can be reduced by between 0.24 and 2.96 Ml/d in 2031 by adopting more the stringent water consumption approaches given by Projections 3, 4 and 5. The suggested policy projection gives a saving of between 0.24 Ml/d (for growth Option 1) and 1.32 Ml/d (for growth Option 4) in 2031.

[61] While the Thames Gateway obviously lies outside of the study area, this is included as a benchmark study, which assessed the level of water saving that would be required to ensure sustainable growth in terms of water resources in a densely populated area and has therefore been included here as a point of comparison.
[62] Milton Keynes Outline WCS, Scott Wilson Ltd, December 2008

## Figure 5-2: Basildon Borough Water Demand Calculations – Housing Option 1 and Employment Option A

### Option 1A

| Housing Development | 2011/12 | 2012/13 | 2013/14 | 2014/15 | 2015/16 | 2016/17 | 2017/18 | 2018/19 | 2019/20 | 2020/21 | 2021/22 | 2022/23 | 2023/24 | 2024/25 | 2025/26 | 2026/27 | 2027/28 | 2028/29 | 2029/30 | 2030/31 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Scenario 1 - Annual Total (Completions and forecasts) | 282.5 | 282.5 | 282.5 | 282.5 | 282.5 | 282.5 | 282.5 | 282.5 | 282.5 | 282.5 | 282.5 | 282.5 | 282.5 | 282.5 | 282.5 | 282.5 | 282.5 | 282.5 | 282.5 | 282.5 |
| Cummulative Total | 283 | 565 | 848 | 1,130 | 1,413 | 1,695 | 1,978 | 2,260 | 2,543 | 2,825 | 3,108 | 3,390 | 3,673 | 3,955 | 4,238 | 4,520 | 4,803 | 5,085 | 5,368 | 5,650 |
| Occupancy Rate | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 |
| Domestic Population Increase (Annual) | 593 | 593 | 593 | 593 | 593 | 593 | 593 | 593 | 593 | 593 | 593 | 593 | 593 | 593 | 593 | 593 | 593 | 593 | 593 | 593 |
| Domestic Population Increase (Cumulative) | 593 | 1,187 | 1,780 | 2,373 | 2,966 | 3,560 | 4,153 | 4,746 | 5,339 | 5,933 | 6,526 | 7,119 | 7,712 | 8,306 | 8,899 | 9,492 | 10,085 | 10,679 | 11,272 | 11,865 |

| Water Demand Scenario - Cumulative Water Consumption (l/h/d) | 2011/12 | 2012/13 | 2013/14 | 2014/15 | 2015/16 | 2016/17 | 2017/18 | 2018/19 | 2019/20 | 2020/21 | 2021/22 | 2022/23 | 2023/24 | 2024/25 | 2025/26 | 2026/27 | 2027/28 | 2028/29 | 2029/30 | 2030/31 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 Average ESW pcc consumption | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 |
| 2 Building Regulations Part G | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 |
| 4 Suggested Policy Scenario | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 |
| 3 Thames Gateway Water Neutrality Study | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 |
| 5 CSH Level 5 & 6 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 |

| Annual Water Demand Calculations (Ml/d) | 2011/12 | 2012/13 | 2013/14 | 2014/15 | 2015/16 | 2016/17 | 2017/18 | 2018/19 | 2019/20 | 2020/21 | 2021/22 | 2022/23 | 2023/24 | 2024/25 | 2025/26 | 2026/27 | 2027/28 | 2028/29 | 2029/30 | 2030/31 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 Average ESW pcc consumption | 0.09 | 0.09 | 0.09 | 0.09 | 0.09 | 0.09 | 0.09 | 0.09 | 0.09 | 0.09 | 0.09 | 0.09 | 0.09 | 0.09 | 0.09 | 0.09 | 0.09 | 0.09 | 0.09 | 0.09 |
| 2 Building Regulations Part G | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 |
| 4 Suggested Policy Scenario | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 |
| 3 Thames Gateway Water Neutrality Study | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 |
| 5 CSH Level 5 & 6 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 |

| Water Demand Calculations (Ml/d) - CUMULATIVE | 2011/12 | 2012/13 | 2013/14 | 2014/15 | 2015/16 | 2016/17 | 2017/18 | 2018/19 | 2019/20 | 2020/21 | 2021/22 | 2022/23 | 2023/24 | 2024/25 | 2025/26 | 2026/27 | 2027/28 | 2028/29 | 2029/30 | 2030/31 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 Average ESW pcc consumption | 0.09 | 0.18 | 0.27 | 0.36 | 0.45 | 0.54 | 0.63 | 0.72 | 0.81 | 0.90 | 0.99 | 1.08 | 1.17 | 1.26 | 1.35 | 1.44 | 1.53 | 1.62 | 1.71 | 1.80 |
| 2 Building Regulations Part G | 0.07 | 0.15 | 0.22 | 0.30 | 0.37 | 0.44 | 0.52 | 0.59 | 0.67 | 0.74 | 0.82 | 0.89 | 0.96 | 1.04 | 1.11 | 1.19 | 1.26 | 1.33 | 1.41 | 1.48 |
| 4 Suggested Policy Scenario | 0.06 | 0.12 | 0.19 | 0.25 | 0.31 | 0.37 | 0.44 | 0.50 | 0.56 | 0.62 | 0.69 | 0.75 | 0.81 | 0.87 | 0.93 | 1.00 | 1.06 | 1.12 | 1.18 | 1.25 |
| 3 Thames Gateway Water Neutrality Study | 0.06 | 0.11 | 0.17 | 0.23 | 0.28 | 0.34 | 0.39 | 0.45 | 0.51 | 0.56 | 0.62 | 0.68 | 0.73 | 0.79 | 0.85 | 0.90 | 0.96 | 1.01 | 1.07 | 1.13 |
| 5 CSH Level 5 & 6 | 0.05 | 0.09 | 0.14 | 0.19 | 0.24 | 0.28 | 0.33 | 0.38 | 0.43 | 0.47 | 0.52 | 0.57 | 0.62 | 0.66 | 0.71 | 0.76 | 0.81 | 0.85 | 0.90 | 0.95 |

| Annual Water Savings (against Building Regs Part G - Scenario 2) (Ml/d) | 2011/12 | 2012/13 | 2013/14 | 2014/15 | 2015/16 | 2016/17 | 2017/18 | 2018/19 | 2019/20 | 2020/21 | 2021/22 | 2022/23 | 2023/24 | 2024/25 | 2025/26 | 2026/27 | 2027/28 | 2028/29 | 2029/30 | 2030/31 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 Suggested Policy Scenario | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| 3 Thames Gateway Water Neutrality Study | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 |
| 5 CSH Level 5 & 6 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 |

| Water Savings (against Building Regs Part G - Scenario 2) (Ml/d) - CUMULATIVE | 2011/12 | 2012/13 | 2013/14 | 2014/15 | 2015/16 | 2016/17 | 2017/18 | 2018/19 | 2019/20 | 2020/21 | 2021/22 | 2022/23 | 2023/24 | 2024/25 | 2025/26 | 2026/27 | 2027/28 | 2028/29 | 2029/30 | 2030/31 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 Suggested Policy Scenario | 0.01 | 0.02 | 0.04 | 0.05 | 0.06 | 0.07 | 0.08 | 0.09 | 0.11 | 0.12 | 0.13 | 0.14 | 0.15 | 0.17 | 0.18 | 0.19 | 0.20 | 0.21 | 0.23 | 0.24 |
| 4 Thames Gateway Water Neutrality Study | 0.02 | 0.04 | 0.05 | 0.07 | 0.09 | 0.11 | 0.12 | 0.14 | 0.16 | 0.18 | 0.20 | 0.21 | 0.23 | 0.25 | 0.27 | 0.28 | 0.30 | 0.32 | 0.34 | 0.36 |
| 3 CSH Level 5 & 6 | 0.03 | 0.05 | 0.08 | 0.11 | 0.13 | 0.16 | 0.19 | 0.21 | 0.24 | 0.27 | 0.29 | 0.32 | 0.35 | 0.37 | 0.40 | 0.43 | 0.45 | 0.48 | 0.51 | 0.53 |

**Figure 5-3: Basildon Borough Water Demand Calculations – Housing Options 2 and 3 and Employment Option B**

## Option 2/3B

| Housing Development | 2011/12 | 2012/13 | 2013/14 | 2014/15 | 2015/16 | 2016/17 | 2017/18 | 2018/19 | 2019/20 | 2020/21 | 2021/22 | 2022/23 | 2023/24 | 2024/25 | 2025/26 | 2026/27 | 2027/28 | 2028/29 | 2029/30 | 2030/31 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Scenario 3 - Annual Total (Completions and forecasts) | 688 | 688 | 688 | 688 | 688 | 688 | 688 | 688 | 688 | 688 | 688 | 688 | 688 | 688 | 688 | 688 | 688 | 688 | 688 | 688 |
| Cummulative Total | 688 | 1,376 | 2,064 | 2,752 | 3,440 | 4,128 | 4,816 | 5,504 | 6,192 | 6,880 | 7,568 | 8,256 | 8,944 | 9,632 | 10,320 | 11,008 | 11,696 | 12,384 | 13,072 | 13,760 |
| Occupancy Rate | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 |
| Domestic Population Increase (Annual) | 1,445 | 1,445 | 1,445 | 1,445 | 1,445 | 1,445 | 1,445 | 1,445 | 1,445 | 1,445 | 1,445 | 1,445 | 1,445 | 1,445 | 1,445 | 1,445 | 1,445 | 1,445 | 1,445 | 1,445 |
| Domestic Population Increase (Cumulative) | 1,445 | 2,890 | 4,334 | 5,779 | 7,224 | 8,669 | 10,114 | 11,558 | 13,003 | 14,448 | 15,893 | 17,338 | 18,782 | 20,227 | 21,672 | 23,117 | 24,562 | 26,006 | 27,451 | 28,896 |

| Water Demand Scenario - Cumulative Water Consumption (l/h/d) | 2011/12 | 2012/13 | 2013/14 | 2014/15 | 2015/16 | 2016/17 | 2017/18 | 2018/19 | 2019/20 | 2020/21 | 2021/22 | 2022/23 | 2023/24 | 2024/25 | 2025/26 | 2026/27 | 2027/28 | 2028/29 | 2029/30 | 2030/31 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 Average ESW pcc consumption | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 |
| 2 Building Regulations Part G | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 |
| 4 Suggested Policy Scenario | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 |
| 3 Thames Gateway Water Neutrality Study | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 |
| 5 CSH Level 5 & 6 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 |

| Annual Water Demand Calculations (Ml/d) | 2011/12 | 2012/13 | 2013/14 | 2014/15 | 2015/16 | 2016/17 | 2017/18 | 2018/19 | 2019/20 | 2020/21 | 2021/22 | 2022/23 | 2023/24 | 2024/25 | 2025/26 | 2026/27 | 2027/28 | 2028/29 | 2029/30 | 2030/31 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 Average ESW pcc consumption | 0.22 | 0.22 | 0.22 | 0.22 | 0.22 | 0.22 | 0.22 | 0.22 | 0.22 | 0.22 | 0.22 | 0.22 | 0.22 | 0.22 | 0.22 | 0.22 | 0.22 | 0.22 | 0.22 | 0.22 |
| 2 Building Regulations Part G | 0.18 | 0.18 | 0.18 | 0.18 | 0.18 | 0.18 | 0.18 | 0.18 | 0.18 | 0.18 | 0.18 | 0.18 | 0.18 | 0.18 | 0.18 | 0.18 | 0.18 | 0.18 | 0.18 | 0.18 |
| 4 Suggested Policy Scenario | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 |
| 3 Thames Gateway Water Neutrality Study | 0.14 | 0.14 | 0.14 | 0.14 | 0.14 | 0.14 | 0.14 | 0.14 | 0.14 | 0.14 | 0.14 | 0.14 | 0.14 | 0.14 | 0.14 | 0.14 | 0.14 | 0.14 | 0.14 | 0.14 |
| 5 CSH Level 5 & 6 | 0.12 | 0.12 | 0.12 | 0.12 | 0.12 | 0.12 | 0.12 | 0.12 | 0.12 | 0.12 | 0.12 | 0.12 | 0.12 | 0.12 | 0.12 | 0.12 | 0.12 | 0.12 | 0.12 | 0.12 |

| Water Demand Calculations (Ml/d) - CUMULATIVE | 2011/12 | 2012/13 | 2013/14 | 2014/15 | 2015/16 | 2016/17 | 2017/18 | 2018/19 | 2019/20 | 2020/21 | 2021/22 | 2022/23 | 2023/24 | 2024/25 | 2025/26 | 2026/27 | 2027/28 | 2028/29 | 2029/30 | 2030/31 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 Average ESW pcc consumption | 0.22 | 0.44 | 0.66 | 0.88 | 1.10 | 1.32 | 1.54 | 1.76 | 1.98 | 2.20 | 2.42 | 2.64 | 2.85 | 3.07 | 3.29 | 3.51 | 3.73 | 3.95 | 4.17 | 4.39 |
| 2 Building Regulations Part G | 0.18 | 0.36 | 0.54 | 0.72 | 0.90 | 1.08 | 1.26 | 1.44 | 1.63 | 1.81 | 1.99 | 2.17 | 2.35 | 2.53 | 2.71 | 2.89 | 3.07 | 3.25 | 3.43 | 3.61 |
| 4 Suggested Policy Scenario | 0.15 | 0.30 | 0.46 | 0.61 | 0.76 | 0.91 | 1.06 | 1.21 | 1.37 | 1.52 | 1.67 | 1.82 | 1.97 | 2.12 | 2.28 | 2.43 | 2.58 | 2.73 | 2.88 | 3.03 |
| 3 Thames Gateway Water Neutrality Study | 0.14 | 0.27 | 0.41 | 0.55 | 0.69 | 0.82 | 0.96 | 1.10 | 1.24 | 1.37 | 1.51 | 1.65 | 1.78 | 1.92 | 2.06 | 2.20 | 2.33 | 2.47 | 2.61 | 2.75 |
| 5 CSH Level 5 & 6 | 0.12 | 0.23 | 0.35 | 0.46 | 0.58 | 0.69 | 0.81 | 0.92 | 1.04 | 1.16 | 1.27 | 1.39 | 1.50 | 1.62 | 1.73 | 1.85 | 1.96 | 2.08 | 2.20 | 2.31 |

| Annual Water Savings (against Building Regs Part G - Scenario 2) (Ml/d) | 2011/12 | 2012/13 | 2013/14 | 2014/15 | 2015/16 | 2016/17 | 2017/18 | 2018/19 | 2019/20 | 2020/21 | 2021/22 | 2022/23 | 2023/24 | 2024/25 | 2025/26 | 2026/27 | 2027/28 | 2028/29 | 2029/30 | 2030/31 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 Suggested Policy Scenario | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 |
| 3 Thames Gateway Water Neutrality Study | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 |
| 5 CSH Level 5 & 6 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 |

| Water Savings (against Building Regs Part G - Scenario 2) (Ml/d) - CUMULATIVE | 2011/12 | 2012/13 | 2013/14 | 2014/15 | 2015/16 | 2016/17 | 2017/18 | 2018/19 | 2019/20 | 2020/21 | 2021/22 | 2022/23 | 2023/24 | 2024/25 | 2025/26 | 2026/27 | 2027/28 | 2028/29 | 2029/30 | 2030/31 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 Suggested Policy Scenario | 0.03 | 0.06 | 0.09 | 0.12 | 0.14 | 0.17 | 0.20 | 0.23 | 0.26 | 0.29 | 0.32 | 0.35 | 0.38 | 0.40 | 0.43 | 0.46 | 0.49 | 0.52 | 0.55 | 0.58 |
| 4 Thames Gateway Water Neutrality Study | 0.04 | 0.09 | 0.13 | 0.17 | 0.22 | 0.26 | 0.30 | 0.35 | 0.39 | 0.43 | 0.48 | 0.52 | 0.56 | 0.61 | 0.65 | 0.69 | 0.74 | 0.78 | 0.82 | 0.87 |
| 3 CSH Level 5 & 6 | 0.07 | 0.13 | 0.20 | 0.26 | 0.33 | 0.39 | 0.46 | 0.52 | 0.59 | 0.65 | 0.72 | 0.78 | 0.85 | 0.91 | 0.98 | 1.04 | 1.11 | 1.17 | 1.24 | 1.30 |

**Figure 5-4: Basildon Borough Water Demand Calculations – Housing Option 4 and Employment Option C**

## Option 4C

| Housing Development | 2011/12 | 2012/13 | 2013/14 | 2014/15 | 2015/16 | 2016/17 | 2017/18 | 2018/19 | 2019/20 | 2020/21 | 2021/22 | 2022/23 | 2023/24 | 2024/25 | 2025/26 | 2026/27 | 2027/28 | 2028/29 | 2029/30 | 2030/31 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Scenario 2 - Annual Total (Completions and forecasts) | 1566.25 | 1566.25 | 1566.25 | 1566.25 | 1566.25 | 1566.25 | 1566.25 | 1566.25 | 1566.25 | 1566.25 | 1566.25 | 1566.25 | 1566.25 | 1566.25 | 1566.25 | 1566.25 | 1566.25 | 1566.25 | 1566.25 | 1566.25 |
| Cummulative Total | 1,566 | 3,133 | 4,699 | 6,265 | 7,831 | 9,398 | 10,964 | 12,530 | 14,096 | 15,663 | 17,229 | 18,795 | 20,361 | 21,928 | 23,494 | 25,060 | 26,626 | 28,193 | 29,759 | 31,325 |
| Occupancy Rate | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 |
| Domestic Population Increase (Annual) | 3,289 | 3,289 | 3,289 | 3,289 | 3,289 | 3,289 | 3,289 | 3,289 | 3,289 | 3,289 | 3,289 | 3,289 | 3,289 | 3,289 | 3,289 | 3,289 | 3,289 | 3,289 | 3,289 | 3,289 |
| Domestic Population Increase (Cumulative) | 3,289 | 6,578 | 9,867 | 13,157 | 16,446 | 19,735 | 23,024 | 26,313 | 29,602 | 32,891 | 36,180 | 39,470 | 42,759 | 46,048 | 49,337 | 52,626 | 55,915 | 59,204 | 62,493 | 65,783 |

| Water Demand Scenario - Cumulative Water Consumption (l/h/d) | 2011/12 | 2012/13 | 2013/14 | 2014/15 | 2015/16 | 2016/17 | 2017/18 | 2018/19 | 2019/20 | 2020/21 | 2021/22 | 2022/23 | 2023/24 | 2024/25 | 2025/26 | 2026/27 | 2027/28 | 2028/29 | 2029/30 | 2030/31 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 Average ESW pcc consumption | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 |
| 2 Building Regulations Part G | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 |
| 4 Suggested Policy Scenario | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 |
| 3 Thames Gateway Water Neutrality Study | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 |
| 5 CSH Level 5 & 6 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 |

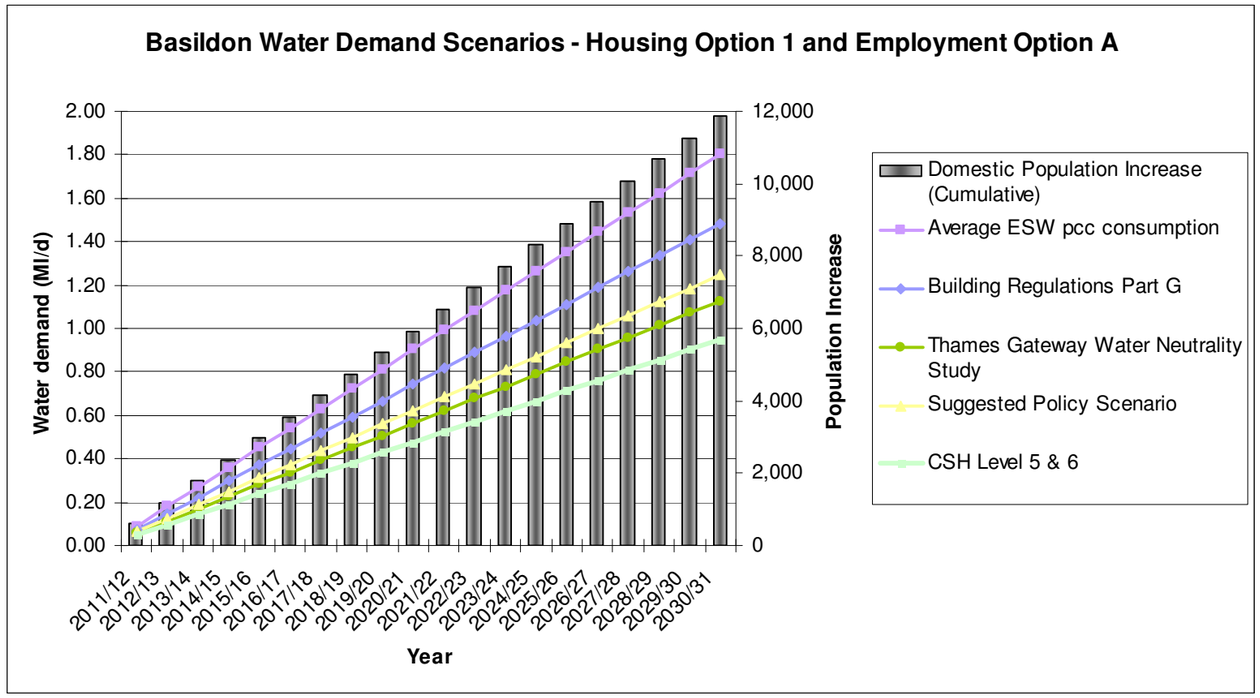
| Annual Water Demand Calculations (Ml/d) | 2011/12 | 2012/13 | 2013/14 | 2014/15 | 2015/16 | 2016/17 | 2017/18 | 2018/19 | 2019/20 | 2020/21 | 2021/22 | 2022/23 | 2023/24 | 2024/25 | 2025/26 | 2026/27 | 2027/28 | 2028/29 | 2029/30 | 2030/31 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 Average ESW pcc consumption | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 |
| 2 Building Regulations Part G | 0.41 | 0.41 | 0.41 | 0.41 | 0.41 | 0.41 | 0.41 | 0.41 | 0.41 | 0.41 | 0.41 | 0.41 | 0.41 | 0.41 | 0.41 | 0.41 | 0.41 | 0.41 | 0.41 | 0.41 |
| 4 Suggested Policy Scenario | 0.35 | 0.35 | 0.35 | 0.35 | 0.35 | 0.35 | 0.35 | 0.35 | 0.35 | 0.35 | 0.35 | 0.35 | 0.35 | 0.35 | 0.35 | 0.35 | 0.35 | 0.35 | 0.35 | 0.35 |
| 3 Thames Gateway Water Neutrality Study | 0.31 | 0.31 | 0.31 | 0.31 | 0.31 | 0.31 | 0.31 | 0.31 | 0.31 | 0.31 | 0.31 | 0.31 | 0.31 | 0.31 | 0.31 | 0.31 | 0.31 | 0.31 | 0.31 | 0.31 |
| 5 CSH Level 5 & 6 | 0.26 | 0.26 | 0.26 | 0.26 | 0.26 | 0.26 | 0.26 | 0.26 | 0.26 | 0.26 | 0.26 | 0.26 | 0.26 | 0.26 | 0.26 | 0.26 | 0.26 | 0.26 | 0.26 | 0.26 |

| Water Demand Calculations (Ml/d) - CUMULATIVE | 2011/12 | 2012/13 | 2013/14 | 2014/15 | 2015/16 | 2016/17 | 2017/18 | 2018/19 | 2019/20 | 2020/21 | 2021/22 | 2022/23 | 2023/24 | 2024/25 | 2025/26 | 2026/27 | 2027/28 | 2028/29 | 2029/30 | 2030/31 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 Average ESW pcc consumption | 0.50 | 1.00 | 1.50 | 2.00 | 2.50 | 3.00 | 3.50 | 4.00 | 4.50 | 5.00 | 5.50 | 6.00 | 6.50 | 7.00 | 7.50 | 8.00 | 8.50 | 9.00 | 9.50 | 10.00 |
| 2 Building Regulations Part G | 0.41 | 0.82 | 1.23 | 1.64 | 2.06 | 2.47 | 2.88 | 3.29 | 3.70 | 4.11 | 4.52 | 4.93 | 5.34 | 5.76 | 6.17 | 6.58 | 6.99 | 7.40 | 7.81 | 8.22 |
| 4 Suggested Policy Scenario | 0.35 | 0.69 | 1.04 | 1.38 | 1.73 | 2.07 | 2.42 | 2.76 | 3.11 | 3.45 | 3.80 | 4.14 | 4.49 | 4.84 | 5.18 | 5.53 | 5.87 | 6.22 | 6.56 | 6.91 |
| 3 Thames Gateway Water Neutrality Study | 0.31 | 0.62 | 0.94 | 1.25 | 1.56 | 1.87 | 2.19 | 2.50 | 2.81 | 3.12 | 3.44 | 3.75 | 4.06 | 4.37 | 4.69 | 5.00 | 5.31 | 5.62 | 5.94 | 6.25 |
| 5 CSH Level 5 & 6 | 0.26 | 0.53 | 0.79 | 1.05 | 1.32 | 1.58 | 1.84 | 2.11 | 2.37 | 2.63 | 2.89 | 3.16 | 3.42 | 3.68 | 3.95 | 4.21 | 4.47 | 4.74 | 5.00 | 5.26 |

| Annual Water Savings (against Building Regs Part G - Scenario 2) (Ml/d) | 2011/12 | 2012/13 | 2013/14 | 2014/15 | 2015/16 | 2016/17 | 2017/18 | 2018/19 | 2019/20 | 2020/21 | 2021/22 | 2022/23 | 2023/24 | 2024/25 | 2025/26 | 2026/27 | 2027/28 | 2028/29 | 2029/30 | 2030/31 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 Suggested Policy Scenario | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 |
| 3 Thames Gateway Water Neutrality Study | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 |
| 5 CSH Level 5 & 6 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 |

| Water Savings (against Building Regs Part G - Scenario 2) (Ml/d) - CUMULATIVE | 2011/12 | 2012/13 | 2013/14 | 2014/15 | 2015/16 | 2016/17 | 2017/18 | 2018/19 | 2019/20 | 2020/21 | 2021/22 | 2022/23 | 2023/24 | 2024/25 | 2025/26 | 2026/27 | 2027/28 | 2028/29 | 2029/30 | 2030/31 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 Suggested Policy Scenario | 0.07 | 0.13 | 0.20 | 0.26 | 0.33 | 0.39 | 0.46 | 0.53 | 0.59 | 0.66 | 0.72 | 0.79 | 0.86 | 0.92 | 0.99 | 1.05 | 1.12 | 1.18 | 1.25 | 1.32 |
| 4 Thames Gateway Water Neutrality Study | 0.10 | 0.20 | 0.30 | 0.39 | 0.49 | 0.59 | 0.69 | 0.79 | 0.89 | 0.99 | 1.09 | 1.18 | 1.28 | 1.38 | 1.48 | 1.58 | 1.68 | 1.78 | 1.87 | 1.97 |
| 3 CSH Level 5 & 6 | 0.15 | 0.30 | 0.44 | 0.59 | 0.74 | 0.89 | 1.04 | 1.18 | 1.33 | 1.48 | 1.63 | 1.78 | 1.92 | 2.07 | 2.22 | 2.37 | 2.52 | 2.66 | 2.81 | 2.96 |

**Figure 5-6: Basildon Borough Water Demand and Saving - Housing Option 1 and Employment Option A**



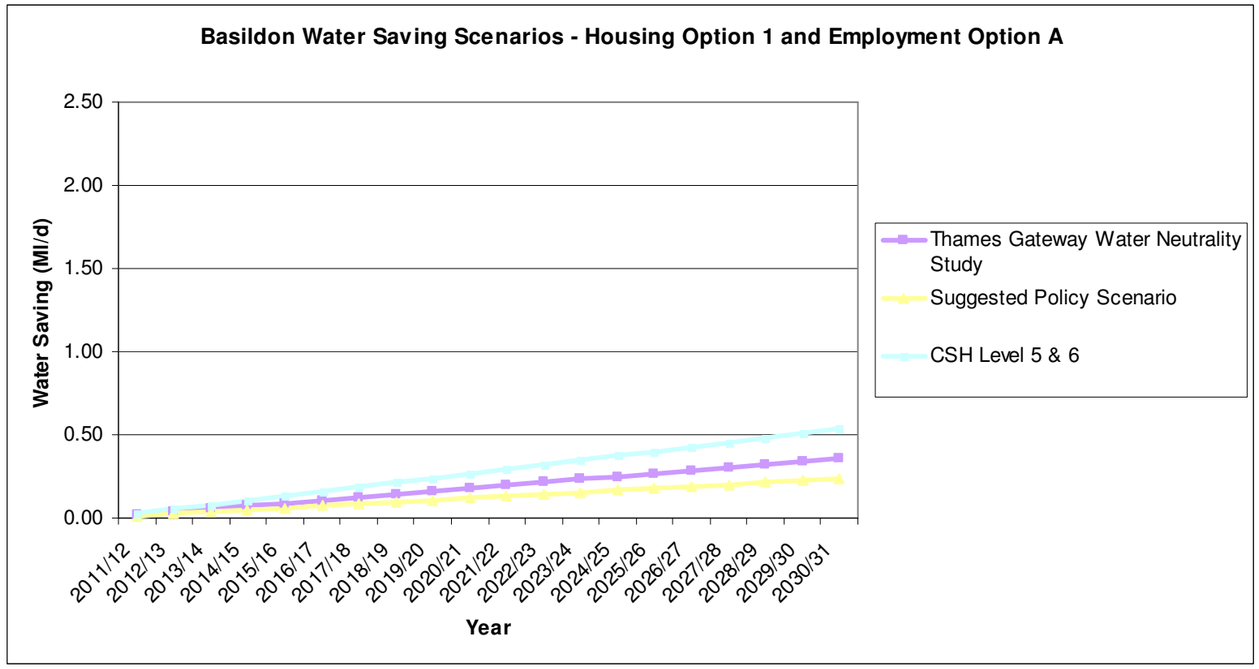
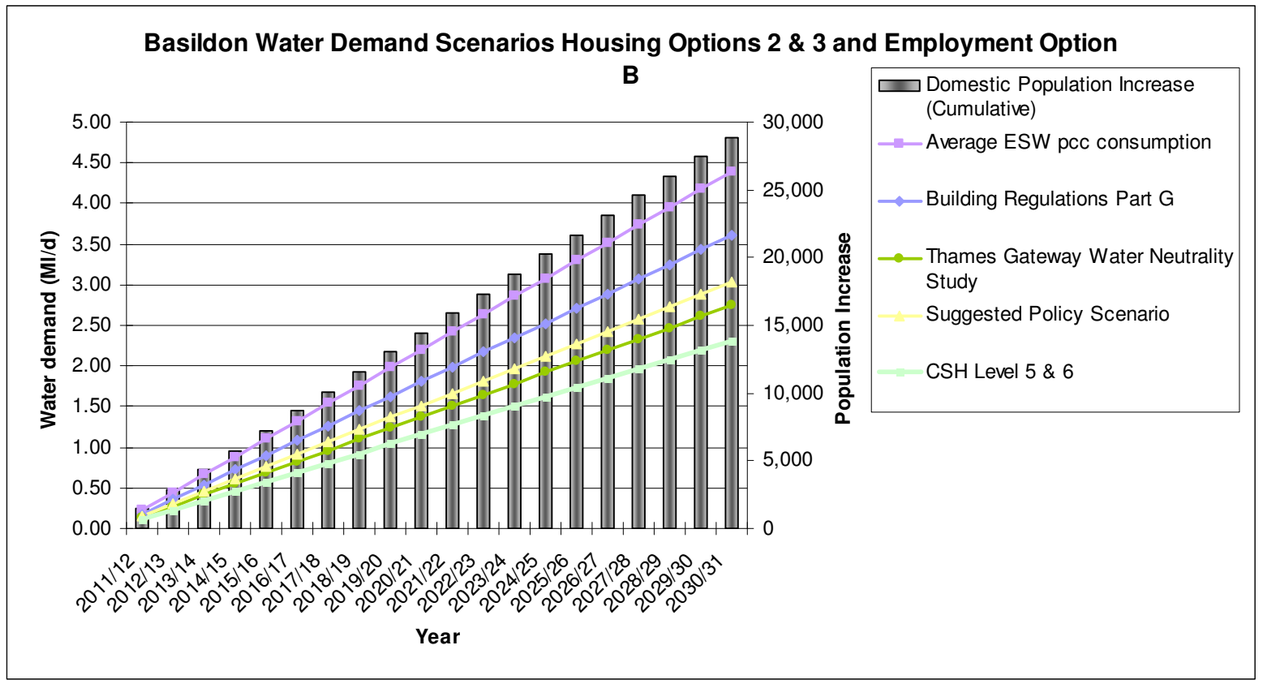



**Figure 5-7: Basildon Borough Water Demand and Saving - Housing Options 2 and 3 and Employment Option B**



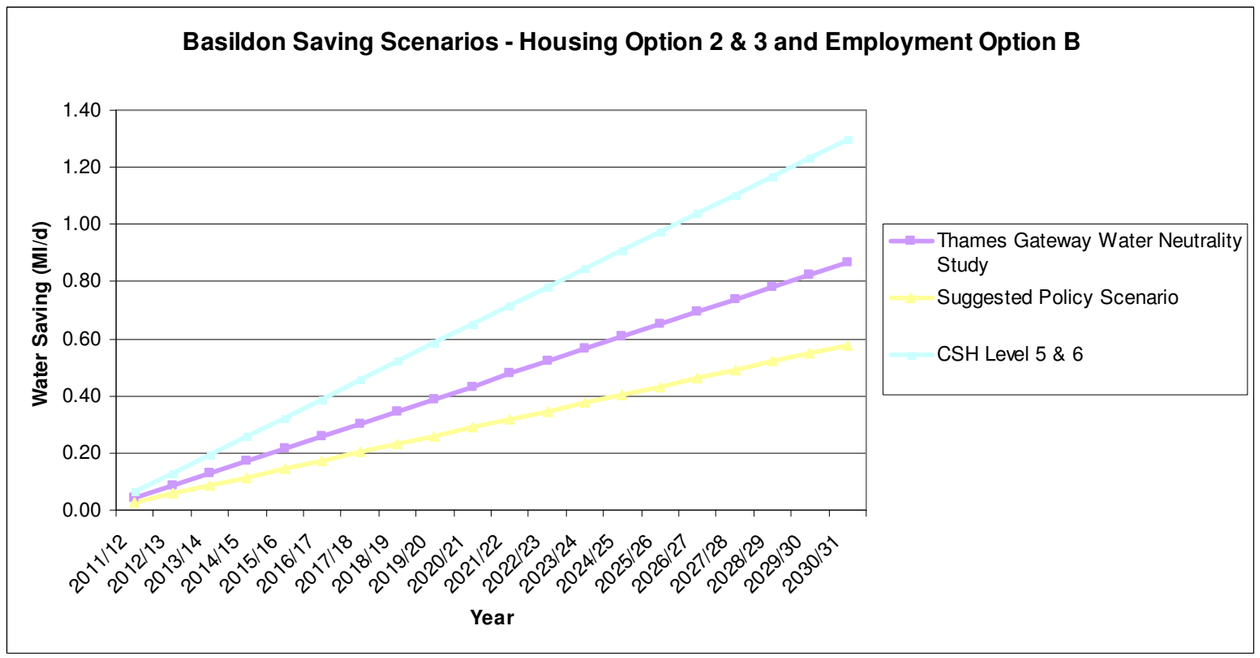
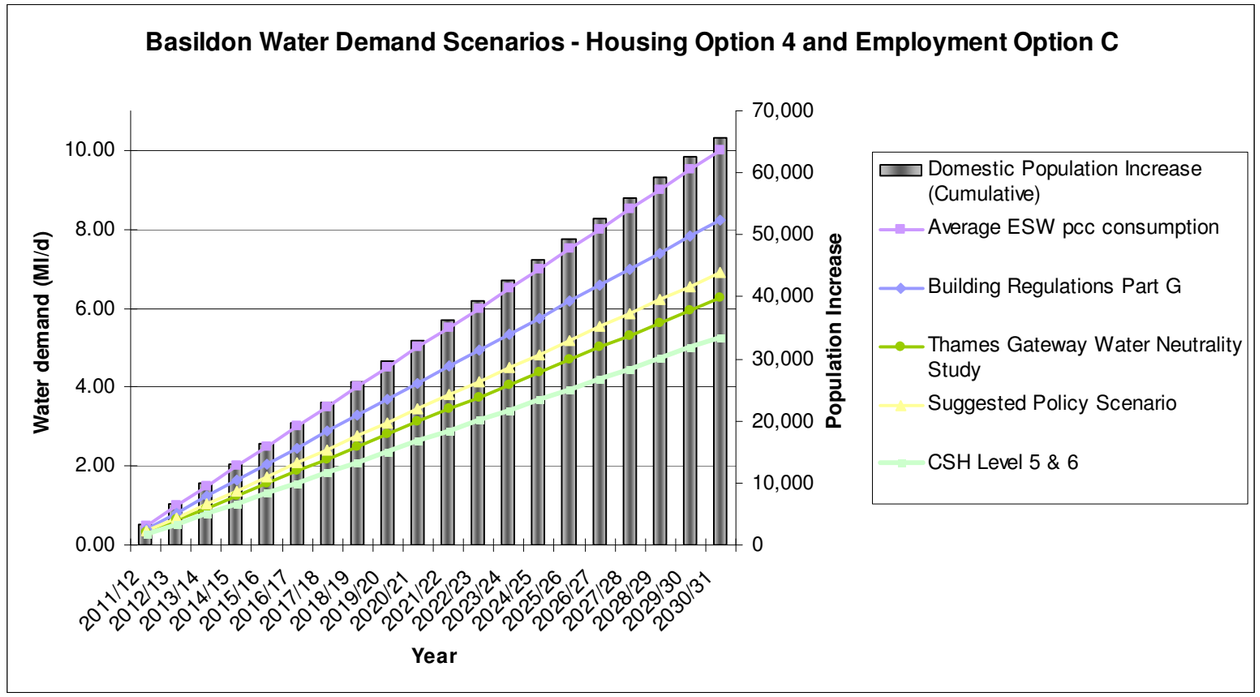
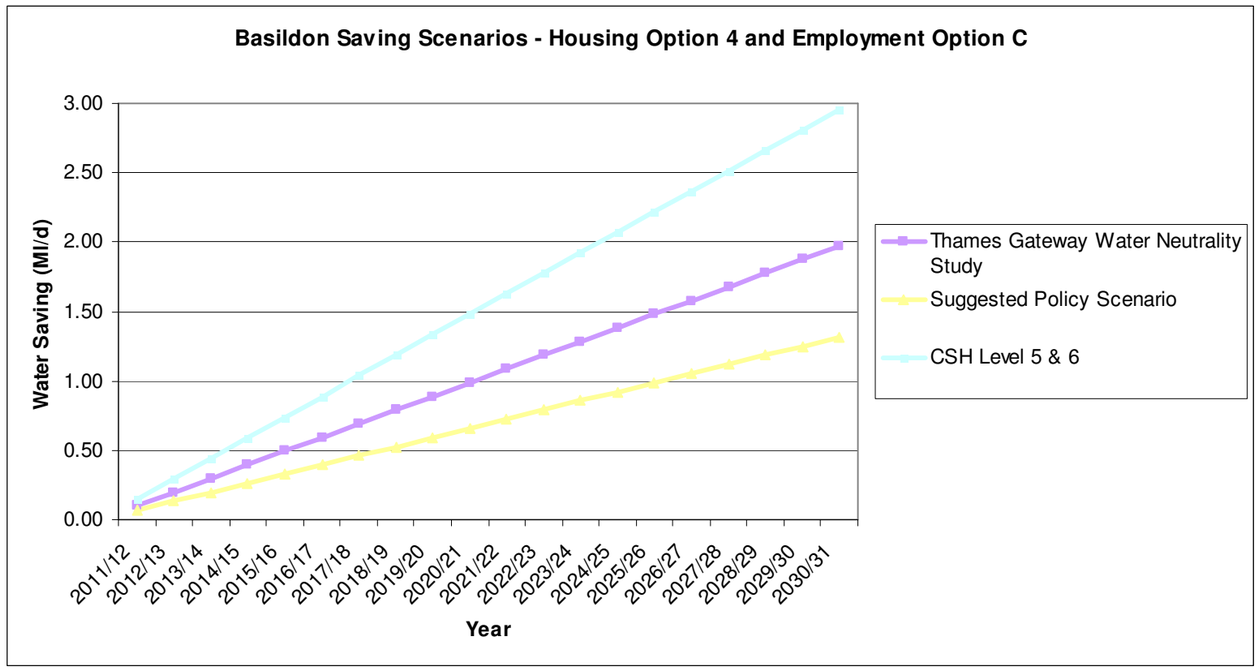



**Figure 5-9: Basildon Borough Water Demand and Saving - Housing Option 4 and Employment Option C**



### 5.4.2 Castle Point Borough water demand strategies

The calculations, shown below in Figures 5-10 to 5-15, indicate that the current metered water consumption (Projection 1) would require between 1.45 Ml/d (for growth Option 1) and 0.96 Ml/d (for growth Option 3) of additional supply by 2031, depending on the level of growth within Castle Point. The Part G of the Building Regulations projection (Projection 2) would require between 1.19 Ml/d (for growth Option 1) and 0.79 Ml/d (for growth Option 3). This compares with the recommended policy projection (Projection 3), which would require between 1 Ml/d (for growth Option 1) and 0.66 Ml/d (for growth option 3) by 2031. These figures, and the water requirements and saving of the other water consumption strategies are displayed graphically below.

Figures 5-2 to 5-9 below display the anticipated water saving from Projections 3, 4 and 5, as compared to the Part G of the Building Regulations projection (Projection 2). Demand can be reduced by between 0.126 and 0.430 Ml/d in 2031 by adopting more the stringent water consumption approaches given by Projections 3, 4 and 5. The suggested policy projection gives a saving of between 0.287 Ml/d (for growth Option 1) and 0.189 Ml/d (for growth Option 3) in 2031.

## Figure 5-10: Castle Point Borough Water Demand Calculations – Housing Option 1

### Option1

| Housing Development | 2011/12 | 2012/13 | 2013/14 | 2014/15 | 2015/16 | 2016/17 | 2017/18 | 2018/19 | 2019/20 | 2020/21 | 2021/22 | 2022/23 | 2023/24 | 2024/25 | 2025/26 | 2026/27 | 2027/28 | 2028/29 | 2029/30 | 2030/31 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Scenario 1 - Annual Total (Completions and forecasts) | 227.5 | 227.5 | 227.5 | 227.5 | 227.5 | 227.5 | 227.5 | 227.5 | 227.5 | 227.5 | 227.5 | 227.5 | 227.5 | 227.5 | 227.5 | 227.5 | 227.5 | 227.5 | 227.5 | 227.5 |
| Cummulative Total | 228 | 455 | 683 | 910 | 1,138 | 1,365 | 1,593 | 1,820 | 2,048 | 2,275 | 2,503 | 2,730 | 2,958 | 3,185 | 3,413 | 3,640 | 3,868 | 4,095 | 4,323 | 4,550 |
| Occupancy Rate | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 |
| Domestic Population Increase (Annual) | 478 | 478 | 478 | 478 | 478 | 478 | 478 | 478 | 478 | 478 | 478 | 478 | 478 | 478 | 478 | 478 | 478 | 478 | 478 | 478 |
| Domestic Population Increase (Cumulative) | 478 | 956 | 1,433 | 1,911 | 2,389 | 2,867 | 3,344 | 3,822 | 4,300 | 4,778 | 5,255 | 5,733 | 6,211 | 6,689 | 7,166 | 7,644 | 8,122 | 8,600 | 9,077 | 9,555 |

| Water Demand Scenario - Cumulative Water Consumption (l/h/d) | 2011/12 | 2012/13 | 2013/14 | 2014/15 | 2015/16 | 2016/17 | 2017/18 | 2018/19 | 2019/20 | 2020/21 | 2021/22 | 2022/23 | 2023/24 | 2024/25 | 2025/26 | 2026/27 | 2027/28 | 2028/29 | 2029/30 | 2030/31 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 Average ESW pcc consumption | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 |
| 2 Building Regulations Part G | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 |
| 4 Suggested Policy Scenario | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 |
| 3 Thames Gateway Water Neutrality Study | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 |
| 5 CSH Level 5 & 6 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 |

| Annual Water Demand Calculations (Ml/d) | 2011/12 | 2012/13 | 2013/14 | 2014/15 | 2015/16 | 2016/17 | 2017/18 | 2018/19 | 2019/20 | 2020/21 | 2021/22 | 2022/23 | 2023/24 | 2024/25 | 2025/26 | 2026/27 | 2027/28 | 2028/29 | 2029/30 | 2030/31 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 Average ESW pcc consumption | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 |
| 2 Building Regulations Part G | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 |
| 4 Suggested Policy Scenario | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 |
| 3 Thames Gateway Water Neutrality Study | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 |
| 5 CSH Level 5 & 6 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 |

| Water Demand Calculations (Ml/d) - CUMULATIVE | 2011/12 | 2012/13 | 2013/14 | 2014/15 | 2015/16 | 2016/17 | 2017/18 | 2018/19 | 2019/20 | 2020/21 | 2021/22 | 2022/23 | 2023/24 | 2024/25 | 2025/26 | 2026/27 | 2027/28 | 2028/29 | 2029/30 | 2030/31 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 Average ESW pcc consumption | 0.07 | 0.15 | 0.22 | 0.29 | 0.36 | 0.44 | 0.51 | 0.58 | 0.65 | 0.73 | 0.80 | 0.87 | 0.94 | 1.02 | 1.09 | 1.16 | 1.23 | 1.31 | 1.38 | 1.45 |
| 2 Building Regulations Part G | 0.06 | 0.12 | 0.18 | 0.24 | 0.30 | 0.36 | 0.42 | 0.48 | 0.54 | 0.60 | 0.66 | 0.72 | 0.78 | 0.84 | 0.90 | 0.96 | 1.02 | 1.07 | 1.13 | 1.19 |
| 4 Suggested Policy Scenario | 0.05 | 0.10 | 0.15 | 0.20 | 0.25 | 0.30 | 0.35 | 0.40 | 0.45 | 0.50 | 0.55 | 0.60 | 0.65 | 0.70 | 0.75 | 0.80 | 0.85 | 0.90 | 0.95 | 1.00 |
| 3 Thames Gateway Water Neutrality Study | 0.05 | 0.09 | 0.14 | 0.18 | 0.23 | 0.27 | 0.32 | 0.36 | 0.41 | 0.45 | 0.50 | 0.54 | 0.59 | 0.64 | 0.68 | 0.73 | 0.77 | 0.82 | 0.86 | 0.91 |
| 5 CSH Level 5 & 6 | 0.04 | 0.08 | 0.11 | 0.15 | 0.19 | 0.23 | 0.27 | 0.31 | 0.34 | 0.38 | 0.42 | 0.46 | 0.50 | 0.54 | 0.57 | 0.61 | 0.65 | 0.69 | 0.73 | 0.76 |

| Annual Water Savings (against Building Regulations Part G - Scenario 2) (Ml/d) | 2011/12 | 2012/13 | 2013/14 | 2014/15 | 2015/16 | 2016/17 | 2017/18 | 2018/19 | 2019/20 | 2020/21 | 2021/22 | 2022/23 | 2023/24 | 2024/25 | 2025/26 | 2026/27 | 2027/28 | 2028/29 | 2029/30 | 2030/31 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 Suggested Policy Scenario | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 |
| 3 Thames Gateway Water Neutrality Study | 0.014 | 0.014 | 0.014 | 0.014 | 0.014 | 0.014 | 0.014 | 0.014 | 0.014 | 0.014 | 0.014 | 0.014 | 0.014 | 0.014 | 0.014 | 0.014 | 0.014 | 0.014 | 0.014 | 0.014 |
| 5 CSH Level 5 & 6 | 0.021 | 0.021 | 0.021 | 0.021 | 0.021 | 0.021 | 0.021 | 0.021 | 0.021 | 0.021 | 0.021 | 0.021 | 0.021 | 0.021 | 0.021 | 0.021 | 0.021 | 0.021 | 0.021 | 0.021 |

| Water Savings (against Building Regulations Part G - Scenario 2) (Ml/d) - CUMULATIVE | 2011/12 | 2012/13 | 2013/14 | 2014/15 | 2015/16 | 2016/17 | 2017/18 | 2018/19 | 2019/20 | 2020/21 | 2021/22 | 2022/23 | 2023/24 | 2024/25 | 2025/26 | 2026/27 | 2027/28 | 2028/29 | 2029/30 | 2030/31 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 Suggested Policy Scenario | 0.010 | 0.019 | 0.029 | 0.038 | 0.048 | 0.057 | 0.067 | 0.076 | 0.086 | 0.096 | 0.105 | 0.115 | 0.124 | 0.134 | 0.143 | 0.153 | 0.162 | 0.172 | 0.182 | 0.191 |
| 4 Thames Gateway Water Neutrality Study | 0.014 | 0.029 | 0.043 | 0.057 | 0.072 | 0.086 | 0.100 | 0.115 | 0.129 | 0.143 | 0.158 | 0.172 | 0.186 | 0.201 | 0.215 | 0.229 | 0.244 | 0.258 | 0.272 | 0.287 |
| 3 CSH Level 5 & 6 | 0.021 | 0.043 | 0.064 | 0.086 | 0.107 | 0.129 | 0.150 | 0.172 | 0.193 | 0.215 | 0.236 | 0.258 | 0.279 | 0.301 | 0.322 | 0.344 | 0.365 | 0.387 | 0.408 | 0.430 |

## Figure 5-11: Castle Point Borough Water Demand Calculations – Housing Option 2

### Option 2

| Housing Development | 2011/12 | 2012/13 | 2013/14 | 2014/15 | 2015/16 | 2016/17 | 2017/18 | 2018/19 | 2019/20 | 2020/21 | 2021/22 | 2022/23 | 2023/24 | 2024/25 | 2025/26 | 2026/27 | 2027/28 | 2028/29 | 2029/30 | 2030/31 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Scenario 2 - Annual Total (Completions and forecasts) | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 |
| Cummulative Total | 200 | 400 | 600 | 800 | 1,000 | 1,200 | 1,400 | 1,600 | 1,800 | 2,000 | 2,200 | 2,400 | 2,600 | 2,800 | 3,000 | 3,200 | 3,400 | 3,600 | 3,800 | 4,000 |
| Occupancy Rate | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 |
| Domestic Population Increase (Annual) | 420 | 420 | 420 | 420 | 420 | 420 | 420 | 420 | 420 | 420 | 420 | 420 | 420 | 420 | 420 | 420 | 420 | 420 | 420 | 420 |
| Domestic Population Increase (Cumulative) | 420 | 840 | 1,260 | 1,680 | 2,100 | 2,520 | 2,940 | 3,360 | 3,780 | 4,200 | 4,620 | 5,040 | 5,460 | 5,880 | 6,300 | 6,720 | 7,140 | 7,560 | 7,980 | 8,400 |

| Water Demand Scenario - Cumulative Water Consumption (l/h/d) | 2011/12 | 2012/13 | 2013/14 | 2014/15 | 2015/16 | 2016/17 | 2017/18 | 2018/19 | 2019/20 | 2020/21 | 2021/22 | 2022/23 | 2023/24 | 2024/25 | 2025/26 | 2026/27 | 2027/28 | 2028/29 | 2029/30 | 2030/31 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 Average ESW pcc consumption | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 |
| 2 Building Regulations Part G | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 |
| 4 Suggested Policy Scenario | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 |
| 3 Thames Gateway Water Neutrality Study | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 |
| 5 CSH Level 5 & 6 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 |

| Annual Water Demand Calculations (Ml/d) | 2011/12 | 2012/13 | 2013/14 | 2014/15 | 2015/16 | 2016/17 | 2017/18 | 2018/19 | 2019/20 | 2020/21 | 2021/22 | 2022/23 | 2023/24 | 2024/25 | 2025/26 | 2026/27 | 2027/28 | 2028/29 | 2029/30 | 2030/31 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 Average ESW pcc consumption | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 |
| 2 Building Regulations Part G | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 |
| 4 Suggested Policy Scenario | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 |
| 3 Thames Gateway Water Neutrality Study | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 |
| 5 CSH Level 5 & 6 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 |

| Water Demand Calculations (Ml/d) - CUMULATIVE | 2011/12 | 2012/13 | 2013/14 | 2014/15 | 2015/16 | 2016/17 | 2017/18 | 2018/19 | 2019/20 | 2020/21 | 2021/22 | 2022/23 | 2023/24 | 2024/25 | 2025/26 | 2026/27 | 2027/28 | 2028/29 | 2029/30 | 2030/31 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 Average ESW pcc consumption | 0.06 | 0.13 | 0.19 | 0.26 | 0.32 | 0.38 | 0.45 | 0.51 | 0.57 | 0.64 | 0.70 | 0.77 | 0.83 | 0.89 | 0.96 | 1.02 | 1.09 | 1.15 | 1.21 | 1.28 |
| 2 Building Regulations Part G | 0.05 | 0.11 | 0.16 | 0.21 | 0.26 | 0.32 | 0.37 | 0.42 | 0.47 | 0.53 | 0.58 | 0.63 | 0.68 | 0.74 | 0.79 | 0.84 | 0.89 | 0.95 | 1.00 | 1.05 |
| 4 Suggested Policy Scenario | 0.04 | 0.09 | 0.13 | 0.18 | 0.22 | 0.26 | 0.31 | 0.35 | 0.40 | 0.44 | 0.49 | 0.53 | 0.57 | 0.62 | 0.66 | 0.71 | 0.75 | 0.79 | 0.84 | 0.88 |
| 3 Thames Gateway Water Neutrality Study | 0.04 | 0.08 | 0.12 | 0.16 | 0.20 | 0.24 | 0.28 | 0.32 | 0.36 | 0.40 | 0.44 | 0.48 | 0.52 | 0.56 | 0.60 | 0.64 | 0.68 | 0.72 | 0.76 | 0.80 |
| 5 CSH Level 5 & 6 | 0.03 | 0.07 | 0.10 | 0.13 | 0.17 | 0.20 | 0.24 | 0.27 | 0.30 | 0.34 | 0.37 | 0.40 | 0.44 | 0.47 | 0.50 | 0.54 | 0.57 | 0.60 | 0.64 | 0.67 |

| Annual Water Savings (against Building Regulations Part G - Scenario 2) (Ml/d) | 2011/12 | 2012/13 | 2013/14 | 2014/15 | 2015/16 | 2016/17 | 2017/18 | 2018/19 | 2019/20 | 2020/21 | 2021/22 | 2022/23 | 2023/24 | 2024/25 | 2025/26 | 2026/27 | 2027/28 | 2028/29 | 2029/30 | 2030/31 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 Suggested Policy Scenario | 0.008 | 0.008 | 0.008 | 0.008 | 0.008 | 0.008 | 0.008 | 0.008 | 0.008 | 0.008 | 0.008 | 0.008 | 0.008 | 0.008 | 0.008 | 0.008 | 0.008 | 0.008 | 0.008 | 0.008 |
| 3 Thames Gateway Water Neutrality Study | 0.013 | 0.013 | 0.013 | 0.013 | 0.013 | 0.013 | 0.013 | 0.013 | 0.013 | 0.013 | 0.013 | 0.013 | 0.013 | 0.013 | 0.013 | 0.013 | 0.013 | 0.013 | 0.013 | 0.013 |
| 5 CSH Level 5 & 6 | 0.019 | 0.019 | 0.019 | 0.019 | 0.019 | 0.019 | 0.019 | 0.019 | 0.019 | 0.019 | 0.019 | 0.019 | 0.019 | 0.019 | 0.019 | 0.019 | 0.019 | 0.019 | 0.019 | 0.019 |

| Water Savings (against Building Regulations Part G - Scenario 2) (Ml/d) - CUMULATIVE | 2011/12 | 2012/13 | 2013/14 | 2014/15 | 2015/16 | 2016/17 | 2017/18 | 2018/19 | 2019/20 | 2020/21 | 2021/22 | 2022/23 | 2023/24 | 2024/25 | 2025/26 | 2026/27 | 2027/28 | 2028/29 | 2029/30 | 2030/31 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 Suggested Policy Scenario | 0.008 | 0.017 | 0.025 | 0.034 | 0.042 | 0.050 | 0.059 | 0.067 | 0.076 | 0.084 | 0.092 | 0.101 | 0.109 | 0.118 | 0.126 | 0.134 | 0.143 | 0.151 | 0.160 | 0.168 |
| 4 Thames Gateway Water Neutrality Study | 0.013 | 0.025 | 0.038 | 0.050 | 0.063 | 0.076 | 0.088 | 0.101 | 0.113 | 0.126 | 0.139 | 0.151 | 0.164 | 0.176 | 0.189 | 0.202 | 0.214 | 0.227 | 0.239 | 0.252 |
| 3 CSH Level 5 & 6 | 0.019 | 0.038 | 0.057 | 0.076 | 0.095 | 0.113 | 0.132 | 0.151 | 0.170 | 0.189 | 0.208 | 0.227 | 0.246 | 0.265 | 0.284 | 0.302 | 0.321 | 0.340 | 0.359 | 0.378 |

## Figure 5-12: Castle Point Borough Water Demand Calculations – Housing Option 3

### Option 3

| Housing Development | 2011/12 | 2012/13 | 2013/14 | 2014/15 | 2015/16 | 2016/17 | 2017/18 | 2018/19 | 2019/20 | 2020/21 | 2021/22 | 2022/23 | 2023/24 | 2024/25 | 2025/26 | 2026/27 | 2027/28 | 2028/29 | 2029/30 | 2030/31 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Scenario 3 - Annual Total (Completions and forecasts) | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 |
| Cummulative Total | 150 | 300 | 450 | 600 | 750 | 900 | 1,050 | 1,200 | 1,350 | 1,500 | 1,650 | 1,800 | 1,950 | 2,100 | 2,250 | 2,400 | 2,550 | 2,700 | 2,850 | 3,000 |
| Occupancy Rate | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 |
| Domestic Population Increase (Annual) | 315 | 315 | 315 | 315 | 315 | 315 | 315 | 315 | 315 | 315 | 315 | 315 | 315 | 315 | 315 | 315 | 315 | 315 | 315 | 315 |
| Domestic Population Increase (Cumulative) | 315 | 630 | 945 | 1,260 | 1,575 | 1,890 | 2,205 | 2,520 | 2,835 | 3,150 | 3,465 | 3,780 | 4,095 | 4,410 | 4,725 | 5,040 | 5,355 | 5,670 | 5,985 | 6,300 |

| Water Demand Scenario - Cumulative Water Consumption (l/h/d) | 2011/12 | 2012/13 | 2013/14 | 2014/15 | 2015/16 | 2016/17 | 2017/18 | 2018/19 | 2019/20 | 2020/21 | 2021/22 | 2022/23 | 2023/24 | 2024/25 | 2025/26 | 2026/27 | 2027/28 | 2028/29 | 2029/30 | 2030/31 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 Average ESW pcc consumption | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 |
| 2 Building Regulations Part G | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 |
| 4 Suggested Policy Scenario | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 |
| 3 Thames Gateway Water Neutrality Study | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 |
| 5 CSH Level 5 & 6 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 |

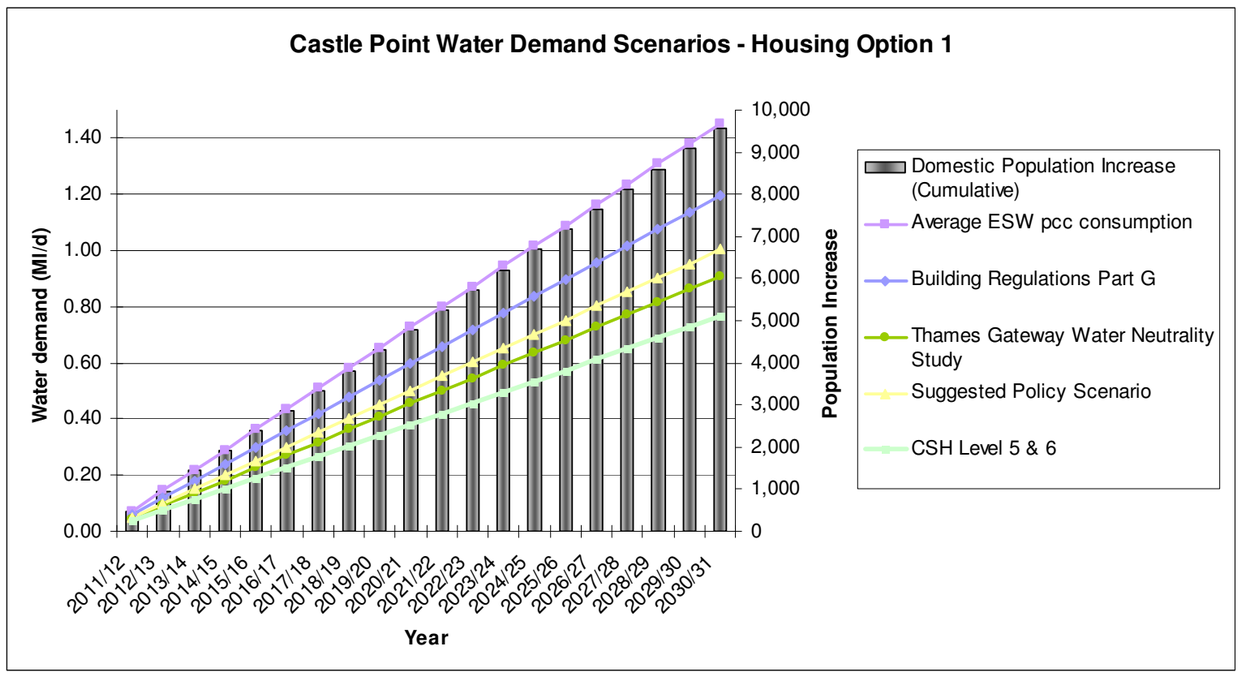
| Annual Water Demand Calculations (Ml/d) | 2011/12 | 2012/13 | 2013/14 | 2014/15 | 2015/16 | 2016/17 | 2017/18 | 2018/19 | 2019/20 | 2020/21 | 2021/22 | 2022/23 | 2023/24 | 2024/25 | 2025/26 | 2026/27 | 2027/28 | 2028/29 | 2029/30 | 2030/31 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 Average ESW pcc consumption | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 |
| 2 Building Regulations Part G | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 |
| 4 Suggested Policy Scenario | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 |
| 3 Thames Gateway Water Neutrality Study | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 |
| 5 CSH Level 5 & 6 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 |

| Water Demand Calculations (Ml/d) - CUMULATIVE | 2011/12 | 2012/13 | 2013/14 | 2014/15 | 2015/16 | 2016/17 | 2017/18 | 2018/19 | 2019/20 | 2020/21 | 2021/22 | 2022/23 | 2023/24 | 2024/25 | 2025/26 | 2026/27 | 2027/28 | 2028/29 | 2029/30 | 2030/31 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 Average ESW pcc consumption | 0.05 | 0.10 | 0.14 | 0.19 | 0.24 | 0.29 | 0.34 | 0.38 | 0.43 | 0.48 | 0.53 | 0.57 | 0.62 | 0.67 | 0.72 | 0.77 | 0.81 | 0.86 | 0.91 | 0.96 |
| 2 Building Regulations Part G | 0.04 | 0.08 | 0.12 | 0.16 | 0.20 | 0.24 | 0.28 | 0.32 | 0.35 | 0.39 | 0.43 | 0.47 | 0.51 | 0.55 | 0.59 | 0.63 | 0.67 | 0.71 | 0.75 | 0.79 |
| 4 Suggested Policy Scenario | 0.03 | 0.07 | 0.10 | 0.13 | 0.17 | 0.20 | 0.23 | 0.26 | 0.30 | 0.33 | 0.36 | 0.40 | 0.43 | 0.46 | 0.50 | 0.53 | 0.56 | 0.60 | 0.63 | 0.66 |
| 3 Thames Gateway Water Neutrality Study | 0.03 | 0.06 | 0.09 | 0.12 | 0.15 | 0.18 | 0.21 | 0.24 | 0.27 | 0.30 | 0.33 | 0.36 | 0.39 | 0.42 | 0.45 | 0.48 | 0.51 | 0.54 | 0.57 | 0.60 |
| 5 CSH Level 5 & 6 | 0.03 | 0.05 | 0.08 | 0.10 | 0.13 | 0.15 | 0.18 | 0.20 | 0.23 | 0.25 | 0.28 | 0.30 | 0.33 | 0.35 | 0.38 | 0.40 | 0.43 | 0.45 | 0.48 | 0.50 |

| Annual Water Savings (against Building Regulations Part G - Scenario 2) (Ml/d) | 2011/12 | 2012/13 | 2013/14 | 2014/15 | 2015/16 | 2016/17 | 2017/18 | 2018/19 | 2019/20 | 2020/21 | 2021/22 | 2022/23 | 2023/24 | 2024/25 | 2025/26 | 2026/27 | 2027/28 | 2028/29 | 2029/30 | 2030/31 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 Suggested Policy Scenario | 0.006 | 0.006 | 0.006 | 0.006 | 0.006 | 0.006 | 0.006 | 0.006 | 0.006 | 0.006 | 0.006 | 0.006 | 0.006 | 0.006 | 0.006 | 0.006 | 0.006 | 0.006 | 0.006 | 0.006 |
| 3 Thames Gateway Water Neutrality Study | 0.009 | 0.009 | 0.009 | 0.009 | 0.009 | 0.009 | 0.009 | 0.009 | 0.009 | 0.009 | 0.009 | 0.009 | 0.009 | 0.009 | 0.009 | 0.009 | 0.009 | 0.009 | 0.009 | 0.009 |
| 5 CSH Level 5 & 6 | 0.014 | 0.014 | 0.014 | 0.014 | 0.014 | 0.014 | 0.014 | 0.014 | 0.014 | 0.014 | 0.014 | 0.014 | 0.014 | 0.014 | 0.014 | 0.014 | 0.014 | 0.014 | 0.014 | 0.014 |

| Water Savings (against Building Regulations Part G - Scenario 2) (Ml/d) - CUMULATIVE | 2011/12 | 2012/13 | 2013/14 | 2014/15 | 2015/16 | 2016/17 | 2017/18 | 2018/19 | 2019/20 | 2020/21 | 2021/22 | 2022/23 | 2023/24 | 2024/25 | 2025/26 | 2026/27 | 2027/28 | 2028/29 | 2029/30 | 2030/31 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 Suggested Policy Scenario | 0.006 | 0.013 | 0.019 | 0.025 | 0.032 | 0.038 | 0.044 | 0.050 | 0.057 | 0.063 | 0.069 | 0.076 | 0.082 | 0.088 | 0.095 | 0.101 | 0.107 | 0.113 | 0.120 | 0.126 |
| 4 Thames Gateway Water Neutrality Study | 0.009 | 0.019 | 0.028 | 0.038 | 0.047 | 0.057 | 0.066 | 0.076 | 0.085 | 0.095 | 0.104 | 0.113 | 0.123 | 0.132 | 0.142 | 0.151 | 0.161 | 0.170 | 0.180 | 0.189 |
| 3 CSH Level 5 & 6 | 0.014 | 0.028 | 0.043 | 0.057 | 0.071 | 0.085 | 0.099 | 0.113 | 0.128 | 0.142 | 0.156 | 0.170 | 0.184 | 0.198 | 0.213 | 0.227 | 0.241 | 0.255 | 0.269 | 0.284 |

**Figure 5-13: Castle Point Borough Water Demand and Saving - Housing Option 1**



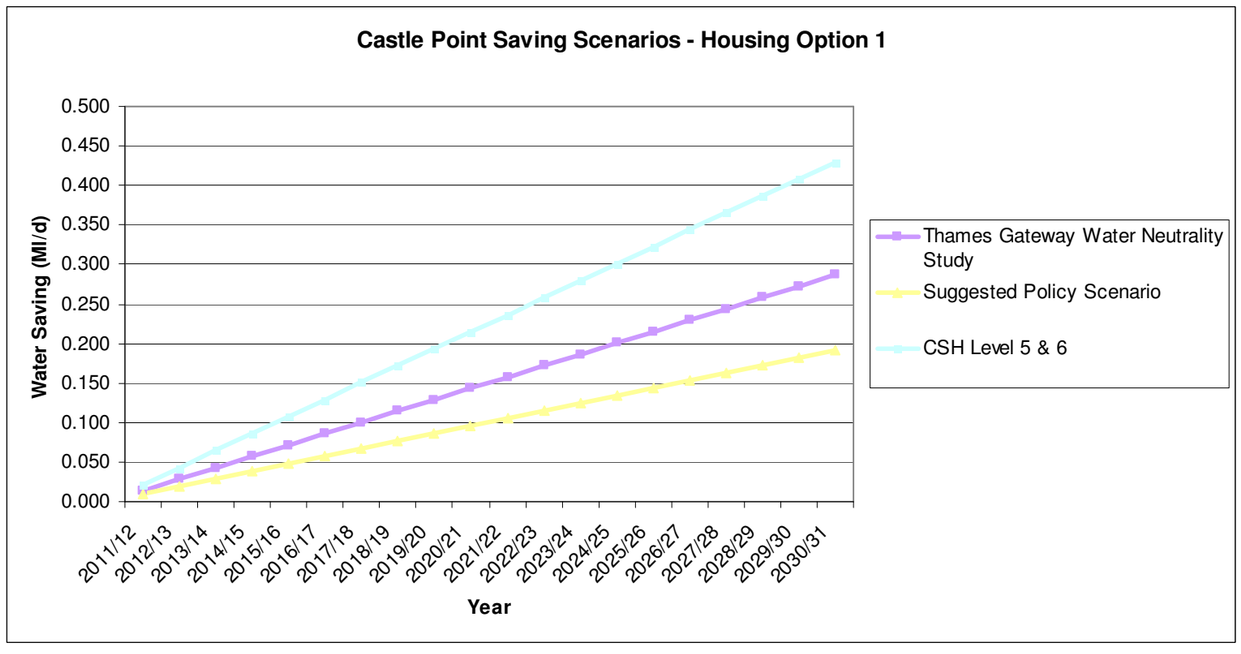
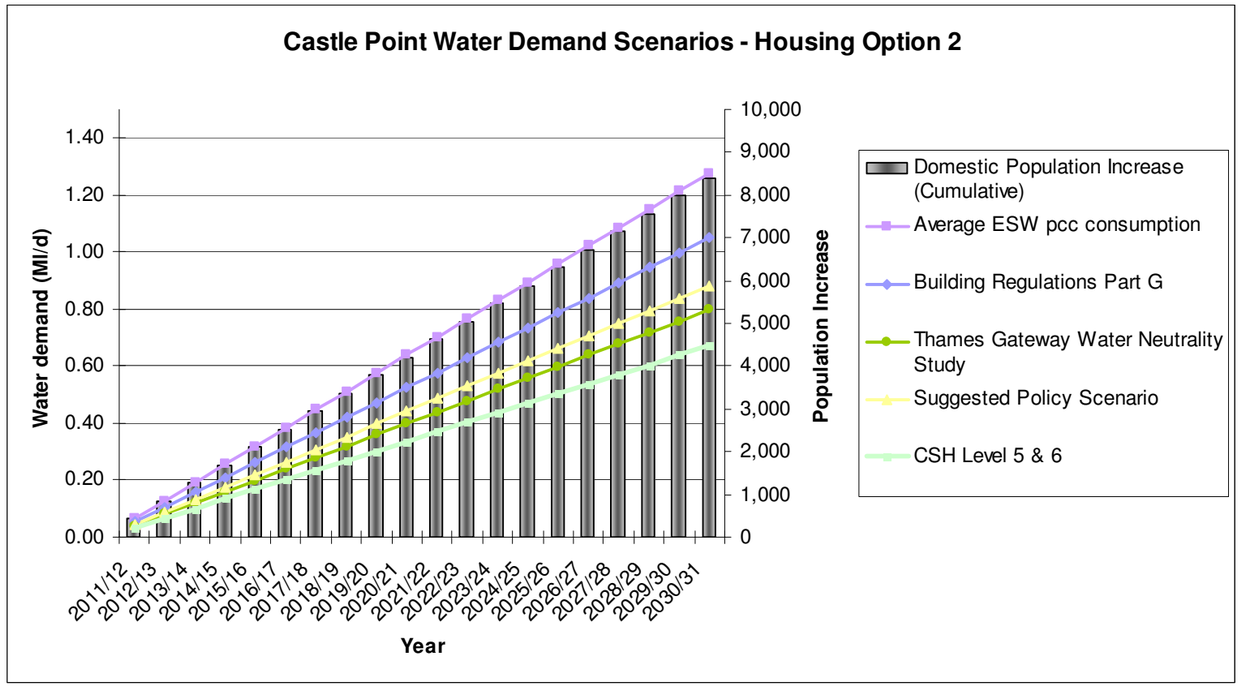



**Figure 5-14: Castle Point Borough Water Demand and Saving - Housing Option 2**



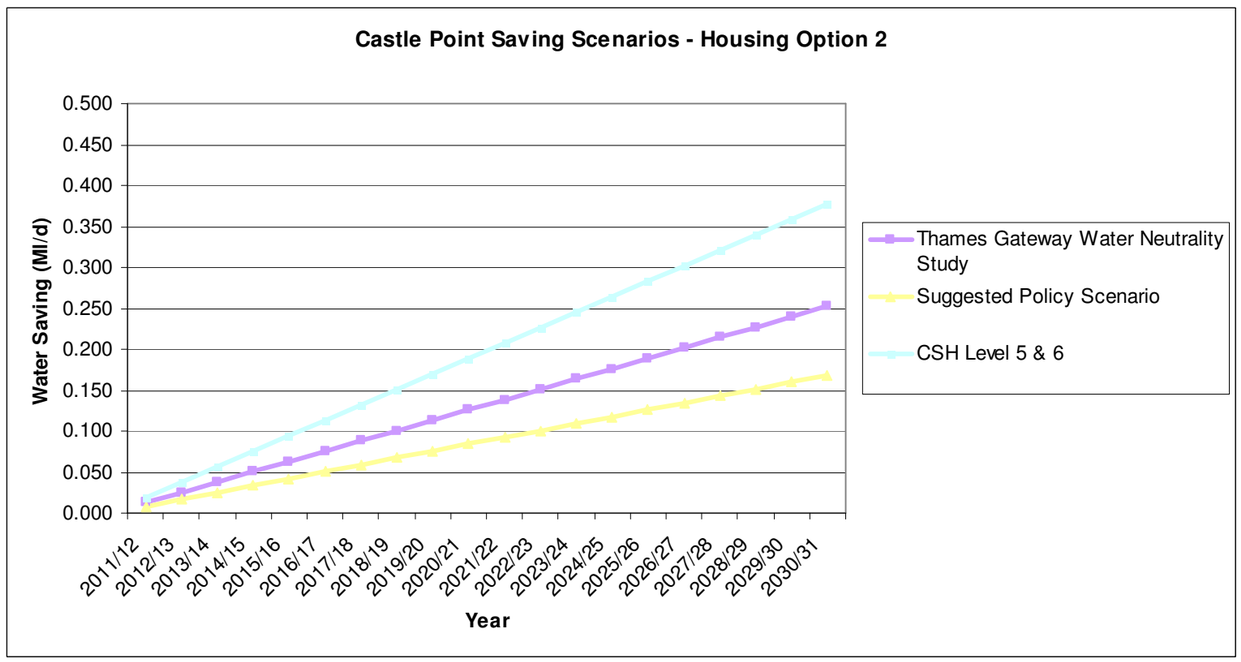
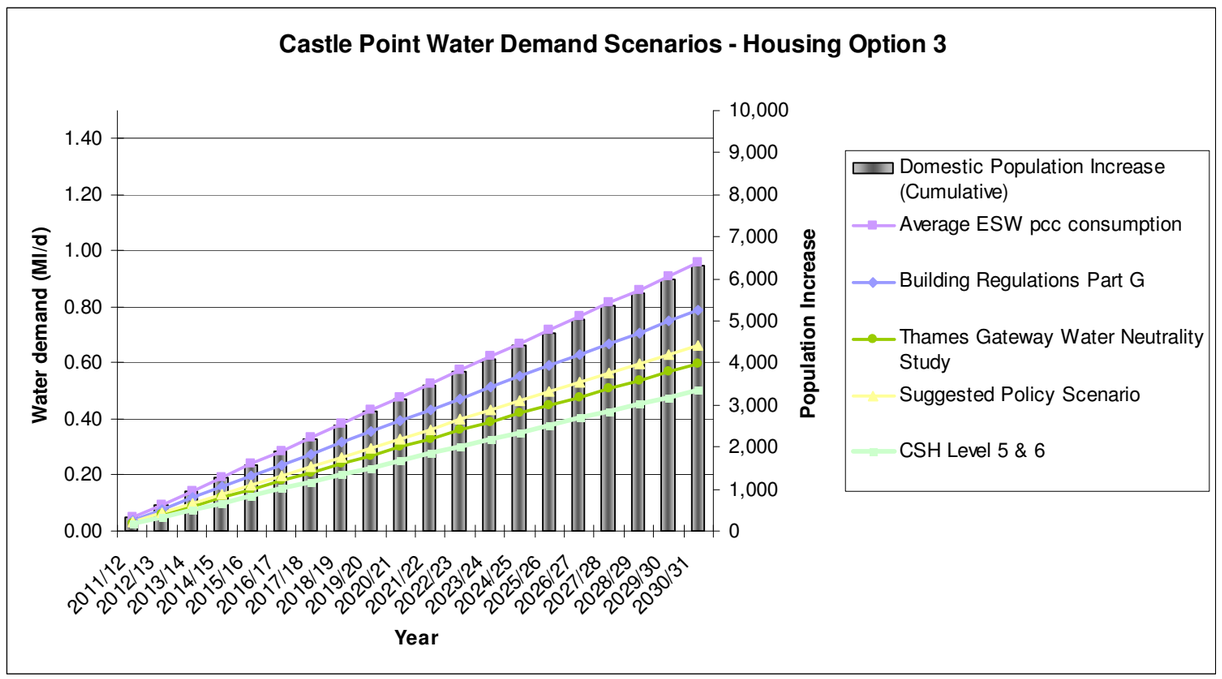
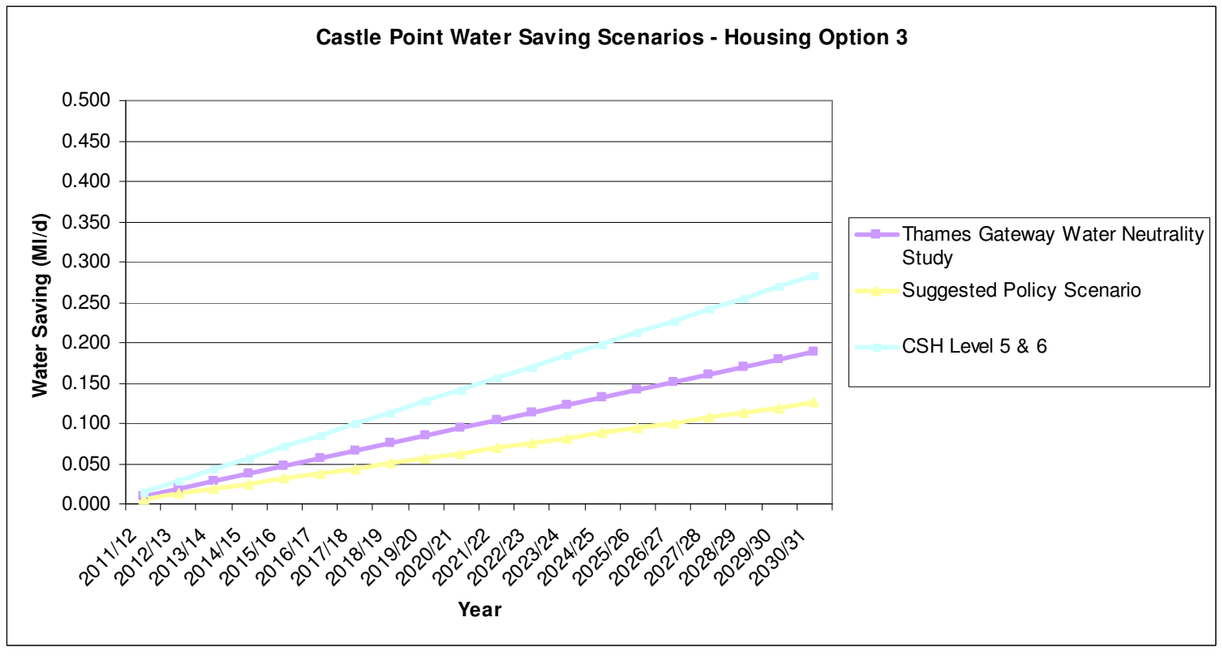



**Figure 5-15: Castle Point Borough Water Demand and Saving - Housing Option 3**



### 5.4.3 Rochford District water demand strategies

The calculations, shown below in Figures 5-16 to 5-17, indicate that the current metered water consumption (Projection 1) would require 1.21 Ml/d of additional supply by 2031. The Part G of the Building Regulations projection (Projection 2) would require 1 Ml/d of additional supply by 2031. This compares with the recommended policy projection (Projection 3), which would require 0.84 Ml/d by 2031. These figures, and the water requirements and saving of the other water consumption strategies are displayed graphically below.

Figures 5-16 to 5-17 below display the anticipated water saving from Projections 3, 4 and 5, as compared to the Part G of the Building Regulations projection (Projection 2). Demand can be reduced by between 0.16 and 0.36 Ml/d in 2031 by adopting more stringent water consumption approaches (Projections 2-5). The suggested policy projection gives a saving of 0.16 Ml/d in 2031.

## Figure 5-16: Rochford District Water Demand Calculations

### Option 1

| Housing Development | 2011/12 | 2012/13 | 2013/14 | 2014/15 | 2015/16 | 2016/17 | 2017/18 | 2018/19 | 2019/20 | 2020/21 | 2021/22 | 2022/23 | 2023/24 | 2024/25 | 2025/26 | 2026/27 | 2027/28 | 2028/29 | 2029/30 | 2030/31 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Scenario 1 - Annual Total (Completions and forecasts) | 190 | 190 | 190 | 190 | 190 | 190 | 190 | 190 | 190 | 190 | 190 | 190 | 190 | 190 | 190 | 190 | 190 | 190 | 190 | 190 |
| Cummulative Total | 190 | 380 | 570 | 760 | 950 | 1,140 | 1,330 | 1,520 | 1,710 | 1,900 | 2,090 | 2,280 | 2,470 | 2,660 | 2,850 | 3,040 | 3,230 | 3,420 | 3,610 | 3,800 |
| Occupancy Rate | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 |
| Domestic Population Increase (Annual) | 399 | 399 | 399 | 399 | 399 | 399 | 399 | 399 | 399 | 399 | 399 | 399 | 399 | 399 | 399 | 399 | 399 | 399 | 399 | 399 |
| Domestic Population Increase (Cumulative) | 399 | 798 | 1,197 | 1,596 | 1,995 | 2,394 | 2,793 | 3,192 | 3,591 | 3,990 | 4,389 | 4,788 | 5,187 | 5,586 | 5,985 | 6,384 | 6,783 | 7,182 | 7,581 | 7,980 |

| Water Demand Scenario - Cumulative Water Consumption (l/h/d) | 2011/12 | 2012/13 | 2013/14 | 2014/15 | 2015/16 | 2016/17 | 2017/18 | 2018/19 | 2019/20 | 2020/21 | 2021/22 | 2022/23 | 2023/24 | 2024/25 | 2025/26 | 2026/27 | 2027/28 | 2028/29 | 2029/30 | 2030/31 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 Average ESW pcc consumption | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 |
| 2 Building Regulations Part G | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 | 125 |
| 4 Suggested Policy Scenario | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 |
| 3 Thames Gateway Water Neutrality Study | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 |
| 5 CSH Level 5 & 6 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 |

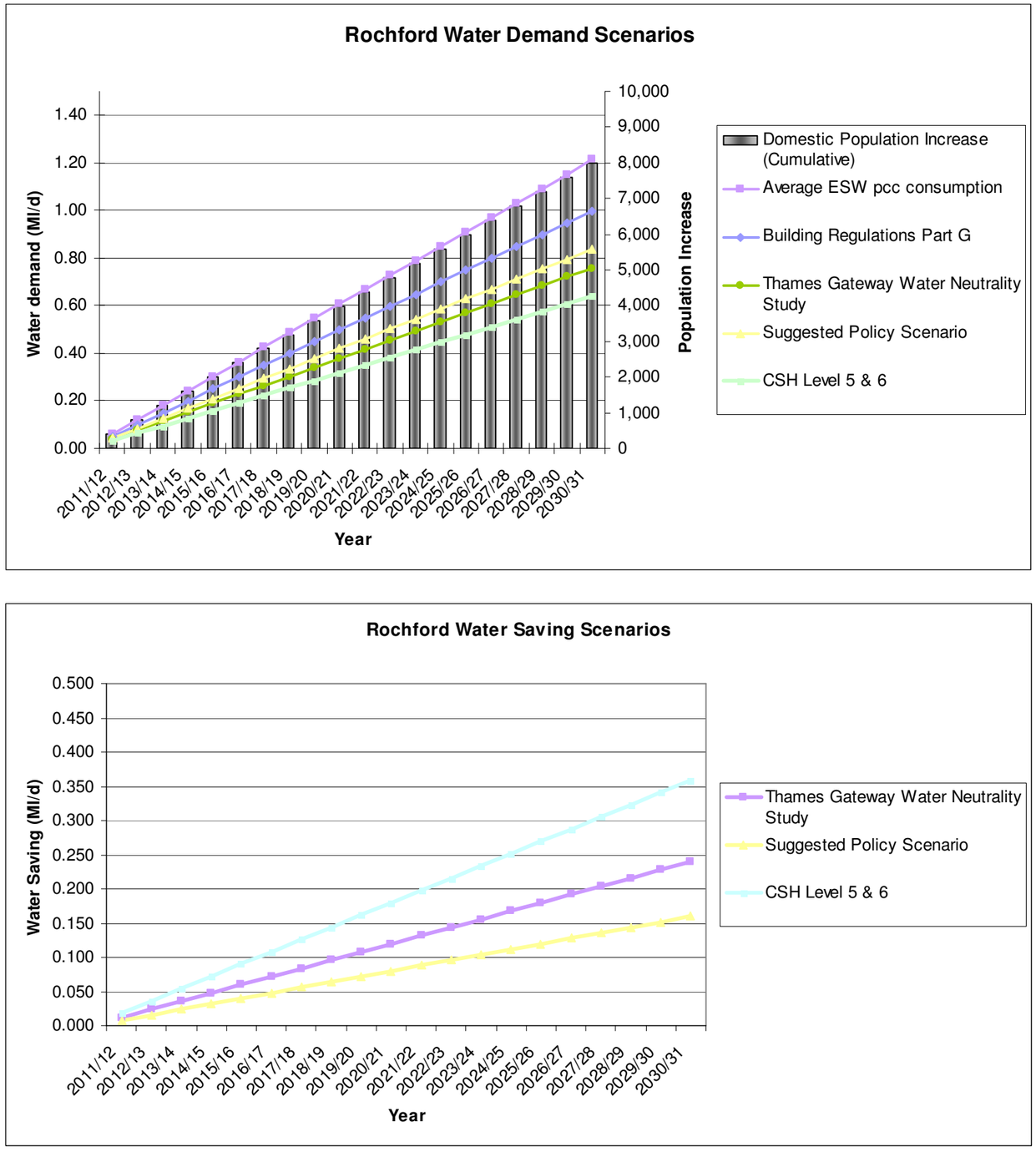
| Annual Water Demand Calculations (Ml/d) | 2011/12 | 2012/13 | 2013/14 | 2014/15 | 2015/16 | 2016/17 | 2017/18 | 2018/19 | 2019/20 | 2020/21 | 2021/22 | 2022/23 | 2023/24 | 2024/25 | 2025/26 | 2026/27 | 2027/28 | 2028/29 | 2029/30 | 2030/31 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 Average ESW pcc consumption | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 |
| 2 Building Regulations Part G | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 |
| 4 Suggested Policy Scenario | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 |
| 3 Thames Gateway Water Neutrality Study | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 |
| 5 CSH Level 5 & 6 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 |

| Water Demand Calculations (Ml/d) - CUMULATIVE | 2011/12 | 2012/13 | 2013/14 | 2014/15 | 2015/16 | 2016/17 | 2017/18 | 2018/19 | 2019/20 | 2020/21 | 2021/22 | 2022/23 | 2023/24 | 2024/25 | 2025/26 | 2026/27 | 2027/28 | 2028/29 | 2029/30 | 2030/31 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 Average ESW pcc consumption | 0.06 | 0.12 | 0.18 | 0.24 | 0.30 | 0.36 | 0.42 | 0.49 | 0.55 | 0.61 | 0.67 | 0.73 | 0.79 | 0.85 | 0.91 | 0.97 | 1.03 | 1.09 | 1.15 | 1.21 |
| 2 Building Regulations Part G | 0.05 | 0.10 | 0.15 | 0.20 | 0.25 | 0.30 | 0.35 | 0.40 | 0.45 | 0.50 | 0.55 | 0.60 | 0.65 | 0.70 | 0.75 | 0.80 | 0.85 | 0.90 | 0.95 | 1.00 |
| 4 Suggested Policy Scenario | 0.04 | 0.08 | 0.13 | 0.17 | 0.21 | 0.25 | 0.29 | 0.34 | 0.38 | 0.42 | 0.46 | 0.50 | 0.54 | 0.59 | 0.63 | 0.67 | 0.71 | 0.75 | 0.80 | 0.84 |
| 3 Thames Gateway Water Neutrality Study | 0.04 | 0.08 | 0.11 | 0.15 | 0.19 | 0.23 | 0.27 | 0.30 | 0.34 | 0.38 | 0.42 | 0.45 | 0.49 | 0.53 | 0.57 | 0.61 | 0.64 | 0.68 | 0.72 | 0.76 |
| 5 CSH Level 5 & 6 | 0.03 | 0.06 | 0.10 | 0.13 | 0.16 | 0.19 | 0.22 | 0.26 | 0.29 | 0.32 | 0.35 | 0.38 | 0.41 | 0.45 | 0.48 | 0.51 | 0.54 | 0.57 | 0.61 | 0.64 |

| Annual Water Savings (against Building Regulations Part G - Scenario 2) (Ml/d) | 2011/12 | 2012/13 | 2013/14 | 2014/15 | 2015/16 | 2016/17 | 2017/18 | 2018/19 | 2019/20 | 2020/21 | 2021/22 | 2022/23 | 2023/24 | 2024/25 | 2025/26 | 2026/27 | 2027/28 | 2028/29 | 2029/30 | 2030/31 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 Suggested Policy Scenario | 0.008 | 0.008 | 0.008 | 0.008 | 0.008 | 0.008 | 0.008 | 0.008 | 0.008 | 0.008 | 0.008 | 0.008 | 0.008 | 0.008 | 0.008 | 0.008 | 0.008 | 0.008 | 0.008 | 0.008 |
| 3 Thames Gateway Water Neutrality Study | 0.012 | 0.012 | 0.012 | 0.012 | 0.012 | 0.012 | 0.012 | 0.012 | 0.012 | 0.012 | 0.012 | 0.012 | 0.012 | 0.012 | 0.012 | 0.012 | 0.012 | 0.012 | 0.012 | 0.012 |
| 5 CSH Level 5 & 6 | 0.018 | 0.018 | 0.018 | 0.018 | 0.018 | 0.018 | 0.018 | 0.018 | 0.018 | 0.018 | 0.018 | 0.018 | 0.018 | 0.018 | 0.018 | 0.018 | 0.018 | 0.018 | 0.018 | 0.018 |

| Water Savings (against Building Regulations Part G - Scenario 2) (Ml/d) - CUMULATIVE | 2011/12 | 2012/13 | 2013/14 | 2014/15 | 2015/16 | 2016/17 | 2017/18 | 2018/19 | 2019/20 | 2020/21 | 2021/22 | 2022/23 | 2023/24 | 2024/25 | 2025/26 | 2026/27 | 2027/28 | 2028/29 | 2029/30 | 2030/31 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 Suggested Policy Scenario | 0.008 | 0.016 | 0.024 | 0.032 | 0.040 | 0.048 | 0.056 | 0.064 | 0.072 | 0.080 | 0.088 | 0.096 | 0.104 | 0.112 | 0.120 | 0.128 | 0.136 | 0.144 | 0.152 | 0.160 |
| 4 Thames Gateway Water Neutrality Study | 0.012 | 0.024 | 0.036 | 0.048 | 0.060 | 0.072 | 0.084 | 0.096 | 0.108 | 0.120 | 0.132 | 0.144 | 0.156 | 0.168 | 0.180 | 0.192 | 0.203 | 0.215 | 0.227 | 0.239 |
| 3 CSH Level 5 & 6 | 0.018 | 0.036 | 0.054 | 0.072 | 0.090 | 0.108 | 0.126 | 0.144 | 0.162 | 0.180 | 0.198 | 0.215 | 0.233 | 0.251 | 0.269 | 0.287 | 0.305 | 0.323 | 0.341 | 0.359 |

**Figure 5-17: Rochford District Water Demand and Saving**



### 5.4.4 Catchment Abstraction Management Strategy

The Catchment Abstraction Management Strategy (CAMS) relevant to the Essex supply area are:

- the Roding, Beam & Ingrebourne CAMS[63];
- the Combined Essex CAMS[64]; and
- the Cam and Ely Ouse CAMS[65].

The CAMS define catchment units called Water Resources Management Units (WRMUs) or Groundwater Management Units (GWMU) and assigns a resource availability status to each, as follows:

- water available - water is likely to be available at all flows including low flows although restrictions may apply;
- no water available - no water is available for further licensing at low flows although water may be available at higher flows with appropriate restrictions;
- over-licensed - current actual abstraction is such that no water is available at low flows, if existing licences were used to their full allocation they could cause unacceptable environmental damage at low flows although water may be available at high flows, with appropriate restrictions; and
- over-abstracted - existing abstraction is causing unacceptable damage to the environment at low flows, although water may still be available at high flows, with appropriate restrictions.

Of the WRMUs covering the ESW Essex supply area only three have a current status of 'water available'. These are the Upper Roach, Crouch and Mardyke rivers, the Rivers Beam, Ingrebourne and Lower Roding and the Chalk Aquifer beneath the Beam, Ingrebourne and Lower Roding catchments.

### 5.4.5 Water Resources Management Plan

As discussed above in section 5.1.3, the study area lies within ESW's Essex Resource Zone. ESW issued its WRMP[66] in January 2010, which sets out the company's plan for management of water resources within its supply area for the period until 2034/2035.

The WRMP concludes the following for the ERZ for both dry year and normal year planning scenarios:

- supply is currently insufficient to meet demand (both including and excluding any allowance for target headroom), the only exception to this is with the normal year scenario for the base year only where a nominal surplus exists;
- with no action the forecast deficit is set to worsen over the planning horizon, due to declining baseline Water Available For Use (WAFU) and increasing distribution input;
- baseline WAFU declines over time due to the effects of climate change; and

[63] The Roding, Beam & Ingrebourne Catchment Abstraction Management Strategy, Environment Agency, January 2006
[64] The Combined Essex Catchment Abstraction Management Strategy, Environment Agency, February 2007
[65] Cam and Ely Ouse Catchment Abstraction Management Strategy, Environment Agency, March 2007
[66] Final Water Resource Management Plan, Essex and Suffolk Water, January 2010.

- distribution input initially declines from the base year to 2010 and then rises immediately afterwards, largely due to the predicted increase in house building post 2010 when the economy was anticipated to be in a state of recovery.

The balance of supply for both dry year and normal year planning scenarios from the WRMP is summarised in Table 5-1 below.

**Table 5-1: Balance of Supply for Essex Resource Zone in Ml/d**

| Planning scenario | Base Year | End of AMP4 | End of AMP5 | End of AMP6 | End of AMP7 | End of AMP8 | Planning horizon |
|---|---|---|---|---|---|---|---|
| | 2007/08 | 2009/10 | 2014/15 | 2019/20 | 2024/25 | 2029/30 | 2034/35 |
| **Dry year** | | | | | | | |
| No headroom | -5.51 | -4.21 | -13.21 | -17.88 | -23.23 | -32.28 | -41.17 |
| Headroom | -5.51 | -21.82 | -45.14 | -52.23 | -50.02 | -60.83 | -63.51 |
| **Normal year** | | | | | | | |
| No headroom | +2.48 | +3.66 | -5.39 | -10.45 | -16.00 | -25.17 | -34.16 |
| Headroom | +2.48 | -13.94 | -37.31 | -44.80 | -42.78 | -53.78 | -56.50 |

The table above shows that with no measures in place to increase the WAFU, ESW would have a supply-demand deficit of over 34.16 Ml/d (assuming no headroom) by the end of the WCS study period for a normal year and over 32.28 Ml/d for a dry year. It can also be seen from Table 5-1 above that the timescales are such that in a dry year, there is already a deficit and water resource management options are required now.

### 5.4.6 Water Resource Zone Forecast Supply-Demand Balance

ESW has investigated sourcing additional water resources from within the three catchments listed in the CAMS as having water available, namely the Upper Roach, Crouch and Mardyke rivers, the Rivers Beam, Ingrebourne and Lower Roding and the Chalk Aquifer beneath the Beam, Ingrebourne and Lower Roding catchments. However the WRMP[67] concluded that no resource development is possible, due to poor water quality combined with relatively small quantities available, which would make any resource development uneconomic.

ESW has therefore investigated other water management options, as listed in the WRMP:

- Customer Side Management Options
    - Meter Installation Policy (including Compulsory Metering)
    - Introduction/Modification of Tariffs
    - Water Efficiency & Water Conservation Measures (Seven option groups)
- Distribution Management Options
    - Leakage Reduction Policy
    - Pressure Reduction Programme.
    - Supply Pipe Leakage Repairs
    - Replacement of Iron Pipes
    - Operational Mains/Service Reservoir Flushing

[67] Final Water Resource Management Plan, Essex and Suffolk Water, January 2010.

- Production Management Options
    - Reduction of Raw Water Losses and Operational Use
    - Reduction of Treatment Works Losses and Operational Use
    - Outage Reduction Schemes
- Resource Management Options
    - New River abstractions
    - New Groundwater abstractions
    - New Reservoir Storage
    - Extension of Existing Reservoirs
    - Conjunctive Use/Management of Resources
    - Aquifer Storage & Recovery (ASR) & Artificial Recharge
    - Desalination
    - Effluent Recycling
    - New/Extended Bulk Transfers
    - Large scale water transfers
    - Esoteric Options (e.g. sea tankering, towing flexible bags, towing icebergs etc).

The option of constructing a new reservoir was discarded in favour of the extension of the existing reservoir at Abberton, due to environmental (increased landtake and environmental impact) and political (impacts on landowners) constraints. The WRMP gives the following estimates for the increases in available water that will result from the Abberton scheme.

**Table 5-2: Increases in available water with the Abberton scheme**

| Scenario | No climate change | | Climate change mid 2025 | |
|---|---|---|---|---|
| | Deployable Output (Ml/d) | Mean Yield (Ml/d) | Deployable Output (Ml/d) | Mean Yield (Ml/d) |
| Baseline (with SAGS*) | 298 | | 290 | |
| Full Abberton scheme | 360 | 62 | 354 | 64 |

| Scenario | Climate change wet 2025 | | Climate change dry 2025 | |
|---|---|---|---|---|
| | Deployable Output (Ml/d) | Mean Yield (Ml/d) | Deployable Output (Ml/d) | Mean Yield (Ml/d) |
| Baseline (with SAGS) | 321 | | 259 | |
| Full Abberton scheme | 396 | 75 | 300 | 41 |

*SAGS = Stour Augmentation Groundwater Scheme

## 5.5 Water Supply Infrastructure

As with the sewer network, impacts on the potable water distribution network from the proposed growth in the study area would be dependent on the exact location of the proposed development. There is limited capacity to transfer increased flows through towns and settlements in the existing networks (although potable water mains often have more capacity than wastewater networks) and there are obvious difficulties with constructing a new main through an already developed area. However, if a large new development were proposed close to an existing supply main, it would be theoretically possible to construct a new pipeline to serve the new development, with the associated costs passed on to the developer. The phasing of new infrastructure and upgrades to existing infrastructure should be considered when planning the development of large sites.

## 5.6 Environmental and Ecological Impact

There are no international sites (Special Areas of Conservation, Special Protection Areas or Ramsar sites) within Basildon Borough, although Benfleet & Southend Marshes SPA/Ramsar site lies within 1km of the boundary. Benfleet & Southend Marshes SPA/Ramsar site lies within the boundary of Castle Point Borough. Crouch & Roach Estuaries SPA/Ramsar site, Foulness SPA/Ramsar site and Essex Estuaries SAC all lie within the boundary of Rochford District.

### 5.6.1 National sites

**Basildon Borough**

Other than those covered by the previously mentioned SPAs and Ramsar sites, there are five SSSIs wholly or partly in Basildon Borough:

- Norsey Wood SSSI – not particularly hydrologically sensitive;
- Basildon Meadows SSSI - not particularly hydrologically sensitive;
- Pitsea Marsh SSSI – hydrologically sensitive; Pitsea Marsh SSSI comprises a mosaic of habitats, including scrub, grassland, reedbed and fen, open water and saltmarsh;
- Vange and Fobbing Marshes SSSI - hydrologically sensitive; the unimproved coastal grassland and associated dykes and creeks support a diversity of maritime grasses and herbs. Many of these species are nationally uncommon or rare, and together form an outstanding assemblage of plants; and
- Holehaven Creek SSSI – hydrologically sensitive; partly within Basildon Borough, the tidal creek system acts as the principal drain for the surrounding grazing marshes and forms a confluence at Holehaven with the River Thames. The intertidal mudflats and saltmarsh habitats of Holehaven Creek support a nationally important number of black-tailed godwit *Limosa limosa islandica* as well as many other birds.

**Castle Point Borough**

Other than those covered by the previously mentioned SPAs and Ramsar sites, there are five SSSIs wholly or partly within Castle Point Borough:

- Garrold's Meadow SSSI – not particularly hydrologically sensitive;
- Great Wood & Dodd's Grove SSSI – not particularly hydrologically sensitive;
- Thundersley Great Common SSSI – not particularly hydrologically sensitive;

- Holehaven Creek SSSI – hydrologically sensitive; partly within Castle Point, the tidal creek system acts as the principal drain for the surrounding grazing marshes and forms a confluence at Holehaven with the River Thames. The intertidal mudflats and saltmarsh habitats of Holehaven Creek support a nationally important number of black-tailed godwit *Limosa limosa islandica* as well as many other birds; and
- Canvey Wick SSSI – hydrologically sensitive; the site is dominated by free-draining grassland and wetland features that support a nationally important assemblage of invertebrates, chiefly associated with herb-rich grassland, disturbed bare ground, open sward, scrub edge, and brackish (coastal wetland) habitats. The brackish wetland habitats include ditches, shallow temporary pools and ponds. These provide aquatic habitat for several rare invertebrates.

**Rochford District**

Other than those covered by the previously mentioned SPAs and Ramsar sites, there is one SSSI in Rochford District, Hockley Woods SSSI, but this site is not particularly hydrologically sensitive.

### 5.6.2 Local sites

**Basildon**

Not including those that overlap with the European sites or SSSIs discussed in this report, there are two Local Nature Reserves (LNR) in Basildon, Mill Meadows LNR and Vange Hill LNR, but neither are particularly hydrologically sensitive.

There are fifty-four non-statutory Local Wildlife Sites (LoWS) in Basildon Borough[68]. Fifteen of these have an aquatic ecology component:

- Little Burstead Common – this site includes a pond which has been enlarged in recent years;
- The Wilderness – this site contains a pond complex and is the source of the River Crouch;;
- Langdon Complex – this site contains a lake and several ponds;
- St Nicholas Church Complex – this site contains a pond;
- Dry Street Pastures – the southern end of this site is a washland linked to a small stream/ditch;
- Moses' Spring/Barrenleys/Claypittshills Woods – a small spring has its origin in this wood;
- Vange Creek Marshes – this is connected to Vange & Fobbing Marshes SSSI;
- Pitsea Landfill – this site includes some intertidal habitat along the Vange and Pitsea Creeks;
- Nevedon Bushes – this site contains a pond;
- Wickford Riverside – the River Crouch falls within the boundary of this site;
- Burnt Mills Washland – this site includes areas of wet grassland, designed to flood as a washland in times of high rainfall, which is currently being relocated north of the A127 to be enable development;
- Bowers Marshes – this site includes a lake and a range of ditches and grazing marsh;

[68] Basildon District Habitat and Biodiversity Service Level Agreement Report, Essex Ecology Services Ltd, 2009

- Southfields Washlands – this site is a washland linked to a concrete channel which periodically overflows;
- Bluntswall Shaws – this site contains a pond; and
- Wick Country Park – this site contains a lake and the course of the North Benfleet Brook.

**Castle Point Borough**

Not including those that overlap with the European sites or SSSIs discussed in this report, there is one LNR in Castle Point, Canvey Lake LNR, but although hydrologically sensitive it is not connected to watercourses used for Public Water Supply.

There are thirty-four non-statutory LoWS in Castle Point Borough[69]. Eleven of these have an aquatic ecology component:

- Rushbottom Lane Flood Pound – this site has poor drainage and therefore a marsh component;
- West Canvey Marshes – this site is an extensive area of grazing marsh and drainage ditches;
- Canvey Village Marsh – this is a smaller area of relict grazing marsh and drainage ditches;
- Shipwrights Wood – this woodland has some marshy areas;
- The Lake, Canvey Island – this site is a large lake;
- Wall Wood/ Nine Acre Wood – this site contains a pond;
- Castle Farm/ Hadleigh Castle Grasslands – this site contains a range of ponds and drainage ditches;
- Two Tree Island Lagoon – this site is a lagoon;
- Pound Wood - this woodland has some marshy areas;
- Oakwood Reservoirs – this site consists of a series of reservoirs; and
- Thorneycreek Fleet – this site consists of a flowing ditch.

**Rochford District**

Not including those that overlap with the European sites or SSSIs discussed in this report, there are three LNRs in Rochford, Marylands LNR, Magnolia Fields LNR and Kendall Park LNR, but none are particularly hydrologically sensitive.

There are thirty-nine non-statutory LoWS in Rochford District[70]. Thirteen of these have an aquatic ecology component:

- Brandy Hole Marsh Extension – this is an area of saltmarsh created by managed retreat along the River Crouch;
- The Dome Grasslands – this is an area of periodically inundated relict grazing marsh on the River Crouch;
- Magnolia Nature Reserve & Fields – this site contains a pond;
- Doggett's Pond – this site contains a pond;

[69] Castle Point Borough Local Wildlife Sites Review, Essex Ecology Services Ltd, 2007
[70] Rochford District Local Wildlife Sites Review, Essex Ecology Services Ltd, 2007

- Sutton Ford Bridge Pasture – this is an area of relict grazing marsh;
- River Roach at Rochford – this is a section of the River Roach at Rochford, above the tidal limit;
- Butts Hill Pond – this site contains a pond;
- The Finches – this site contains a pond;
- Barling Pits – this site consists of flooded gravel pits;
- Star Lane Pits – this site consists of flooded gravel pits;
- Paglesham Seawall – this is a seawall on the tidal River Roach;
- Great Wakering Common – this site contains a pond and ditches; and
- Wallasea Island Managed Realignment – this consists of an area of intertidal habitat on the River Crouch.

### 5.6.3 Screening assessment

The potable water for the study area is currently transferred from central Essex and south Suffolk. This requires abstraction from some or all of the Rivers Crouch, Roach and Blackwater, or from tributaries of these watercourses. There are no Public Water Supply abstractions from the watercourses that feed the Benfleet & Southend Marshes SPA.

From 2014, any possible shortfall in the potable water supply needs of the study area will be met through the Abberton Reservoir enlargement scheme, which is currently under construction and was subject to its own Appropriate Assessment. The increased storage capacity will increase the habitat available for the internationally important bird populations, leading to a positive effect. Since the Abberton Scheme has already been subject to its own Appropriate Assessment; as such, there is no need for it to be reconsidered in this Outline WCS.

Until the Abberton scheme comes online however, ESW will continue to operate with a supply/demand shortfall and will seek to address this through demand management measures. It is expected that during this period there will be no need to increase the existing groundwater and/or surface water licenses which currently supply water to Basildon Borough, Rochford District and Castle Point Borough. Moreover, the existing spare capacity in these consents, which may be required to serve new development in the study area up to 2014/15, has already been evaluated for its potential to result in adverse effects on European sites through the Environment Agency's Review of Consents (RoC) process (which always assesses the full licensed volume irrespective of whether the current actual volume is lower) and therefore do not need to be reconsidered as part of this Outline WCS.

### 5.6.4 Conclusion

There will be no need to consider impacts on Designated Sites as a result of increased abstraction any further in this Outline WCS, since the long-term water supply strategy will be met by the Abberton Reservoir scheme. However, this scheme has now been consented and has been subject to its own Appropriate Assessment as part of that process.

## 5.7 Conclusions

ESW is predicting a supply/demand deficit during the plan period; in a dry year there is already a deficit. However, ESW has predicted that the implementation of the Abberton Reservoir

scheme will provide the additional water resources required for growth within the Essex Resource Zone, and hence also the study area, until 2031 and beyond.

An Appropriate Assessment was carried out by ESW for the purposes of the Abberton Reservoir Scheme, which concluded no adverse effects on designated conservation sites. The Abberton Reservoir Scheme has therefore been consented and construction of the scheme is already underway. Despite this, it is important that water efficiency measures be incorporated into all new development, to ensure the most sustainable use of existing resources in the study area.

The suggested policy recommendation (as discussed further below in section 9.2) is for a water use target of 105 l/h/d for new households. This is lower than the per capita consumption that ESW has assumed in its WRMP. ESW have assumed a pcc of 125 l/h/d for new builds, in line with Part G of the Building Regulations, and a pcc of 105 l/h/d (Level 3 of CfSH) for social housing. Therefore, ESW plans to have sufficient resources to meet forecast demand without the need for all new homes to meet CfSH Level 3/4. This assumes that there will be a reduction in the volume of water used on average in existing households due to a combination of increased water metering and retrofitting water efficiency measures. There are however a number of benefits in new homes meeting level 3/4 (or greater), which the Local Planning Authorities should consider in any decisions regarding water efficiency planning policy. Further details on water efficiency and associated savings are given in Section 5.8 below.

## 5.8 Measures to achieve CfSH Levels 3/4

In order to reduce water consumption and manage demand for the limited water resources within the study area, a number of measures and devices are available[71]. The varying costs, space and design constraints of these devices mean that they can be divided into two categories; measures that should be installed for new developments and those which can be retrofitted into existing properties.

### 5.8.1 New Developments

**Rainwater Harvesting**

Rainwater harvesting (RWH) is the capture and storage of rain water that lands on the roof of a property. This can have the dual advantage of both reducing the volume of water leaving a site, thereby reducing surface water management requirements and potential flooding issues, and be a direct source of water, thereby reducing the amount of water that needs to be supplied to a property from the mains water system.

RWH systems typically consist of a collection area (usually a rooftop), a method of conveying the water to a storage tank (gutters, down spouts and pipes), a filtration and treatment system, a storage tank and a method of conveying the water from the storage container to the taps (pipes with pumped or gravity flow). A treatment system may also be included; the level to which the rainwater gets treated depends on the source of the rainwater and the purpose for which it has been collected. Rainwater is usually first filtered, to remove larger debris such as leaves and grit. A second stage may also be incorporated into the holding tank; some systems contain biological treatment within the holding tank, or flow calming devices on the inlet and outlets that allow heavier particles to sink to the bottom, with lighter debris and oils floating to the surface of the water. A floating extraction system can then allow the clean rainwater to be extracted from between these two layers[72].

[71] Source: Water Efficiency in the South East of England, Environment Agency, April 2007.
[72] Aquality Rainwater Harvesting brochure, 2008

### Greywater Recycling

Greywater recycling (GWR) is the treatment and re-use of wastewater from showers, baths and sinks, for uses where potable quality water is not essential e.g. toilet flushing. Greywater is not suitable for human consumption or for irrigating plants or crops that are intended for human consumption. The source of greywater should be selected by available volumes and pollution levels, which often rules out the use of kitchen and clothes washing waste water as these tend to be most highly polluted. However, in larger system virtually all non-toilet sources can be used, subject to appropriate treatment.

The storage volumes required for GWR are usually smaller than those required for rainwater harvesting as the supply of greywater is more reliable than rainfall. In domestic situations, grey water production often exceeds demand and a correctly designed system can therefore cope with high demand application and irregular use, such as garden irrigation. Combined rainwater harvesting and greywater recycling systems can be particularly effective, with the use of rainwater supplementing greywater flows at peak demand times (e.g. morning and evenings).

A recent sustainable water management strategy carried out for a proposed EcoTown development at Northstowe[73] calculated the volumes of water that could be made available from the use of RWH and GWR. These were assessed against water demand calculated using the BRE Water Demand Calculator[74].

**Table 5-3: Potential water savings from RWH and GWR**

| Appliance | Demand with Efficiencies (l/h/day) | Potential Source | Grey Water Required (l/h/day) | Out As | Grey Water available (80% efficiency) (l/h/day) | Consumptions with GWR (l/h/day) |
|---|---|---|---|---|---|---|
| Toilet | 15 | Grey | 15 | Sewage | 0 | 0 |
| Wash hand basin | 9 | Potable | 0 | Grey | 7 | 9 |
| Shower | 23 | Potable | 0 | Grey | 18 | 23 |
| Bath | 15 | Potable | 0 | Grey | 12 | 15 |
| Kitchen Sink | 21 | Potable | 0 | Sewage | 0 | 21 |
| Washing Machine | 17 | Grey | 17 | Sewage | 0 | 0 |
| Dishwasher | 4 | Potable | 0 | Sewage | 0 | 4 |
| **Total** | **103** | | **31** | | **37** | **72** |

The above demonstrates the water savings that can be achieved by GWR. If the toilet and washing machine are connected to the GWR system a saving of 32 litres per person per day can be achieved. If only the toilet is connected to the GWR system, this saving would be reduced to 15 litres per person per day.

The treatment requirements of the GWR system will also vary, as water which is to be used for flushing the toilet does not need to be treated to the same standard as that which is to be used for the washing machine. The source of the greywater also greatly affects the type of treatment required. Greywater from a washing machine may contain suspended solids, organic matter,

[73] Sustainable water management strategy for Northstowe, WSP, December 2007
[74] http://www.thewatercalculator.org.uk/faq.asp

oils and grease, detergents (including nitrates and phosphates) and bleach. Greywater from a dishwasher could have a similar composition, although the proportion of fats, oils and grease is likely to be higher; similarly for wastewater from a kitchen sink. Wastewater from a bath or shower will contain suspended solids, organic matter (hair and skin), soap and detergents. All wastewater will contain bacteria, although the risk of infection from this is considered to be low[75].

**Costs – Financial**

Research into the financial costs of installing and operating RWH and GWR systems gives a range of values, as follows:

**Table 5-4: Costs of RWH and GWR systems**

| Cost | Cost | Comments |
|---|---|---|
| Installation cost | £1,750 | Cost of reaching Code Level 5/6 for water consumption in a 2-bed flat[76] |
| | £2,000 | For a single dwelling[77] |
| | £800 | Cost per house for a communal system[78] |
| | £2,650 | Cost of reaching Code Level 3/4 for water consumption in a 3-bed semi-detached house[79] |
| Operation of GWR | £30 per annum[80] | |
| Operation of RWH | £15 per annum[81] | |
| Replacement costs | £3,000 to replace[82] | It is assumed a replacement system will be required every 25 years |

There is less research and evidence relating to the cost of community scale systems compared to individual household systems, but it is thought that economies of scale will mean than larger scale systems will be cheaper to install than those for individual properties. As shown above, the Cost Review of the Code for Sustainable Homes indicated that the cost of installing a GWR/RWH system in flats is less than the cost for a semi-detached house. Similarly, the Water Efficient Buildings website estimates the cost of installing a GWR/RWH system to be £2,000 for a single dwelling and £800 per property for a share of a communal system.

A reduction in water consumption will result in a reduction in water bills (for metered properties). The average price for a metered water customer in 2006-2007[83] was approximately 94 pence per $m^3$, or 0.094 pence per litre (excluding wastewater charges). ESW's average per capita consumption without any water efficiency is 142 l/h/d[84].

Therefore, assuming that actual water use in the home meets CSH 5/6 (80 l/h/d), savings in water bills can be estimated by the following equation[85]:

[75] Centre for the Built Environment, www.cbe.org.uk
[76] Code for Sustainable Homes: A Cost Review, Communities and Local Government, 2008
[77] http://www.water-efficient-buildings.org.uk/?page_id=1056
[78] http://www.water-efficient-buildings.org.uk/?page_id=1056
[79] Code for Sustainable Homes: A Cost Review, Communities and Local Government, 2008
[80] Environment Agency Publication - Science Report – SC070010, Greenhouse Gas Emissions of Water Supply and Demand Management Options, 2008
[81] Environment Agency Publication - Science Report – SC070010, Greenhouse Gas Emissions of Water Supply and Demand Management Options, 2008
[82] Environment Agency Publication - Science Report – SC070010, Greenhouse Gas Emissions of Water Supply and Demand Management Options, 2008
[83] http://www.ofwat.gov.uk/legacy/aptrix/ofwat/publish.nsf/Content/rpt_int_08unitcostswater.html
[84] Rob Morris, Anglian Water Services, Pers. Comm., 2010.
[85] Cambridge (and surrounding major growth areas) WCS Phase 2, Halcrow, 2010

*Water saving (37 l/h/d) x unit cost of water (0.094 pence per litre) x days in year (365) x occupancy rate (2.1) / 100 (to convert from pence to pounds) = £26.66 saving in water bills per property per year*[86].

Figure 2-5 above shows the installation costs of GWR/RWH systems to be between approximately £2,000 and £2,650; therefore investment return period will be approximately 45-60 years for individual households, although cheaper, communal GWR/RWH systems may have shorter investment return periods.

However, the costs must be considered in relation to the cost of the supply of mains water for an individual householder. Research at the University of Bradford[87], has shown that in nearly 4000 model simulations of a rainwater harvesting system, under no circumstances were these systems found to be more cost effective than mains water.

**Costs – Energy/Carbon**

Research has shown that the energy and carbon costs of GWR systems are considerably higher than those for conventionally supplied mains potable water. The energy cost of pumping alone is higher than the total impact of the equivalent volume of mains water (pumping costs for RWH range from 1-3kWh/m3, total energy cost for mains water 0.56kWh/m3[88].

Large or community scale schemes may have even higher energy requirements; due to the larger distances involved it is unlikely that gravity flow would be effective and the water must therefore be pumped through the various elements of the GWR system. There are economies of scale to be applied to the installation of GWR/RWH systems, with larger systems proving to be more cost effective with a shorter investment return period. Systems are therefore more commonly incorporated into the design of new build schools, hotels, community centres or other similar buildings.

Several supply companies produce systems which are designed for commercial operations, such as the Commercial AQUA-Recycling-Control system from Aqua-lity[89]. Such systems are often able to take water from all non-toilet sources in a building, due to the lower pollution loads in the wastewater compared to domestic waste (washing machines, kitchens sinks etc). Treatment is similar to that for domestic systems and is again dependent on the source and intended use of the greywater.

### 5.8.2 Retrofitting

The installation of GWR and RWH systems into existing homes and businesses can be difficult and costly, sometimes requiring considerable physical alteration to the building's structure. It is therefore often not cost effective to use such water saving techniques and other measures must be used. These are often smaller, simple devices that can be retrofitted into existing properties at relatively low cost; as discussed below.

**Low or variable flush toilets**

Toilets use about 30 per cent of the total water used in a household[90]. An old style single flush toilet can use up to 13 litres of water in one flush. New, more water-efficient dual-flush toilets

[86] Calculation adapted from http://www.water-efficient-buildings.org.uk/?page_id=179
[87] Predicting the hydraulic and life-cycle cost performance of rainwater harvesting systems using a computer based modelling tool, Water Practice & Technology, 2006 – 7th International Conference on Urban Drainage Modelling, Roebuck and Ashley, 2007, http://www.sudsolutions.com/website_dls/RainCycle_Paper.pdf
[88] WaterUK 2008, Sustainability Indicators 2007/08
[89] www.aqua-lity.co.uk
[90] http://www.waterwise.org.uk/reducing_water_wastage_in_the_uk/house_and_garden/toilet_flushing.html

can use as little as 2.6 litres[91] per flush. A study carried out in 2000 by Southern Water and the Environment Agency[92] on 33 domestic properties in Sussex showed that the average dual flush saving observed during the trial was 27 per cent, equivalent to a volumetric saving of around 2.6 litres per flush. The study suggested that replacing existing toilets with low or variable flush alternatives could reduce the volume of water used for toilet flushing by approximately 27 per cent on average.

**Low flow taps and showers**

Flow reducing aerating taps and shower heads restrict the flow of water without reducing water pressure. Thames Water estimates that an aerating shower head can cut water use by 60 per cent with no loss of performance[93].

**Metering**

The installation of a water meter has the potential to generate significant water use reductions as it gives customers a financial incentive to reduce their water consumption. This also encourages the installation and use of other water saving products, by introducing a financial incentive for these too and introducing a price signal against which the payback time of new water efficiency measures can be assessed.

Metering typically results in a 5-10 per cent reduction from unmetered supply, which equates to a water saving of approximately 33.5 l per household, assuming occupancy rate of 2.3[94]. In 2009, DEFRA instructed Anna Walker (the Chair of the Office of Rail Regulation) to carry out an independent review of charging for household water and sewerage services (the Walker Review)[95]. The typical savings in water bills of metered and unmetered households were compared by the Walker Review, which gives an indication of the levels of water saving that can be expected.

**Table 5-5: Change in typical metered and unmetered household bills**

| 2009-10 Metered | 2009-10 Unmetered | 2014-15 Metered | 2014-15 Unmetered | % change Metered | % change Unmetered |
|---|---|---|---|---|---|
| 348 | 470 | 336 | 533 | -3 | 13 |

**Cistern displacement devices**

These are simple devices which are placed in the toilet cistern by the user, which displace water and therefore reduce the volume that is used with each flush. This can be easily installed by the householder and are very cheap to produce and supply. Water companies and environmental organisations often provide these for free.

Depending on the type of devices used (these can vary from a custom made device, such bag filled with material that expands on contact with water, to a household brick) the water savings can be up to 3 litres per flush.

[91] http://www.lecico.co.uk/
[92] The Water Efficiency of Retrofit Dual Flush Toilets, Southern Water/Environment Agency, December 2000
[93] http://www.thameswater.co.uk/cps/rde/xchg/corp/hs.xsl/9047.htm
[94] 2.3 is used for existing properties as opposed to 2.1 for new properties – the latter reflects changes in population over time. This figure was discussed and agreed with AWS for the East Cambridgeshire and Fenland Detailed WCS (Scott Wilson, 2011), but it is felt that the conclusions of the discussion are also appropriate here. Rob Morris, personal communication with Carl Pelling of Scott Wilson, 30th June 2011.
[95] Independent Walker Review of Charging and Metering for Water and Sewerage services, DEFRA, 2009, http://www.defra.gov.uk/environment/quality/water/industry/walkerreview/

### Pressure control

Reducing pressure within the water supply network can be an effective method of reducing the volume of water supplied to customers. However, many modern appliances, such as Combi boilers, point of use water heaters and electric showers require a minimum water pressure to function. Careful monitoring of pressure is therefore required to ensure that a minimum water pressure is maintained. For areas which already experience low pressure (such as those areas with properties that are included on a water company's DG2 Register) this is not suitable. Limited data is available on the water savings that can be achieved from this method.

### Variable tariffs

Variable tariffs can provide different incentives to customers and distribute a water company's costs across customers in different ways.

The Walker Review assessed variable tariffs for water, including:

- rising block tariff;
- a declining block tariff;
- a seasonal tariff; and
- time of day tariff.

A rising block tariff increases charges for each subsequent block of water used. This can raise the price of water to very high levels for customers whose water consumption is high, which gives a financial incentive to not to consume additional water (for discretionary use, for example) while still giving people access to low price water for essential use.

A declining block tariff decreases charges for each subsequent block of water used. This reflects the fact that the initial costs of supply are high, while additional supply has a marginal additional cost. This is designed to reduce bills for very high users and although it weakens incentives for them to reduce discretionary water use, in commercial tariffs it can reflect the economies of scale from bulk supplies.

A seasonal tariff reflects the additional costs of summer water supply and the fact that fixed costs are driven largely by the peak demand placed on the system, which is likely to be in the summer.

Time-of-day tariffs have a variable cost per unit supply according to the time of the day when the water is used; this requires smart meters. This type of charging reflects the cost of water supply and may reduce an individual household's bill; it may not reduce overall water use for a customer.

### Water efficient appliances

Washing machines and dishwashers have become much more water efficient over the past twenty years; whereas an old washing machine may use up to 150 litres per cycle, modern efficient machines may use as little as 35 litres per cycle. An old dishwasher could use up to 50 litres per cycle, but modern models can use as little as 10 litres. However, this is partially offset by the increased frequency with which these are now used. It has been estimated[96] that dishwashers, together with the kitchen tap, account for about 8-14 per cent of water used in the home.

[96] Water Efficiency Retrofitting: A Best Practice Guide, Waterwise, 2009, www.waterwise.org.uk

The Water Efficient Product Labelling Scheme provides information on the water efficiency of a product (such as washing machines) and allows the consumer to compare products and select the efficient product. The water savings from installation of water efficient appliances therefore varies, depending on the type of machine used.

**Non-domestic properties**

There is also the potential for considerable water savings in non-domestic properties; depending on the nature of the business water consumption may be high e.g. food processing businesses. Even in businesses where water use is not high, such as B1 Business or B8 Storage and Distribution, there is still the potential for water savings using the retrofitting measures listed above in section 5.8.2. Water audits are useful methods of identifying potential savings and implementation of measures and installation of water saving devices could be funded by the asset owner; this could be justified by significant financial savings which can be achieved through implementation of water efficient measures.

There is significant potential for water efficiency in the agricultural sector from rainwater harvesting. The Environment Agency guide for farmers[97] illustrates the potential benefits to both the environment and the farmer from the installation of a RWH system. For example, a farm growing soft fruit in polytunnels could harvest 5,852 $m^3$ of water per year from 120 hectares of tunnels, which could give the following benefits:

- such as better soil drainage between the tunnels,
- improved humidity levels inside them; and
- an improvement in plant health through the use of harvested water.

**Costs – Financial**

A joint study by the Environment Agency and the Energy Saving Trust[98] assumed the following costs for a selection of water efficient devices:

- low flow shower £30;
- washing up bowl (to reduce water use in washing dishes under a running tap) £25; and
- aerating tap £10.

It can be assumed that white goods (i.e. washing machine and dishwasher) would be replaced at end of life; as virtually all modern appliances are energy efficient this is not considered to be an additional cost. Toilet cistern displacement devices are often supplied free of charge by water companies and this is therefore also not considered to be an additional cost.

The cost of installing a water meter has been assumed to be £500 per property[99]. It is assumed that the replacement costs will be the same as the installation costs (£500), and that meters would need to be replaced every 15 years[100].

**Costs – Energy/Carbon**

It is estimated that the energy emissions associated with the use of hot water in homes amounts to over 5 per cent of total UK greenhouse gas emissions and is thought to be over

[97] Rainwater Harvesting: an on-farm guide, Environment Agency, 2009
[98] Quantifying the Energy and Carbon Effects of Water Saving, Full Technical Report, Environment Agency and the Energy Saving Trust, 2009
[99] Cambridge (and surrounding major growth areas) WCS Phase 2, Halcrow, 2010
[100] Environment Agency Publication - Science Report – SC070010: Greenhouse Gas Emissions of Water Supply and Demand Management Options, 2008

than seven times that emitted by the water industry[101]. Energy used in heating domestic water accounts a large proportion of the energy consumption in the home.

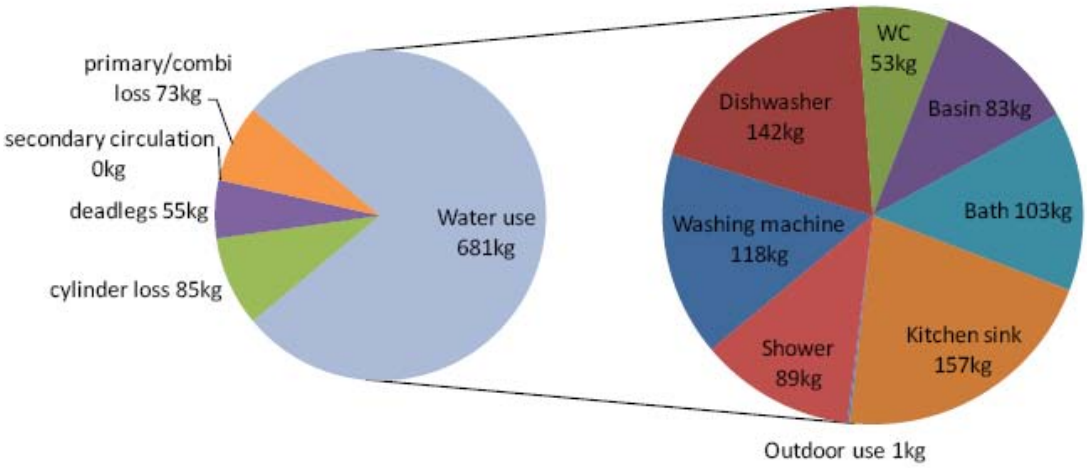
A joint study by the Environment Agency and the Energy Saving Trust[102] assessed the energy and carbon implications of the installation of water saving devices. The report initially calculated a baseline water consumption figure for existing housing stock, using the following assumptions:

**Table 5-6: Baseline energy consumption assumptions**

| Device | Volume of water per use (litres) | Frequency of use (per person per day) |
|---|---|---|
| Toilet | 9.4 | 4.66 |
| Kitchen Taps | 59 | Taps taken as volume/day, 40% cold |
| Basin taps hot | 42 | Taps taken as volume/day, 30% cold |
| Bath | 70 | 0.21 |
| Washing machine | 50 | 0.34 |
| Shower | 25.7 | 0.59 |
| Dishwasher | 21.3 | 0.29 |

The study then modelled the $CO_2$ emissions from this 'standard' existing dwelling, as shown below in Figure 5-18. Appliances requiring hot water using appliances dominate, but water use for toilet flushing produces 53kg of $CO_2$ emissions per year (approximately 50 per cent from water company emissions and 50 per cent due to heat loss as cold mains water in the toilet cistern heats to room temperature).

**Figure 5-18: $CO_2$ emissions from a 'standard' existing dwelling**

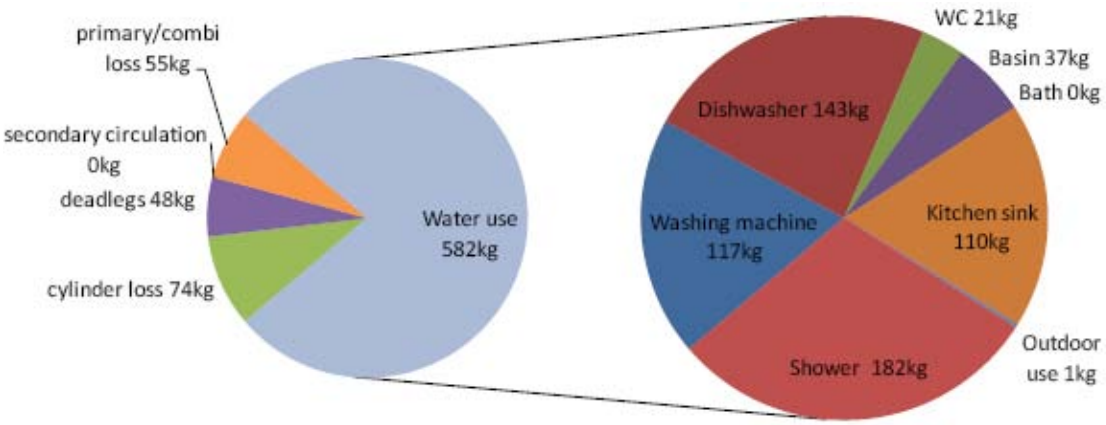



[101] Anglian Water Services, Water Resource Management Plan, 2010, http://www.anglianwater.co.uk/environment/water-resources/resource-management/

[102] Quantifying the Energy and Carbon Effects of Water Saving, Full Technical Report, Environment Agency and the Energy Saving Trust, 2009

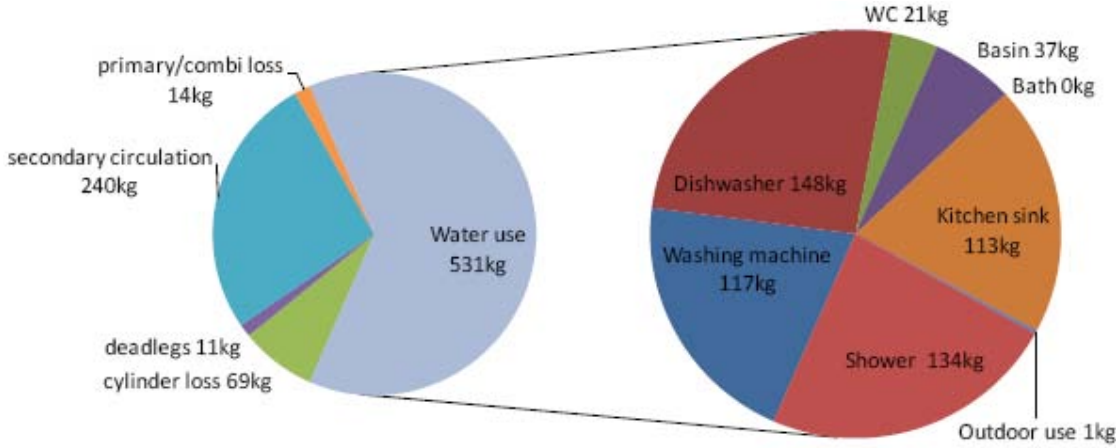
The study then assessed the impacts on this baseline figure of 681 kg $CO_2$ for water use from a home which has water use compliant with CfSH level 3/4.

**Figure 5-19: $CO_2$ emissions from a CfSH Level 3/4 dwelling**




The study then assessed the impacts of a home which has water use compliant with CfSH level 5/6.

**Figure 5-20: $CO_2$ emissions from a CfSH Level 5/6 dwelling**




It can therefore be seen that the carbon cost of achieving Levels 3/4 and 5/6 compares favourably to the baseline scenario of current average water use of 681kg/$CO_2$. CfSH level 3/4 represents a carbon saving of 99 kg/$CO_2$ and CfSH Level 5/6 represents a carbon saving of 150 kg/$CO_2$.

# 6 South Essex Flood Risk Management

## 6.1 Flood Risk to Development

It is important for the Outline WCS to include an assessment of the constraints of, and the infrastructure required to mitigate, the impacts of flood risk to proposed growth. Both flood risk to, and flood risk from development needs to be considered in the overall assessment of growth.

### 6.1.1 Planning Policy Statement 25

Planning Policy Statement 25: Development and Flood Risk (PPS25)[103] and its accompanying Practice Guide[104] set out guidance and requirements for the assessment of flood risk. While these documents do not directly form part of the guidance for carrying out a WCS, they have been used during the production of this report. The guidance set out within PPS25 must be applied in order to address flood risk from all sources (fluvial, pluvial, tidal, groundwater, artificial and sewer).

PPS25 defines flood zones as follows:

**Table 6-1: Flood zones as defined by PPS25**

| Flood Zone | Probability of flooding | Appropriate uses[105] |
|---|---|---|
| Zone 1 - Low probability | Land assessed as having a less than 1 in 1000 annual probability of river or sea flooding in any year (<0.1%). | All uses of land are appropriate in this zone. |
| Zone 2 - Medium Probability | Land assessed as having between a 1 in 100 and 1 in 1000 annual probability of river flooding (1% – 0.1%) or between a 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5% – 0.1%) in any year. | Water-compatible (e.g. flood control infrastructure, docks, marinas and wharves), less vulnerable (e.g. shops, restaurants and cafes) and more vulnerable (e.g. hospitals, dwelling houses and prisons) uses of land and essential infrastructure (e.g. electricity generating power stations and primary substations). |
| Zone 3a - High Probability | Land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%) or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year. | Water-compatible and less vulnerable uses of land |
| Zone 3b - The Functional Floodplain | Land where water has to flow or be stored in times of flood | Water-compatible uses and the essential infrastructure |

[103] Planning Policy Statement 25: Development and Flood Risk, Communities and Local Government, March 2010
[104] Planning Policy Statement 25: Development and Flood Risk – Practice Guide, Communities and Local Government, December 2009
[105] Refer to Table D2 of PPS25 for full list of appropriate land uses for each flood zone, http://www.communities.gov.uk/documents/planningandbuilding/pdf/planningpolicystatement25.pdf

PPS25 states that the Sequential Test must be applied by local authorities when allocating new development sites, in order to steer development away from the areas of greatest flood risk. The Sequential Test is a planning principle that seeks to identify, allocate or develop land in low flood risk zones before land in high flood risk zones. When a development type is not compatible with flood risk in a particular location, the Exception Test may be applied if there are valid reasons as to why the development should proceed, as set out in PPS25.

In addition, development in Flood Zones 2 and 3, and sites greater than 1 hectare in area within Flood Zone 1 should be subject to a PPS25 compliant FRA. The FRA should also ensure compliance with the detailed WCS, Level 2 SFRA and SWMP. PPS25 also sets out the requirements for local authorities to carry out and keep under review Strategic Flood Risk Assessments (SFRAs).

### 6.1.2 Strategic Flood Risk Assessments

Scott Wilson was commissioned by the Thames Gateway South Essex (TGSE) Partnership in 2006 to undertake an SFRA on behalf of the local authorities of Thurrock Council, Castle Point Borough Council, Basildon District Council, Southend Borough Council and Rochford District Council[106], which identified flood risk issues relevant to both existing and proposed developments and guided the authorities to meet the requirements of Guidance Note 25 (PPG25) 'Development and Flood Risk'[107], the precursor to PPS25. In addition to the main SFRA report, Scott Wilson was commissioned to produce five reports to address the flood risk concerns specific to each local authority.

In order to meet the requirements of PPS25, the SFRA was updated by Scott Wilson in 2010 and 2011. Separate reports were produced for each of the three councils, rather than the combined report previously published.

**Basildon Borough**

The updated SFRA for Basildon is still in draft form, awaiting approval by the Environment Agency. The previous SFRA was carried out in 2006 and therefore is not compliant with the requirements of PPS25. The findings of the 2006 SFRA are therefore not suitable for use within this WCS and the findings of the updated 2011 SFRA have been used, subject to Environment Agency approval.

**Castle Point Borough**

Castle Point Borough Council commissioned Scott Wilson to produce an SFRA in accordance with PPS25, in order to provide an update to the previous 2006 SFRA. The updated SFRA was published in November 2010[108].

**Rochford District**

Rochford District Council commissioned Scott Wilson to produce an SFRA in accordance with PPS25, in order to provide an update to the previous 2006 SFRA. The updated SFRA was published in February 2011[109].

### 6.1.3 Catchment Flood Management Plans

**South Essex CFMP**

[106] Thames Gateway South Essex Strategic Flood Risk Assessment, Scott Wilson, 2006
[107] Planning Policy Guidance 25: Development and Flood Risk (PPG25), Communities and Local Government, July 2001
[108] Castle Point BC Strategic Flood Risk Assessment – Level 1 & 2, Scott Wilson, 2010
[109] Rochford DC Strategic Flood Risk Assessment – Level 1 & 2, Scott Wilson, 2011

The South Essex Catchment Flood Management Plan[110] (CFMP) covers the catchments of the rivers Crouch, Roach and Mardyke, along with smaller independent watercourses along the Thames estuary, on the Dengie peninsula, throughout the south Essex area. The CFMP gives an overview of flood risk and sets out the Environment Agency's preferred plan for sustainable flood risk management over the next 50 to 100 years. It was signed off by the Anglian Regional Director on the 24 September 2008 and was agreed by the Anglian Regional Flood Defence Committee on 26 September 2008.

The CFMP lists the following as the main current sources of flood risk to people, property and infrastructure in South Essex:

- fluvial flooding - from the rivers Mardyke, Crouch, Roach, which constitute the highest fluvial flood risk in the CFMP area, urban locations within these catchments that are at highest risk include: Wickford, Eastwood, Stanford-le-Hope and Purfleet;
- tidal flooding - from the North Sea and the estuaries affects several coastal and estuarine towns and the lower reaches of the rivers Crouch, Horndon, Mardyke and Roach are also influenced by tides. Tidal flooding is the main source of flooding in this CFMP area, although coastal areas are relatively well defended from tidal defences up to a Standard of Protection of 0.1% (1 in 1000 years);
- surface water flooding - Southend-on-Sea, Basildon, Wickford and Grays are at a high risk of surface water problems due to a relatively large urban area. The steeper slopes and impermeable clay underlying some areas in the catchment, such as Hawkwell and Rayleigh, also means a greater likelihood of surface water flooding;
- sewer flooding – this has caused significant problems in Stanford-le-Hope, Southend-on-Sea, Purfleet, Tilbury and Basildon in the past, where the majority of the sewer flooding problems has been as a result of inadequate capacity of the system and blockages; and
- groundwater flooding – this is not a major issue, but areas around Aveley and Purfleet where the underlying chalk is exposed may be vulnerable to groundwater flooding.

The CFMP divides the South Essex area into 12 policy units, of which the following lie within, or overlap, the study area:

**Table 6-2: CFMP Policy Units and policies**

| Policy Unit | | Recommended policy |
|---|---|---|
| 2 | Southend-on-Sea/Rayleigh | Reduce existing flood risk management actions (accepting that flood risk will increase with time). |
| 4 | Southern Crouch Catchment | No active intervention (including flood warning and maintenance). Continue to monitor and advise. |
| 6 | Wickford | Take further action to reduce flood risk (now or in the future). |
| 7 | Basildon | Take further action to sustain the current level of flood risk into the future (responding to the potential increase in risk from urban development, land use change and climate change). |
| 12 | Thames Urban Tidal | Take further action to sustain the current level of flood risk into the future (responding to the potential increase in risk from urban development, land use change and climate change). |

[110] South Essex Catchment Flood Management Plan Final Plan, August 2008

**North Essex CFMP**

The North Essex Catchment Flood Management Plan[111] (CFMP) covers the catchments of four major rivers: the River Chelmer, Blackwater, Colne and Stour as well as Holland Brook and other smaller watercourses. The downstream limit of the CFMP area is located at the Essex and South Suffolk Shoreline Management Plan (SMP) boundary, which stretches from Landguard Point (on the north bank of the Orwell estuary) to Purfleet (on the north bank of the River Thames). North Billericay lies within the North Essex CFMP area.

The CFMP identifies the following as the major sources of flood risk in the North Essex CFMP area:

- river flooding from the River Chelmer in Chelmsford and the River Colne in Colchester, as well as river flooding from smaller streams and ditches including the effects of blockages including Great Bardfield in the Blackwater headwaters and Great Yeldham, Sible Hedingham and Castle Hedingham along the Colne headwaters;
- failure or overwhelming of pumping stations on some of the smaller watercourses, such as Ramsey River, causing localised flooding;
- sewer flooding to isolated properties due to the system being overwhelmed after heavy rainfall; and
- surface water flooding is not currently a major source of flood risk in North Essex. However there may be some risk in towns and villages in the headwaters of the catchment where steeper slopes cause rapid run-off, such as in Steeple Bumpstead, Little Yeldham, Sible Hedingham, Chappel, Fordstreet, Shalford, Braintree, Kelvedon, Mountnessing, Finchingfield and Hatfield Peverel.

The CFMP divides the North Essex area into policy units, of which north Billericay lies within Policy Unit 2, Blackwater and Chelmer, Upper Reaches and Coastal streams. This is classed as an area of low to moderate flood risk where there can be a general reduction in existing flood risk management actions. This policy will tend to be applied where the overall level of risk to people and property is low to moderate and it may no longer be economically viable to focus on continuing current levels of maintenance of existing defences if resources can be used to reduce risk where there are more people at higher risk. The Environment Agency will therefore review the flood risk management actions being taken to ensure they are proportionate to the level of risk.

### 6.1.4 Surface Water Management Plans

One of the recommendations of Sir Michael Pitt's Review of the 2007 summer floods (The Pitt Review[112]) was that Surface Water Management Plans (SWMPs) should provide the basis for managing local flood risk. As part of the Government's response to the Pitt Review, Ministers announced investment of £15 million to help local authorities co-ordinate and lead local flood management work with an initial step of funding for six local authorities to develop first edition SWMPs[113]. The SWMPs outlines the preferred surface water management strategy in a given location, where 'surface water flooding' describes flooding from sewers, drains, groundwater, and runoff from land, small water courses and ditches that occurs as a result of heavy rainfall.

[111] North Essex Catchment Flood Management Plan Final Plan, December 2009
[112] Learning lessons from the 2007 floods: An independent review by Sir Michael Pitt, June 2008, http://webarchive.nationalarchives.gov.uk/20100807034701/http://archive.cabinetoffice.gov.uk/pittreview/thepittreview/final_report.html
[113] http://www.defra.gov.uk/environment/flooding/manage/surfacewater/

The principal output from a SWMP is a preferred strategy for the coordinated management of surface water flood risk within a given area[114]. Heavy rainfall in January 2011 caused widespread disruption in the study area and emphasised the need for a strategic approach to identify measures to manage and reduce the impact of surface water flooding. In addition to this, the Environment Agency has provided a draft map of indicative flood risk areas, as required under the Flood Risk Regulations, to Essex County Council in its role as Lead Local Flood Authority (LLFA) to support the production of a Preliminary Flood Risk Assessment (PFRA). The draft outputs identify an area covering Basildon, Rochford, Castle Point and neighbouring Southend-on-Sea as one of 10 indicative areas where greater than 30,000 people are at risk from surface water flooding, providing further evidence of the need for a strategic approach to manage the risk from surface water flooding.

Basildon, Rochford, Castle Point Councils and Essex County Council therefore appointed Scott Wilson in 2010 to carry out a SWMP for the study area, in conjunction with this Outline WCS. It is a separate report.

**Phase 1 – Preparation**

Phase 1 involved collecting and reviewing surface water data from key stakeholders, and to build partnerships between stakeholders responsible for local flood risk management. The 'essential partners' have been identified and the 'SWMP Working Group' has been set up to guide progress through each of the four SWMP phases. The SWMP Working group comprises:

- the Client Group (Essex County Council (LLFA), Basildon Borough Council (Lead Delivery Partner), Castle Point Borough Council and Rochford District Council);
- the Steering Group (Environment Agency and Anglian Water); and
- the specialist project team (URS/Scott Wilson).

The wider stakeholders have also been identified and the level at which they will be contacted. A communications and engagement plan has been produced, along with a 'live' Governance Structure, which is periodically reviewed, to support the delivery of the SWMP.

**Phase 2 – Risk Assessment**

As part of the Phase 2 Risk Assessment, direct rainfall modelling has been undertaken across Basildon and Castle Point Boroughs and the urban extent of Rochford District. The Environment Agency Flood Map for Surface Water has been used for the rural (eastern) extent of Rochford DC. This has been carried out for a number of specified rainfall events.

The results of this modelling have been used to identify Potential Surface Water Flooding Hotspots (PSWFHs), where flooding affects houses, businesses and/or infrastructure, and Critical Drainage Areas (CDAs), where the contributing catchment area and features that influence the predicted flood event are identified.

In total 37 CDAs have been identified across the study area. However, in order to develop and present options in Phase 3, the CDAs have been prioritised based historical flooding, risk of groundwater flooding, sewer flooding incidents, critical infrastructure at risk and the number of properties at risk of flooding. Therefore, only the most significant CDAs, 23 in total, will be taken forward to Phase 3. The other CDAs will be reported in the SWMP, but no further work is proposed on these in subsequent phases.

[114] Defra (March 2010) Surface Water Management Plan Technical Guidance www.defra.gov.uk

**Phase 3 – Options Assessment**

For each of the shortlisted CDAs identified, site specific measures need to be identified that could be considered to help alleviate surface water flooding. These measures will then be shortlisted to identify a potential preferred option for each of the shortlisted CDAs. There are also opportunities for generic measures to be implemented, through the establishment of a policy position on issues regarding the use of widespread use of water conservation measures, such as water butts and rainwater harvesting technology, soakaways, permeable paving and green roofs. In addition there are Borough wide opportunities to raise community awareness.

**Phase 4 – Implementation and Review**

This phase will be undertaken following the completion of the Options Assessment, and will establish a long-term Action Plan for each of the Councils to assist them in the management of surface water flood risk across the South Essex area. The purpose of the Action Plan is to:

- outline the actions required to implement the preferred options identified in Phase 3;
- identify the partners or stakeholders responsible for implementing the action; and
- provide an indication of the priority of the actions and a timescale for delivery.

### 6.1.5 TE2100 Plan

TE2100[115] is an Environment Agency project to create a long-term flood risk management strategy for the tidal Thames area, which includes the Thames Estuary, its tidal tributaries and floodplain from Teddington to a line between Shoeburyness and Sheerness.

The current flood defence structures along the Thames estuary were designed to protect against a 1-in-1,000 year flood in 2030 for most of the TE2100 area, although some less developed areas such as Grain, North Kent Marshes and parts of the Southend frontage have lower standards of protection. In addition the present flood defences are gradually deteriorating, and will reach the peak of their design lives over the next 20 to 30 years. This, coupled with climate change, has led to the development of the TE2100 project, which aims:

*"To develop a flood management plan for London and the Thames Estuary that is risk based, takes into account existing and future assets, is sustainable, includes the needs of stakeholders and addresses the issues in the context of a changing climate and varying socio-economic conditions that may develop over the next 100 years."*

The objectives of the TE2100 Plan are:

- to reduce the risk of flooding to people, and to minimise the adverse impacts of flooding to property and the environment;
- to adapt to the challenges that we will face from climate change;
- to support and inform the land use planning process to ensure appropriate, sustainable and resilient development in the tidal Thames floodplain; to protect the social, cultural and commercial value of the tidal River Thames, its tidal tributaries and its floodplain; and
- to enhance and restore estuarine ecosystems to contribute to biodiversity targets and maximise the environmental benefits of natural floods.

[115] http://www.environment-agency.gov.uk/static/documents/Leisure/TE2100_EnvironmentSum.pdf

### 6.1.6 Key Flood Risk issues in Basildon

Hydrodynamic breach modelling was carried out as part of the updated SFRA at two locations to assess the impact of a failure of the Fobbing Horse Flood Barrier in the Vange Creek and the Benfleet Creek Flood Barrier. The results demonstrated that in the event of a failure of these flood barriers, floodwaters would inundate the southern part of the Borough including the Vange marshes, Pitsea marshes and Bowers marshes. During the 0.5% AEP modelled event for 2010, flood depths were modelled to inundate parts of Pitsea marsh and Bowers marsh to approximately 0.5 m. During the 0.1% AEP event including an allowance for climate change to 2110, the extent of flooding is much greater, affecting the Vange marsh to depths of 3 m and Pitsea marsh and Bowers marsh to depths of up to 2 m.

Modelling was also undertaken to simulate the impact of overtopping of the existing defences. This modelling showed that no overtopping occurs in the 0.5% AEP event including an allowance for climate change to 2110. During the 0.1% AEP event with an allowance for climate change to 2110, floodwaters are shown to overtop defences and inundate parts of the Vange marshes to depths of approximately 2 m. Under the CFMP for South Essex and TE2100 Project, the policies for this area are to sustain the current level of flood risk into the future, responding to the potential increases in risk from urban development, land use change and climate change.

The SFRA identified the corridors of the River Crouch and River Wid and the topographic tributaries that lead into these watercourses to be the key areas of increased risk of surface water flooding. However, it also noted that further assessment of the risk of flooding from surface water is being undertaken as part of the Surface Water Management Plan for the Borough which includes pluvial modelling.

The mapping for this is extensive and it has therefore not been included within this WCS; instead reference should be made to the SFRA.

NB: At the time of writing this WCS, the Level 2 SFRA was in draft format awaiting client and EA comment.

### 6.1.7 Key Flood Risk issues in Castle Point

Hydrodynamic breach modelling was carried out as part of the updated SFRA, which demonstrated that the majority of the south of the Borough (largely Canvey Island) is at residual risk of flooding. Following a breach at any point in the defences during an extreme water level scenario, flood waters will naturally flow to low points in the Borough, including drainage channels and infrastructure such as roads that provide less resistance to flood flows. Similarly, should the East Haven Creek Barrier or the Benfleet Creek Barrier fail to function, flood defences around Canvey Island could be overtopped during extreme water level events and flooding would be widespread across the Island.

Depth mapping shows that within the Canvey Island flood cell, approximately one third of land is anticipated to experience maximum flood depths of 0 m to 0.5 m following a breach event during the 1 in 200 year flood event plus climate change to 2110. During the 1 in 1000 year event plus climate change, depths reach 3-5m and greater. Time to inundation mapping demonstrates that the rate of inundation is considerable, with the majority of Canvey Island being inundated within 1-4 hours of a breach at any of the 8 selected locations.

Hydrodynamic modelling of overtopping, when the flood barriers are operational, shows that part of Canvey Island is at risk of flooding during the 1 in 200 year flood plus climate change to

2110 as a result of overtopping of the existing defences. This is greatly increased when considering the 1 in 1000 year event plus climate change to 2110.

As with Basildon above, the mapping for this is extensive and it has therefore not been included within this WCS; instead reference should be made to the SFRA.

### 6.1.8 Key Flood Risk issues in Rochford

Hydrodynamic breach modelling was undertaken at seven locations around the tidal frontage of Rochford District to provide more detail on the nature of the residual tidal flood risk. In addition, modelling was undertaken to simulate overtopping of the existing defences in order to assess the actual flood risk.

The results of this confirmed that parts of the District are at significant residual risk of flooding from tidal sources. Overtopping or a breach in the flood defences has the potential to result in flooding to depths of greater than 3 m throughout Shoeburyness, Paglesham, Wallasea Island and South Fambridge, putting existing development and occupants at great risk. Given the low lying nature of the coastline in this part of the District, flood waters are likely to propagate rapidly, greatly reducing the time available for warning and evacuation of residents. Policies adopted as part of the Catchment Flood Management Plan for the tidal parts of the Rochford District aim to reduce or cease existing levels of flood risk management now and into the future. It is therefore likely that the flood risk from tidal sources in this District will continue to increase over time.

In addition to flood risk from tidal sources, fluvial systems also pose a risk to parts of the Rochford District. The impermeable underlying geology and seasonally wet, deep clay soils in the western parts of the district lead to rapid runoff of surface water into local watercourses. The channelisation of these watercourses increases the rapid conveyance of water downstream and leads to problems where watercourses converge. Fluvial flooding primarily affects Rochford town, where the River Roach, Nobles Green Ditch and Eastwood Brook meet. A number of other smaller watercourses in Rawreth and Rayleigh also pose a fluvial flood risk.

As with Basildon and Castle Point above, strategic flood risk mapping of Rochford District and the preparation of hazard maps was carried out, primarily based on the results of the breach modelling, carried out specifically for the purposes of this study. The mapping for this is extensive and it has therefore not been included within this WCS; reference should be made to the SFRA.

## 6.2 Flood Risk from Development – Surface Water Management

Surface Water Management is a key consideration when assessing development within large areas. PPS25 requires that new development does not increase the risk of flooding elsewhere by managing surface water runoff generated as a result of developing land. Altering large areas of land by urbanising it fundamentally alters the way in which rainfall drains to watercourses and has the potential to increase the rate and amount of water that enters watercourses causing an increase in flood risk.

Surface water management is a key consideration in the study area due to the historic surface water flooding and the fact that a large proportion of the study area is already highly urbanised. New development must consider the impact of further urbanisation on the existing drainage system, and discharge of surface water must be mitigated within the limitations of the drainage system.

In many cases, the management of surface water is achieved via a requirement to restrict runoff from developed sites to that which occurs from the pre-development site usage and this is achieved by incorporating a range of Sustainable Drainage Systems (SuDS) which aim to maximise the amount of rainwater which is returned to the ground (infiltration) and then to hold back (attenuate) excess surface water. Incorporating SuDS often requires a large amount of space and for large developments often requires the consideration of large scale strategic features such as balancing ponds which can attenuate and store large volumes of water generated during very heavy rain storms to prevent flood risk downstream. It is therefore essential that surface water drainage is managed separately from wastewater, both to reduce impact on the existing combined system and to meet the requirements of national and regional policy.

At the present point in the planning process, it has not been possible to determine outline requirements of the SuDS features that could be possible at each of the growth areas. This is because specific site details are not known and hence it is not possible to consider potential sizes of surface water attenuation features or specific topographic/geological constraints at each site. However, a strategic scale SuDS suitability assessment has been undertaken for areas where growth is proposed.

### 6.2.1 SuDS suitability

Sustainable Drainage Systems (SuDS) techniques can be used to reduce the rate and volume and improve the water quality of surface water discharges from sites to the receiving environment (i.e. natural watercourse or public sewer etc). Various SuDS techniques are available and operate on two main principles, infiltration or attenuation.

All systems generally fall into one of these two categories, or a combination of the two. Wherever possible, a SuDS technique should seek to contribute to each of the three goals identified below with the favoured system contributing significantly to each objective. The objectives are as follows:

- reduce flood risk (to the site and neighbouring areas);
- reduce pollution; and
- provide landscape and wildlife benefits.

These goals can be achieved by utilising a management plan incorporating a chain of techniques, as outlined in Interim Code of Practice for Sustainable Drainage Systems[116], where each component adds to the performance of the whole system:

- prevention - good site design and upkeep to prevent runoff and pollution (e.g. limited paved areas, regular pavement sweeping);
- source control runoff control at/near to source (e.g. rainwater harvesting, green roofs, pervious pavements);
- site control water management from a multitude of catchments (e.g. route water from roofs, impermeable paved areas to one infiltration/holding site); and
- regional control integrate runoff management systems from a number of sites (e.g. into a detention pond).

In order to give an indication of suitability of infiltration SuDS for the WCS, the likely capacity for infiltration type SuDS for the growth towns has been considered. A high level assessment has

[116] Interim Code of Practice for Sustainable Drainage Systems, National SuDS Working Group, July 2004

therefore been made based on the geological conditions of the main growth areas as a whole. In summary the assessment has been made on the following criteria:

- the presence of an aquifer underneath the site and the requirement to protect groundwater used as potable supply through the designation of SPZs; and
- the rate at which water is able to pass through the soil and underlying geology (referred to as its permeability).

The SFRAs have been used in this WCS to inform the assessment of SuDS type and this assessment is included within Section 7 of this report (Growth Towns Assessments) where the water environment and water infrastructure constraints for each key growth location are summarised. It should be noted that there are no SPZs within the study area and this aspect of SuDS selection has therefore not been considered.

**Basildon**

The South Essex CFMP identifies the presence of seasonally wet, deep clay soils across the Basildon study area. These soils are relatively impermeable and therefore contribute to rapid runoff of surface water runoff, resulting in a greater risk of surface water flooding and causing watercourses to respond rapidly to rainfall.

As a result of the underlying soils and geology, the use of infiltration systems is largely not appropriate for use in Basildon and options for the use of attenuation measures, as described in the SFRA, should therefore be explored for use in development sites across the Borough. Site specific calculations of SuDS requirements should be carried out early in the planning and design process for each site, as it likely that these measures could require a large portion of the development site.

**Castle Point**

The predominant solid geology underlying the Castle Point Borough is London Clay, which is impermeable and therefore rapid runoff can be expected. The majority of Castle Point does not have any drift geology overlying the London Clay. There are minimal deposits of clay, silt and sand overlying the London Clay[117].

The South Essex CFMP identifies the presence of seasonally wet, deep loam to clay soils across the Castle Point Borough. These soils are relatively impermeable and therefore contribute to rapid runoff of surface water runoff, resulting in a greater risk of surface water flooding and causing watercourses to respond rapidly to rainfall. As a result of the underlying soils and geology, the use of infiltration systems may not be appropriate for use in Castle Point. Given the low-lying nature of Canvey Island and the existing pumped drainage systems, source control mechanisms such as green / brown roofs and rainwater harvesting and grey water recycling should be encouraged for new developments to restrict the volumes and rates of surface water runoff leaving a site.

Exact locations and site areas were not known for the proposed development sites in Castle Point Borough at the time of writing this WCS and therefore the calculation of attenuation volume requirements, as given above for Basildon, could not be carried out. However, site specific calculations of SuDS requirements should be carried out early in the planning and design process for each site, as it likely that these measures could require a large portion of the development site.

[117] Environment Agency (August 2008) South Essex Catchment Flood Management Plan

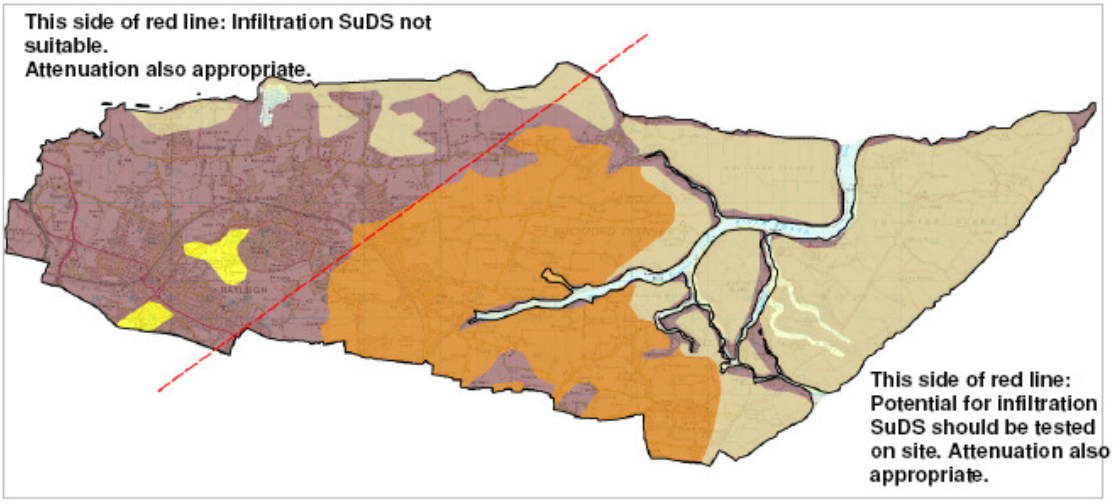
### Rochford

A divide can be seen across the Rochford with respect to geology and soil characteristics, and thereby the suitability of infiltration SuDS. In the west of the district, including the area around Rayleigh, Hullbridge, Hockley, Ashingdon and Hawkwell, the geology is predominantly clay and there are no drift deposits overlying this area. The soils are relatively impermeable and surface water typically runs off rapidly. As a result infiltration SuDS are not deemed suitable for this area. The use of attenuation measures should be explored when considering site design and layout.

The east of the district, including Rochford, Great Wakering and Foulness Island is characterised by the presence of river terrace deposits and alluvium. These are relatively permeable and therefore result in a relatively low rainfall to runoff conversion rate. There may be potential for the use of infiltration SuDS in these areas, however on-site infiltration testing should be undertaken on a site by site basis to determine its suitability. The underlying geology in this area is still clay and therefore it is likely that attenuation measures will be more suitable in this area as well.

Figure 6-1 below shows an indicative overview of infiltration SuDS suitability in Rochford. However, the suitability of individual proposed development sites for the use of different SuDS techniques will need to be determined on a site by site basis. Investigation will be required including geology, infiltration rates and groundwater vulnerability. Where infiltration SuDS are proposed, consideration may need to be given to pollution control.

**Figure 6-1: Indicative Geology & SuDS Suitability in Rochford**




Site locations and areas were not available in digital format for the proposed development sites in Rochford District at the time of writing this WCS and therefore the calculation of attenuation volume requirements, as given above for Basildon, could not be carried out. However, site specific calculations of SuDS requirements should be carried out early in the planning and design process for each site, as it likely that these measures could require a large portion of the development site.

## 6.3 Flood Risk from Development - Increased WwTW Discharges

Increased discharges from WwTW due to development may adversely affect flood risk downstream. PPS25 requires that there is no increase in flood risk downstream due to development. Mitigation measures may be required where:

- there is a quantifiable increase in frequency of spill from storm storage tanks due to additional foul flows; or
- the receiving watercourse and associated flood risk area is particularly sensitive to changes in flows.

In order to prevent increased flood risk from additional wastewater flows, mitigation for the increase in treated wastewater flows could be to provide additional storage volume in any flood attenuation facilities near to the WwTW. To allow further evaluation of options for combining storage in strategic flood attenuation facilities, the approximate volume of compensation storage that could mitigate the increase in flows from each WwTW should be estimated within the Detailed Water Cycle Study.

The potential impacts should be assessed for WwTW which discharge to fluvial watercourses where increased flows are proposed. Of the works within the study area, only Billericay and Shenfield and Hutton discharge to fluvial watercourses and may require mitigation for additional flows. However, as the increase in flows required have not been established, it is not possible to carry this out at this stage.

## 6.4 Climate Change

Climate change impacts such as changing rainfall patterns and increased river flows and sea levels are key considerations to future flood risk, surface water management and development planning throughout the study area. Climate change is the main driver for increases in flood risk that will occur in the future in the South Essex study area.

The South Essex CFMP, the three SFRAs and the ongoing SWMPs produced for each of the client authorities have taken climate change into consideration, in accordance with the requirements of PPS25. The flood and hazard mapping used for this WCS therefore includes the effects of climate change, as does the overall assessment of flood risk and within this WCS.

There are numerous location across the study area where the low-lying topography necessitates pumped surface water outfalls e.g. Canvey Island and Watery Lane in Rochford. The effects of climate change and sea level rise on these outfalls will be to increase tide locking, that is the periods during which the level of the tide is higher than the level of the outfall and a discharge cannot be made. This can lead to ponding of surface water behind the outfall, or flooding in extreme circumstances.

The SWMP, which is being carried out by Scott Wilson in conjunction with this WCS, will assess the impacts of climate change on such outfalls and provide suggestions for appropriate mitigation measures, where relevant.

## 6.5 Conclusions

Due to the low lying nature of the coastal areas, such as Canvey Island and Foulness, there are parts areas of the study area that lie within Flood Zones 2 and 3. In accordance with PPS25 and the Sequential Test, development should be directed away from areas of flood risk

and new development should be located in Flood Zone 1 where practicable. Residential development should not be located in Flood Zones 2 and 3 unless there are no sites available in Flood Zone 1 which would be appropriate for the development proposed. If there is no reasonably available site in Flood Zone 1, the flood vulnerability of the proposed development (according to Table D.2, Annex D of PPS25) can be taken into account in locating development in Flood Zone 2 and then Flood Zone 3.

Reference should be made to the mapping contained within the SFRAs for each of the Districts to ensure planned development is located away from the areas of greatest flood risk; see Section 7 below for an individual assessment of flood risk to the proposed growth locations. In addition, site specific Flood Risk Assessments will be required for all proposed development sites within Flood Zones 2 and 3, and for all sites in Flood Zone 1 which are greater than 1 hectare in area.

In all areas, consideration should be given to the risk of increased flood risk from the development. Foul and surface water should be separated wherever possible to reduce the flows to be treated at WwTW. Surface water should be attenuated and treated with SuDS, using the hierarchy given in section 6.2.2 above. The future maintenance needs for SuDS systems must be considered, as must the practicality of systems. Consultation with the Environment Agency should be undertaken on a site specific basis, to ensure run-off rates to watercourses are acceptable and will not increase the risk of flooding elsewhere.

# 7 South Essex Growth Areas Assessment

## 7.1 Introduction

The Outline WCS report has identified constraints in terms of proposed growth within Basildon Borough, Castle Point Borough and Rochford District in relation to the six key 'water cycle' areas:

- water resources;
- wastewater treatment;
- wastewater transmission;
- ecology;
- flood risk; and
- surface water management.

The resultant outcome was the formulation of a constraints matrix for each of the key development areas. The matrix has been designed so that the amount of subjective interpretation of the data is minimised, and hence the traffic lights allocated are based on factual and quantitative data where possible.

The most relevant and important constraints have been identified to aid in the assessment of development within the Boroughs/ Districts of Basildon, Castle Point and Rochford. For the purpose of the constraints matrices these were amalgamated and put into generic colour coded categories, as outlined in the following town assessments.

It is important to note that a colour coding of red does not necessarily mean that the proposed development cannot take place, merely that if development were to take place here greater, more significant, and potentially costly constraints would have to be overcome which would likely involve a higher level of infrastructure investment or greater strategic planning. This would require further study at the Detailed WCS stage,

The constraints matrix and traffic light colour coding has been applied to each of the areas in the Boroughs/ Districts of Basildon, Castle Point and Rochford where significant levels of growth are proposed, as described further in the subsequent sections.

## 7.2 Basildon Borough

| Area(s) of Search: | Component | Is development an option? | Comments | How many residential units? | Timeline | Additional infrastructure required |
|---|---|---|---|---|---|---|
| 01 | Water Resources | ✓ | ESW has predicted that the implementation of the Abberton scheme will provide the additional water resources required for growth within the Essex Resource Zone, and hence also the study area, until 2031. | Unlimited | 2014/2015 onwards (after construction of the Abberton scheme) | None |
| | Water Supply Network | ✓ | New connection to the water supply would form part of ESW's 'business as usual' supply arrangements. The costs of new development would either be passed to the developer or funded by ESW, depending on the individual development's circumstances. | Not known at this point. | Would need approval and funding through the planning process; this could take a number of years depending on the individual development's circumstances. | Connection from existing main to new development area – to be funded by developer. |
| | Wastewater Network | ✓ | Development Area 01 is proposed on greenfield land adjacent to the existing Wickford WwTW so could be connected directly to the terminal sewer with no need for upgrade of the sewer network. | Not known at this point. | Would need approval and funding through the planning process; this could take a number of years depending on the individual development's circumstances. | Connection from existing main to new development area – to be funded by developer. |
| | Wastewater Treatment | ✓ | Wickford WwTW nearby has enough processing capacity to accommodate approximately 3600 new households, although the proposed Runwell Hospital development within the Wickford WwTW catchment will reduce the capacity by 624 dwellings. | Approximately 3,000 across the entire Wickford WwTW catchment | If >3,000 new houses are proposed, works upgrades may be required, which would need funding through the AMP process. The earliest the work could commence would be during AMP6 (2015-2020). | None |
| | Wastewater Consents | ✓ | The discharge consent limits give the potential for increases to flows without affecting the downstream water quality. However, this could require significant upgrades to the WwTW to enable the discharge quality to be improved. | Approximately 3,000 across the entire Wickford WwTW catchment | If works upgrades are required, this would need funding through the AMP process. The earliest the work could commence would be during AMP6 (2015-2020). | Upgrades to the WwTW (funded by AWS through AMP) may be needed for >3,000 new homes. |
| | Ecology | ✓ | The Appropriate Assessment of the Abberton scheme concluded that there would be no significant effects; therefore the increased water demand would not impact on designated sites. No increases in polluting loads would result from increased flows from Wickford WwTW, if the standard of treatment were improved to the limits of conventional wastewater treatment, and there would therefore be no impacts on designated sites. | N/A | N/A | None |
| | Flood Risk Management | ✓ | Mainly Flood Zone 1, with areas of FZ2 and 3 to the north and east of the area of search. Development should be steered away from FZ2 and 3. | N/A | N/A | None |
| | Surface water management and SuDS potential | ✓ | Due to largely impermeable soils and geology across the Borough the use of infiltration systems is not appropriate and attenuation SuDS should be used in development sites across the Borough. These should be sized according to the proposed development and a drainage strategy will be required for all proposed developments. | N/A | Would need approval and funding through the planning process; this could take a number of years depending on the individual development's circumstances. | Attenuation SuDS would be required to ensure no increase in run off rates from the developed site. |

| Area(s) of Search: | Component | Is development an option? | Comments | How many residential units? | Timeline | Additional infrastructure required |
|---|---|---|---|---|---|---|
| 02, 03, 04 and 17 | Water Resources | ✓ | ESW has predicted that the implementation of the Abberton scheme will provide the additional water resources required for growth within the Essex Resource Zone, and hence also the study area, until 2031. | Unlimited | 2014/2015 onwards (after construction of the Abberton scheme) | None |
| | Water Supply Network | ✓ | New connection to the water supply would form part of ESW's 'business as usual' supply arrangements. The costs of new development would either be passed to the developer or funded by ESW, depending on the individual development's circumstances. | Not known at this point. | Would need approval and funding through the planning process; this could take a number of years depending on the individual development's circumstances. | Connection from existing main to new development area – to be funded by developer. |
| | Wastewater Network | ✓ | The Wickford network consists of a combination of gravity sewers and pumped rising mains, with a number of DG5 flood events recorded in various locations within the combined network. Analysis of existing network models is required to determine the feasibility of new housing at this location in terms of reviewing the capacity of the existing sewer network to receive additional flows. | Not known at this point. | Modelling required by AWS and any upgrades would need approval and funding through the planning process; this could take a number of years depending on the individual development's circumstances. | Connection from existing main to new development area – to be funded by developer. Upgrades to existing network may also be required. |
| | Wastewater Treatment | ✓ | Wickford WwTW nearby has enough processing capacity to accommodate approximately 3600 new households, although the proposed Runwell Hospital development within the Wickford WwTW catchment will reduce the capacity by 624 dwellings. | Approximately 3,000 across the entire Wickford WwTW catchment | If >3,000 new houses are proposed, works upgrades may be required, which would need funding through the AMP process. The earliest the work could commence would be during AMP6 (2015-2020). | None |
| | Wastewater Consents | ✓ | The discharge consent limits give the potential for increases to flows without affecting the downstream water quality. However, this could require significant upgrades to the WwTW to enable the discharge quality to be improved. | Approximately 3,000 across the entire Wickford WwTW catchment | If works upgrades are required, this would need funding through the AMP process. The earliest the work could commence would be during AMP6 (2015-2020). | Upgrades to the WwTW (funded by AWS through AMP) may be needed for >3,000 new homes. |
| | Ecology | ✓ | The Appropriate Assessment of the Abberton scheme concluded that there would be no significant effects; therefore the increased water demand would not impact on designated sites. No increases in polluting loads would result from increased flows from Wickford WwTW, if the standard of treatment were improved to the limits of conventional wastewater treatment, and there would therefore be no impacts on designated sites. | N/A | N/A | None |
| | Flood Risk Management | ✓ | The areas of search lie within Flood Zone 1. | N/A | N/A | None |
| | Surface water management and SuDS potential | ✓ | Due to largely impermeable soils and geology across the Borough the use of infiltration systems is not appropriate and attenuation SuDS should be used in development sites across the Borough. These should be sized according to the proposed development and a drainage strategy will be required for all proposed developments. | N/A | Would need approval and funding through the planning process; this could take a number of years depending on the individual development's circumstances. | Attenuation SuDS would be required to ensure no increase in run off rates from the developed site. |

| Area(s) of Search: | Component | Is development an option? | Comments | How many residential units? | Timeline | Additional infrastructure required |
|---|---|---|---|---|---|---|
| 18 and 19 | Water Resources | ✓ | ESW has predicted that the implementation of the Abberton scheme will provide the additional water resources required for growth within the Essex Resource Zone, and hence also the study area, until 2031. | Unlimited | 2014/2015 onwards (after construction of the Abberton scheme) | None |
| | Water Supply Network | ✓ | New connection to the water supply would form part of ESW's 'business as usual' supply arrangements. The costs of new development would either be passed to the developer or funded by ESW, depending on the individual development's circumstances. | Not known at this point. | Would need approval and funding through the planning process; this could take a number of years depending on the individual development's circumstances. | Connection from existing main to new development area – to be funded by developer. |
| | Wastewater Network | ✓ | The main trunk sewers leaving these areas are 225 mm and 300 mm, which suggests upgrades may be required if significant development is to be located here. Modelling of the adjacent network is required to determine the number of houses that can be located within these areas. | Not known at this point. | Modelling required by AWS and any upgrades would need approval and funding through the planning process; this could take a number of years depending on the individual development's circumstances. | Connection from existing main to new development area – to be funded by developer. Upgrades to existing network may also be required. |
| | Wastewater Treatment | ✓ | Wickford WwTW nearby has enough processing capacity to accommodate approximately 3,600 new households, although the proposed Runwell Hospital development within the Wickford WwTW catchment will reduce the capacity by 624 dwellings. | Approximately 3,000 across the entire Wickford WwTW catchment | If >3,000 new houses are proposed, works upgrades may be required, which would need funding through the AMP process. The earliest the work could commence would be during AMP6 (2015-2020). | None |
| | Wastewater Consents | ✓ | The discharge consent limits give the potential for increases to flows without affecting the downstream water quality. However, this could require significant upgrades to the WwTW to enable the discharge quality to be improved. | Approximately 3,000 across the entire Wickford WwTW catchment | If works upgrades are required, this would need funding through the AMP process. The earliest the work could commence would be during AMP6 (2015-2020). | Upgrades to the WwTW (funded by AWS through AMP) may be needed for >3,000 new homes. |
| | Ecology | ✓ | The Appropriate Assessment of the Abberton scheme concluded that there would be no significant effects; therefore the increased water demand would not impact on designated sites. No increases in polluting loads would result from increased flows from Wickford WwTW, if the standard of treatment were improved to the limits of conventional wastewater treatment, and there would therefore be no impacts on designated sites. | N/A | N/A | None |
| | Flood Risk Management | ✓ | Mainly Flood Zone 1, with areas of FZ2 and 3 to the west of the area of search. Development should be steered away from FZ2 and 3. | N/A | N/A | None |
| | Surface water management and SuDS potential | ✓ | Due to largely impermeable soils and geology across the Borough the use of infiltration systems is not appropriate and attenuation SuDS should be used in development sites across the Borough. These should be sized according to the proposed development and a drainage strategy will be required for all proposed developments. | N/A | Would need approval and funding through the planning process; this could take a number of years depending on the individual development's circumstances. | Attenuation SuDS would be required to ensure no increase in run off rates from the developed site. |

| Area(s) of Search: | Component | Is development an option? | Comments | How many residential units? | Timeline | Additional infrastructure required |
|---|---|---|---|---|---|---|
| 20 | Water Resources | ✓ | ESW has predicted that the implementation of the Abberton scheme will provide the additional water resources required for growth within the Essex Resource Zone, and hence also the study area, until 2031. | Unlimited | 2014/2015 onwards (after construction of the Abberton scheme) | None |
| | Water Supply Network | ✓ | New connection to the water supply would form part of ESW's 'business as usual' supply arrangements. The costs of new development would either be passed to the developer or funded by ESW, depending on the individual development's circumstances. | Not known at this point. | Would need approval and funding through the planning process; this could take a number of years depending on the individual development's circumstances. | Connection from existing main to new development area – to be funded by developer. |
| | Wastewater Network | ✓ | Model runs will be required to determine the capacity of the network to take additional flows. The network drains principally by gravity to a terminal transfer pumping station close to the works. | Not known at this point. | Modelling required by AWS and any upgrades would need approval and funding through the planning process; this could take a number of years depending on the individual development's circumstances. | Connection from existing main to new development area – to be funded by developer. Upgrades to existing network may also be required. |
| | Wastewater Treatment | ✓ | Pitsea WwTW nearby has enough processing capacity to accommodate approximately 10,600 new households. | Approximately 10,600 across the entire Pitsea WwTW catchment | If >10,600 new houses are proposed, works upgrades may be required, which would need funding through the AMP process. The earliest the work could commence would be during AMP6 (2015-2020). | None |
| | Wastewater Consents | ✓ | The discharge consent limits give the potential for increases to flows without affecting the downstream water quality. However, this could require significant upgrades to the WwTW to enable the discharge quality to be improved. | Approximately 10,600 across the entire Pitsea WwTW catchment | If works upgrades are required, this would need funding through the AMP process. The earliest the work could commence would be during AMP6 (2015-2020). | Upgrades to the WwTW (funded by AWS through AMP) may be needed for >10,600 new homes. |
| | Ecology | ✓ | The Appropriate Assessment of the Abberton scheme concluded that there would be no significant effects; therefore the increased water demand would not impact on designated sites. No increases in polluting loads would result from increased flows from Pitsea WwTW and there would therefore be no impacts on designated sites. | N/A | N/A | None |
| | Flood Risk Management | ✓ | Mainly Flood Zone 1, with areas of FZ2 and 3 to the north and east of the area of search. Development should be steered away from FZ2 and 3. | N/A | N/A | None |
| | Surface water management and SuDS potential | ✓ | Due to largely impermeable soils and geology across the Borough the use of infiltration systems is not appropriate and attenuation SuDS should be used in development sites across the Borough. These should be sized according to the proposed development and a drainage strategy will be required for all proposed developments. | N/A | Would need approval and funding through the planning process; this could take a number of years depending on the individual development's circumstances. | Attenuation SuDS would be required to ensure no increase in run off rates from the developed site. |

| Area(s) of Search: | Component | Is development an option? | Comments | How many residential units? | Timeline | Additional infrastructure required |
|---|---|---|---|---|---|---|
| 21 | Water Resources | ✓ | ESW has predicted that the implementation of the Abberton scheme will provide the additional water resources required for growth within the Essex Resource Zone, and hence also the study area, until 2031. | Unlimited | 2014/2015 onwards (after construction of the Abberton scheme) | None |
| | Water Supply Network | ✓ | New connection to the water supply would form part of ESW's 'business as usual' supply arrangements. The costs of new development would either be passed to the developer or funded by ESW, depending on the individual development's circumstances. | Not known at this point. | Would need approval and funding through the planning process; this could take a number of years depending on the individual development's circumstances. | Connection from existing main to new development area – to be funded by developer. |
| | Wastewater Network | ✓ | There is no sewerage infrastructure aside from Pitsea WwTW and its outfall to Timberman's Creek. The majority of area 21 is at a high probability risk of flooding (Flood Zone 3a[118]) and although sewerage infrastructure would meet the requirements of PPS25, any infrastructure in this zone would need adequate pollution control measures in place. | Not known at this point. | New infrastructure would need approval and funding through the planning process; this could take a number of years depending on the individual development's circumstances. | Connection from existing main to new development area – to be funded by developer. Flood defences and appropriate pollution control measures needed. |
| | Wastewater Treatment | ✓ | Pitsea WwTW nearby has enough processing capacity to accommodate approximately 10,600 new households. | Approximately 10,600 across the entire Pitsea WwTW catchment | If >10,600 new houses are proposed, works upgrades may be required, which would need funding through the AMP process. The earliest the work could commence would be during AMP6 (2015-2020). | None |
| | Wastewater Consents | ✓ | The discharge consent limits give the potential for increases to flows without affecting the downstream water quality. However, this could require significant upgrades to the WwTW to enable the discharge quality to be improved. | Approximately 10,600 across the entire Pitsea WwTW catchment | If works upgrades are required, this would need funding through the AMP process. The earliest the work could commence would be during AMP6 (2015-2020). | Upgrades to the WwTW (funded by AWS through AMP) may be needed for >10,600 new homes. |
| | Ecology | ✓ | The Appropriate Assessment of the Abberton scheme concluded that there would be no significant effects; therefore the increased water demand would not impact on designated sites. No increases in polluting loads would result from increased flows from Pitsea WwTW and there would therefore be no impacts on designated sites. | N/A | N/A | None |
| | Flood Risk Management | x | Mainly Flood Zone 3, where residential development would not be considered appropriate under PPS25 | N/A | N/A | None |
| | Surface water management and SuDS potential | ✓ | Due to largely impermeable soils and geology across the Borough the use of infiltration systems is not appropriate and attenuation SuDS should be used in development sites across the Borough. These should be sized according to the proposed development and a drainage strategy will be required for all proposed developments. | N/A | Would need approval and funding through the planning process; this could take a number of years depending on the individual development's circumstances. | Attenuation SuDS would be required to ensure no increase in run off rates from the developed site. |

[118] URS Scott Wilson Level 2 SFRA 2011

| Area(s) of Search: | Component | Is development an option? | Comments | How many residential units? | Timeline | Additional infrastructure required |
|---|---|---|---|---|---|---|
| 22 | Water Resources | ✓ | ESW has predicted that the implementation of the Abberton scheme will provide the additional water resources required for growth within the Essex Resource Zone, and hence also the study area, until 2031. | Unlimited | 2014/2015 onwards (after construction of the Abberton scheme) | None |
| | Water Supply Network | ✓ | New connection to the water supply would form part of ESW's 'business as usual' supply arrangements. The costs of new development would either be passed to the developer or funded by ESW, depending on the individual development's circumstances. | Not known at this point. | Would need approval and funding through the planning process; this could take a number of years depending on the individual development's circumstances. | Connection from existing main to new development area – to be funded by developer. |
| | Wastewater Network | ✓ | The network drains principally by gravity to a terminal transfer pumping station close to the works and model runs will be required to determine the capacity of the network to take additional flows. | Not known at this point. | Modelling required by AWS and any new or upgraded infrastructure would need approval and funding through the planning process; this could take a number of years depending on the individual development's circumstances. | Connection from existing main to new development area – to be funded by developer. Upgrades to existing network may also be required. |
| | Wastewater Treatment - Pitsea | ✓ | Pitsea WwTW nearby has enough processing capacity to accommodate approximately 10,600 new households. | Approximately 10,600 across the entire Pitsea WwTW catchment | If >10,600 new houses are proposed, works upgrades may be required, which would need funding through the AMP process. The earliest the work could commence would be during AMP6 (2015-2020). | Upgrades to the WwTW (funded by AWS through AMP) may be needed |
| | Wastewater Treatment - Basildon | ✓ | Basildon WwTW was identified during the AWS flow audit as operating at DWF capacity and is therefore deemed to have no volumetric capacity. | Not known at this point. | If works upgrades are required, this would need funding through the AMP process. The earliest the work could commence would be during AMP6 (2015-2020). | Upgrades to the WwTW (funded by AWS through AMP) may be needed |
| | Wastewater Consents - Pitsea | ✓ | The discharge consent limits give the potential for increases to flows without affecting the downstream water quality. However, this could require significant upgrades to the WwTW to enable the discharge quality to be improved. | Approximately 10,600 across the entire Pitsea WwTW catchment | If works upgrades are required, this would need funding through the AMP process. The earliest the work could commence would be during AMP6 (2015-2020). | Upgrades to the WwTW (funded by AWS through AMP) may be needed |
| | Wastewater Consents - Basildon | ✓ | There is capacity to increase discharges from Basildon WwTW without affecting the receiving watercourse, assuming discharge standards can be improved | Not known at this point. | If works upgrades are required, this would need funding through the AMP process. The earliest the work could commence would be during AMP6 (2015-2020). | Upgrades to the WwTW (funded by AWS through AMP) may be needed |
| | Ecology | ✓ | The Appropriate Assessment of the Abberton scheme concluded that there would be no significant effects; therefore the increased water demand would not impact on designated sites. No increases in polluting loads would result from increased flows from Pitsea or Basildon WwTW, if the standard of treatment at Basildon were improved to the limits of conventional wastewater treatment, and there would therefore be no impacts on designated sites. | N/A | N/A | None |
| | Flood Risk Management | ✓ | The area of search lies within Flood Zone 1. | N/A | N/A | None |
| | Surface water management and SuDS potential | ✓ | Due to largely impermeable soils and geology across the Borough the use of infiltration systems is not appropriate and attenuation SuDS should be used in development sites across the Borough. These should be sized according to the proposed development and a drainage strategy will be required for all proposed developments. | N/A | Would need approval and funding through the planning process; this could take a number of years depending on the individual development's circumstances. | Attenuation SuDS would be required to ensure no increase in run off rates from the developed site. |

| Area(s) of Search: | Component | Is development an option? | Comments | How many residential units? | Timeline | Additional infrastructure required |
|---|---|---|---|---|---|---|
| 23 and 24 | Water Resources | ✓ | ESW has predicted that the implementation of the Abberton scheme will provide the additional water resources required for growth within the Essex Resource Zone, and hence also the study area, until 2031. | Unlimited | 2014/2015 onwards (after construction of the Abberton scheme) | None |
| | Water Supply Network | ✓ | New connection to the water supply would form part of ESW's 'business as usual' supply arrangements. The costs of new development would either be passed to the developer or funded by ESW, depending on the individual development's circumstances. | Not known at this point. | Would need approval and funding through the planning process; this could take a number of years depending on the individual development's circumstances. | Connection from existing main to new development area – to be funded by developer. |
| | Wastewater Network | ✓ | There is little existing sewage infrastructure in the two areas, but connection could be made to the Basildon WwTW network. However, some transfer pumping stations may need upgrading in the event of receiving additional flows from new development. | Not known at this point. | New or upgraded infrastructure would need approval and funding through the planning process; this could take a number of years depending on the individual development's circumstances. | Connection from existing main to new development area – to be funded by developer. Upgrades to existing network may also be required. |
| | Wastewater Treatment | ✓ | Basildon WwTW was identified during the AWS flow audit as operating at DWF capacity and is therefore deemed to have no volumetric capacity. | Not known at this point. | If works upgrades are required, this would need funding through the AMP process. The earliest the work could commence would be during AMP6 (2015-2020). | Upgrades to the WwTW (funded by AWS through AMP) may be needed |
| | Wastewater Consents | ✓ | There is capacity to increase discharges from Basildon WwTW without affecting the receiving watercourse, assuming discharge standards can be improved | Not known at this point. | If works upgrades are required, this would need funding through the AMP process. The earliest the work could commence would be during AMP6 (2015-2020). | Upgrades to the WwTW (funded by AWS through AMP) may be needed |
| | Ecology | ✓ | The Appropriate Assessment of the Abberton scheme concluded that there would be no significant effects; therefore the increased water demand would not impact on designated sites. No increases in polluting loads would result from increased flows from Basildon WwTW, if the standard of treatment were improved to the limits of conventional wastewater treatment, and there would therefore be no impacts on designated sites. | N/A | N/A | None |
| | Flood Risk Management | ✓ | The areas of search lie within Flood Zone 1. | N/A | N/A | None |
| | Surface water management and SuDS potential | ✓ | Due to largely impermeable soils and geology across the Borough the use of infiltration systems is not appropriate and attenuation SuDS should be used in development sites across the Borough. These should be sized according to the proposed development and a drainage strategy will be required for all proposed developments. | N/A | Would need approval and funding through the planning process; this could take a number of years depending on the individual development's circumstances. | Attenuation SuDS would be required to ensure no increase in run off rates from the developed site. |

| Area(s) of Search: | Component | Is development an option? | Comments | How many residential units? | Timeline | Additional infrastructure required |
|---|---|---|---|---|---|---|
| 05, 16, 06, 14 and 15 | Water Resources | ✓ | ESW has predicted that the implementation of the Abberton scheme will provide the additional water resources required for growth within the Essex Resource Zone, and hence also the study area, until 2031. | Unlimited | 2014/2015 onwards (after construction of the Abberton scheme) | None |
| | Water Supply Network | ✓ | New connection to the water supply would form part of ESW's 'business as usual' supply arrangements. The costs of new development would either be passed to the developer or funded by ESW, depending on the individual development's circumstances. | Not known at this point. | Would need approval and funding through the planning process; this could take a number of years depending on the individual development's circumstances. | Connection from existing main to new development area – to be funded by developer. |
| | Wastewater Network | ✓ | There is little existing infrastructure in these areas and new and upgraded sewers will be needed. | Not known at this point. | Would need approval and funding through the planning process; this could take a number of years depending on the individual development's circumstances. | Connection from existing main to new development area – to be funded by developer. Upgrades to existing network may also be required. |
| | Wastewater Treatment | ✓ | Basildon WwTW was identified during the AWS flow audit as operating at DWF capacity and is therefore deemed to have no volumetric capacity. | Not known at this point. | Works upgrades may be required, which would need funding through the AMP process. The earliest the work could commence would be during AMP6 (2015-2020). | Upgrades to the WwTW (funded by AWS through AMP) may be needed |
| | Wastewater Consents | ✓ | There is capacity to increase discharges from Basildon WwTW without affecting the receiving watercourse, assuming discharge standards can be improved | Not known at this point. | If works upgrades are required, this would need funding through the AMP process. The earliest the work could commence would be during AMP6 (2015-2020). | Upgrades to the WwTW (funded by AWS through AMP) may be needed |
| | Ecology | ✓ | The Appropriate Assessment of the Abberton scheme concluded that there would be no significant effects; therefore the increased water demand would not impact on designated sites. No increases in polluting loads would result from increased flows from Basildon WwTW, if the standard of treatment were improved to the limits of conventional wastewater treatment, and there would therefore be no impacts on designated sites. | N/A | N/A | None |
| | Flood Risk Management | ✓ | The areas of search lie within Flood Zone 1. | N/A | N/A | None |
| | Surface water management and SuDS potential | ✓ | Due to largely impermeable soils and geology across the Borough the use of infiltration systems is not appropriate and attenuation SuDS should be used in development sites across the Borough. These should be sized according to the proposed development and a drainage strategy will be required for all proposed developments. | N/A | Would need approval and funding through the planning process; this could take a number of years depending on the individual development's circumstances. | Attenuation SuDS would be required to ensure no increase in run off rates from the developed site. |

| Area(s) of Search: | Component | Is development an option? | Comments | How many residential units? | Timeline | Additional infrastructure required |
|---|---|---|---|---|---|---|
| 07 | Water Resources | ✓ | ESW has predicted that the implementation of the Abberton scheme will provide the additional water resources required for growth within the Essex Resource Zone, and hence also the study area, until 2031. | Unlimited | 2014/2015 onwards (after construction of the Abberton scheme) | None |
| | Water Supply Network | ✓ | New connection to the water supply would form part of ESW's 'business as usual' supply arrangements. The costs of new development would either be passed to the developer or funded by ESW, depending on the individual development's circumstances. | Not known at this point. | Would need approval and funding through the planning process; this could take a number of years depending on the individual development's circumstances. | Connection from existing main to new development area – to be funded by developer. |
| | Wastewater Network | ✓ | A new connection would be needed to the existing network, but due to the proximity of the area to Billericay WwTW, it is thought that little upgrade would be required to the existing infrastructure. | Not known at this point. | Would need approval and funding through the planning process; this could take a number of years depending on the individual development's circumstances. | Connection from existing main to new development area – to be funded by developer. |
| | Wastewater Treatment - Billericay | ✓ | There is volumetric capacity for approximately 2,100 new dwellings at Billericay WwTW. It is understood that low growth numbers are proposed for the town; if growth is within the volumetric capacity limits of the works then no upgrades will be required at the WwTW. Capacity for an additional 18,450 houses may be available at the adjacent Shenfield and Hutton WwTW, assuming it is possible to make a connection to the sewer network for this WwTW. | Approximately 2,100 across the entire Billericay WwTW catchment (20,550 with additional capacity from Shenfield and Hutton) | If >2,100 new houses are proposed, works upgrades may be required, which would need funding through the AMP process. The earliest the work could commence would be during AMP6 (2015-2020). | If >2,100 new houses are proposed, connection to Shenfield & Hutton WwTW would be required if growth exceeds the capacity of Billericay WwTW. |
| | Wastewater Treatment - Basildon | ✓ | Basildon WwTW was identified during the AWS flow audit as operating at DWF capacity and is therefore deemed to have no volumetric capacity. | Not known at this point. | Works upgrades may be required, which would need funding through the AMP process. The earliest the work could commence would be during AMP6 (2015-2020). | Upgrades to the WwTW (funded by AWS through AMP) may be needed |
| | Wastewater Consents - Billericay | ✓ | An increase in consented discharge volume will not be possible without breaching downstream water quality standards, although additional capacity could be made available from the adjacent Shenfield and Hutton WwTW, assuming a connection to this catchment could be made. | Approximately 2,100 across the entire Billericay WwTW catchment (20,550 with additional capacity from Shenfield and Hutton) | If works upgrades are required, this would need funding through the AMP process. The earliest the work could commence would be during AMP6 (2015-2020). | Connection to Shenfield & Hutton WwTW would be required if growth exceeds the capacity of Billericay WwTW. |
| | Wastewater Consents - Basildon | ✓ | There is capacity to increase discharges from Basildon WwTW without affecting the receiving watercourse, assuming discharge standards can be improved | Not known at this point. | If works upgrades are required, this would need funding through the AMP process. The earliest the work could commence would be during AMP6 (2015-2020). | None |
| | Ecology | ✓ | The Appropriate Assessment of the Abberton scheme concluded that there would be no significant effects; therefore the increased water demand would not impact on designated sites. No increases in polluting loads would result from increased flows from Pitsea or Basildon WwTW, if the standard of treatment at Basildon were improved to the limits of conventional wastewater treatment, and there would therefore be no impacts on designated sites. | N/A | N/A | None |
| | Flood Risk Management | ✓ | The area of search lies within Flood Zone 1. | N/A | N/A | None |
| | Surface water management and SuDS potential | ✓ | Due to largely impermeable soils and geology across the Borough the use of infiltration systems is not appropriate and attenuation SuDS should be used in development sites across the Borough. These should be sized according to the proposed development and a drainage strategy will be required for all proposed developments. | N/A | Would need approval and funding through the planning process; this could take a number of years depending on the individual development's circumstances. | Attenuation SuDS would be required to ensure no increase in run off rates from the developed site. |

| Area(s) of Search: | Component | Is development an option? | Comments | How many residential units? | Timeline | Additional infrastructure required |
|---|---|---|---|---|---|---|
| 10 and 11 | Water Resources | ✓ | ESW has predicted that the implementation of the Abberton scheme will provide the additional water resources required for growth within the Essex Resource Zone, and hence also the study area, until 2031. | Unlimited | 2014/2015 onwards (after construction of the Abberton scheme) | None |
| | Water Supply Network | ✓ | New connection to the water supply would form part of ESW's 'business as usual' supply arrangements. The costs of new development would either be passed to the developer or funded by ESW, depending on the individual development's circumstances. | Not known at this point. | Would need approval and funding through the planning process; this could take a number of years depending on the individual development's circumstances. | Connection from existing main to new development area – to be funded by developer. |
| | Wastewater Network | ✓ | Areas 10 and 11 are not connected to the existing network and so connection to existing infrastructure (Basildon, Billericay or Shenfield and Hutton) could require upgrading of existing sewers. | Not known at this point. | Would need approval and funding through the planning process; this could take a number of years depending on the individual development's circumstances. | Connection from existing main to new development area – to be funded by developer. Upgrades to existing network may also be required. |
| | Wastewater Treatment | ✓ | The Areas of Search do not lie within the catchment of any of AWS's WwTWs. A connection could theoretically be made to Billericay or Shenfield and Hutton WwTWs (see above). There is volumetric capacity for approximately 2,100 new dwellings at Billericay WwTW, although increases beyond this would not be permitted. There is volumetric capacity for approximately 18,450 new dwellings at Shenfield and Hutton WwTW | Approximately 2,100 across the entire Billericay WwTW catchment (20,550 with additional capacity from Shenfield and Hutton) assuming a connection could be made | If >2,100 new houses are proposed, works upgrades may be required, which would need funding through the AMP process. The earliest the work could commence would be during AMP6 (2015-2020). | If >2,100 new houses are proposed at Billericay or >18,450 at Shenfield & Hutton, upgrades to the WwTW (funded by AWS through AMP) may be needed |
| | Wastewater Consents | ✓ | No increases to consented DWF would be permitted at Billericay WwTW owing to water quality targets set by the RBMP. | Approximately 2,100 across the entire Billericay WwTW catchment (20,550 with additional capacity from Shenfield and Hutton) assuming a connection could be made | If works upgrades are required, this would need funding through the AMP process. The earliest the work could commence would be during AMP6 (2015-2020). | Connection to Shenfield & Hutton WwTW would be required if growth exceeds the capacity of Billericay WwTW. |
| | Ecology | ✓ | The Appropriate Assessment of the Abberton scheme concluded that there would be no significant effects; therefore the increased water demand would not impact on designated sites. There is capacity within the current consented DWF at Billericay and Shenfield and Hutton WwTWs and as long as the level of proposed growth is below this, there would be no impacts on designated sites. | N/A | N/A | None |
| | Flood Risk Management | ✓ | The areas of search lie within Flood Zone 1. | N/A | N/A | None |
| | Surface water management and SuDS potential | ✓ | Due to largely impermeable soils and geology across the Borough the use of infiltration systems is not appropriate and attenuation SuDS should be used in development sites across the Borough. These should be sized according to the proposed development and a drainage strategy will be required for all proposed developments. | N/A | Would need approval and funding through the planning process; this could take a number of years depending on the individual development's circumstances. | Attenuation SuDS would be required to ensure no increase in run off rates from the developed site. |

| Area(s) of Search: | Component | Is development an option? | Comments | How many residential units? | Timeline | Additional infrastructure required |
|---|---|---|---|---|---|---|
| 12 | Water Resources | ✓ | ESW has predicted that the implementation of the Abberton scheme will provide the additional water resources required for growth within the Essex Resource Zone, and hence also the study area, until 2031. | Unlimited | 2014/2015 onwards (after construction of the Abberton scheme) | None |
| | Water Supply Network | ✓ | New connection to the water supply would form part of ESW's 'business as usual' supply arrangements. The costs of new development would either be passed to the developer or funded by ESW, depending on the individual development's circumstances. | Not known at this point. | Would need approval and funding through the planning process; this could take a number of years depending on the individual development's circumstances. | Connection from existing main to new development area – to be funded by developer. |
| | Wastewater Network | ✓ | A number of DG5 flood events are recorded in various locations within the network. Modelling would be required to determine whether the existing network has capacity to take additional flows from this area. | Not known at this point. | Modelling required by AWS and any new or upgraded infrastructure would need approval and funding through the planning process; this could take a number of years depending on the individual development's circumstances. | Connection from existing main to new development area – to be funded by developer. Upgrades to existing network may also be required. |
| | Wastewater Treatment | ✓ | The southern half of the Area of Search does not lie within the catchment of any of AWS's WwTWs. A connection could theoretically be made to Billericay or Shenfield and Hutton WwTWs (see above). There is volumetric capacity for approximately 2,100 new dwellings at Billericay WwTW, although increases beyond this would not be permitted. There is volumetric capacity for approximately 18,450 new dwellings at Shenfield and Hutton WwTW | Approximately 2,100 across the entire Billericay WwTW catchment (20,550 with additional capacity from Shenfield and Hutton) assuming a connection could be made | If >2,100 new houses are proposed, works upgrades may be required, which would need funding through the AMP process. The earliest the work could commence would be during AMP6 (2015-2020). | If >2,100 new houses are proposed at Billericay or >18,450 at Shenfield & Hutton, upgrades to the WwTW (funded by AWS through AMP) may be needed |
| | Wastewater Consents | ✓ | No increases to consented DWF would be permitted at Billericay WwTW owing to water quality targets set by the RBMP. | Approximately 2,100 across the entire Billericay WwTW catchment (20,550 with additional capacity from Shenfield and Hutton) assuming a connection could be made | If works upgrades are required, this would need funding through the AMP process. The earliest the work could commence would be during AMP6 (2015-2020). | Connection to Shenfield & Hutton WwTW would be required if growth exceeds the capacity of Billericay WwTW. |
| | Ecology | ✓ | The Appropriate Assessment of the Abberton scheme concluded that there would be no significant effects; therefore the increased water demand would not impact on designated sites. There is capacity within the current consented DWF at Billericay and Shenfield and Hutton WwTWs and as long as the level of proposed growth is below this, there would be no impacts on designated sites. | N/A | N/A | None |
| | Flood Risk Management | ✓ | The areas of search lie within Flood Zone 1. | N/A | N/A | None |
| | Surface water management and SuDS potential | ✓ | Due to largely impermeable soils and geology across the Borough the use of infiltration systems is not appropriate and attenuation SuDS should be used in development sites across the Borough. These should be sized according to the proposed development and a drainage strategy will be required for all proposed developments. | N/A | Would need approval and funding through the planning process; this could take a number of years depending on the individual development's circumstances. | Attenuation SuDS would be required to ensure no increase in run off rates from the developed site. |

| Area(s) of Search: | Component | Is development an option? | Comments | How many residential units? | Timeline | Additional infrastructure required |
|---|---|---|---|---|---|---|
| 13 and 08 | Water Resources | ✓ | ESW has predicted that the implementation of the Abberton scheme will provide the additional water resources required for growth within the Essex Resource Zone, and hence also the study area, until 2031. | Unlimited | 2014/2015 onwards (after construction of the Abberton scheme) | None |
| | Water Supply Network | ✓ | New connection to the water supply would form part of ESW's 'business as usual' supply arrangements. The costs of new development would either be passed to the developer or funded by ESW, depending on the individual development's circumstances. | Not known at this point. | Would need approval and funding through the planning process; this could take a number of years depending on the individual development's circumstances. | Connection from existing main to new development area – to be funded by developer. |
| | Wastewater Network | ✓ | Only relatively small diameter pipes (150 mm – 225 mm) are available for connection, meaning upgrades of the existing infrastructure are likely to be required, should development take place in this location. | Not known at this point. | Any new or upgraded infrastructure would need approval and funding through the planning process; this could take a number of years depending on the individual development's circumstances. | Connection from existing main to new development area – to be funded by developer. Upgrades to existing network may also be required. |
| | Wastewater Treatment | ✓ | Basildon WwTW was identified during the AWS flow audit as operating at DWF capacity and is therefore deemed to have no volumetric capacity. | Not known at this point. | If works upgrades are required, these would need funding through the AMP process. The earliest the work could commence would be during AMP6 (2015-2020). | Upgrades to the WwTW (funded by AWS through AMP) may be needed |
| | Wastewater Consents | ✓ | There is capacity to increase discharges from Basildon WwTW without affecting the receiving watercourse, assuming discharge standards can be improved | Not known at this point. | If works upgrades are required, this would need funding through the AMP process. The earliest the work could commence would be during AMP6 (2015-2020). | Upgrades to the WwTW (funded by AWS through AMP) may be needed |
| | Ecology | ✓ | The Appropriate Assessment of the Abberton scheme concluded that there would be no significant effects; therefore the increased water demand would not impact on designated sites. No increases in polluting loads would result from increased flows from Basildon WwTW, if the standard of treatment were improved to the limits of conventional wastewater treatment, and there would therefore be no impacts on designated sites. | N/A | N/A | None |
| | Flood Risk Management | ✓ | The areas of search lie within Flood Zone 1. | N/A | N/A | None |
| | Surface water management and SuDS potential | ✓ | Due to largely impermeable soils and geology across the Borough the use of infiltration systems is not appropriate and attenuation SuDS should be used in development sites across the Borough. These should be sized according to the proposed development and a drainage strategy will be required for all proposed developments. | N/A | Would need approval and funding through the planning process; this could take a number of years depending on the individual development's circumstances. | Attenuation SuDS would be required to ensure no increase in run off rates from the developed site. |

| Area(s) of Search: | Component | Is development an option? | Comments | How many residential units? | Timeline | Additional infrastructure required |
|---|---|---|---|---|---|---|
| 09 | Water Resources | ✓ | ESW has predicted that the implementation of the Abberton scheme will provide the additional water resources required for growth within the Essex Resource Zone, and hence also the study area, until 2031. | Unlimited | 2014/2015 onwards (after construction of the Abberton scheme) | None |
| | Water Supply Network | ✓ | New connection to the water supply would form part of ESW's 'business as usual' supply arrangements. The costs of new development would either be passed to the developer or funded by ESW, depending on the individual development's circumstances. | Not known at this point. | Would need approval and funding through the planning process; this could take a number of years depending on the individual development's circumstances. | Connection from existing main to new development area – to be funded by developer. |
| | Wastewater Network | ✓ | Connection could be made to a number of sewer runs, but modelling to determine spare capacity and the impact on the network of additional flows would be required. | Not known at this point. | Modelling required by AWS and any new or upgraded infrastructure would need approval and funding through the planning process; this could take a number of years depending on the individual development's circumstances. | Connection from existing main to new development area – to be funded by developer. Upgrades to existing network may also be required. |
| | Wastewater Treatment | ✓ | There is volumetric capacity for approximately 2,100 new dwellings at Billericay WwTW, although increases beyond this would not be permitted owing to water quality targets set by the RBMP. There is volumetric capacity for approximately 18,450 new dwellings at Shenfield and Hutton WwTW | Approximately 2,100 across the entire Billericay WwTW catchment (20,550 with additional capacity from Shenfield and Hutton) assuming a connection could be made | If >2,100 new houses are proposed, works upgrades may be required, which would need funding through the AMP process. The earliest the work could commence would be during AMP6 (2015-2020). | If >2,100 new houses are proposed, connection to Shenfield & Hutton WwTW would be required if growth exceeds the capacity of Billericay WwTW. |
| | Wastewater Consents | ✓ | No increases to consented DWF would be permitted at Billericay WwTW owing to water quality targets set by the RBMP. | Approximately 2,100 across the entire Billericay WwTW catchment (20,550 with additional capacity from Shenfield and Hutton) assuming a connection could be made | If works upgrades are required, this would need funding through the AMP process. The earliest the work could commence would be during AMP6 (2015-2020). | Connection to Shenfield & Hutton WwTW would be required if growth exceeds the capacity of Billericay WwTW. |
| | Ecology | ✓ | The Appropriate Assessment of the Abberton scheme concluded that there would be no significant effects; therefore the increased water demand would not impact on designated sites. There is capacity within the current consented DWF at Billericay and Shenfield and Hutton WwTWs and as long as the level of proposed growth is below this, there would be no impacts on designated sites. | N/A | N/A | None |
| | Flood Risk Management | ✓ | There are areas of Flood Zones 1, 2 and 3 in this Area of Search.Development should be steered away from FZ2 and 3. | N/A | N/A | None |
| | Surface water management and SuDS potential | ✓ | Due to largely impermeable soils and geology across the Borough the use of infiltration systems is not appropriate and attenuation SuDS should be used in development sites across the Borough. These should be sized according to the proposed development and a drainage strategy will be required for all proposed developments. | N/A | Would need approval and funding through the planning process; this could take a number of years depending on the individual development's circumstances. | Attenuation SuDS would be required to ensure no increase in run off rates from the developed site. |

| Area(s) of Search: | Component | Is development an option? | Comments | How many residential units? | Timeline | Additional infrastructure required |
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| Barn Hall | Water Resources | ✓ | ESW has predicted that the implementation of the Abberton scheme will provide the additional water resources required for growth within the Essex Resource Zone, and hence also the study area, until 2031. | Unlimited | 2014/2015 onwards (after construction of the Abberton scheme) | None |
| | Water Supply Network | ✓ | New connection to the water supply would form part of ESW's 'business as usual' supply arrangements. The costs of new development would either be passed to the developer or funded by ESW, depending on the individual development's circumstances. | Not known at this point. | Would need approval and funding through the planning process; this could take a number of years depending on the individual development's circumstances. | Connection from existing main to new development area – to be funded by developer. |
| | Wastewater Network | ✓ | Analysis of existing network models is required to determine the feasibility of new housing at this location in terms of reviewing the capacity of the existing sewer network to receive additional flows. | Not known at this point. | Modelling required by AWS and any new or upgraded infrastructure would need approval and funding through the planning process; this could take a number of years depending on the individual development's circumstances. | Connection from existing main to new development area – to be funded by developer. Upgrades to existing network may also be required. |
| | Wastewater Treatment | ✓ | Wickford WwTW nearby has enough processing capacity to accommodate approximately 3600 new households, although the proposed Runwell Hospital development within the Wickford WwTW catchment will reduce the capacity by 624 dwellings. | Approximately 3,000 across the entire Wickford WwTW catchment | If >3,000 new houses are proposed, works upgrades may be required, which would need funding through the AMP process. The earliest the work could commence would be during AMP6 (2015-2020). | None |
| | Wastewater Consents | ✓ | The discharge consent limits give the potential for increases to flows without affecting the downstream water quality. However, this could require significant upgrades to the WwTW to enable the discharge quality to be improved. | Approximately 3,000 across the entire Wickford WwTW catchment | If works upgrades are required, this would need funding through the AMP process. The earliest the work could commence would be during AMP6 (2015-2020). | Upgrades to the WwTW (funded by AWS through AMP) may be needed |
| | Ecology | ✓ | The Appropriate Assessment of the Abberton scheme concluded that there would be no significant effects; therefore the increased water demand would not impact on designated sites. No increases in polluting loads would result from increased flows from Wickford WwTW, if the standard of treatment were improved to the limits of conventional wastewater treatment, and there would therefore be no impacts on designated sites. | N/A | N/A | None |
| | Flood Risk Management | ✓ | The Urban Area lies within Flood Zone 1. | N/A | N/A | None |
| | Surface water management and SuDS potential | ✓ | Due to largely impermeable soils and geology across the Borough the use of infiltration systems is not appropriate and attenuation SuDS should be used in development sites across the Borough. These should be sized according to the proposed development and a drainage strategy will be required for all proposed developments. | N/A | Would need approval and funding through the planning process; this could take a number of years depending on the individual development's circumstances. | Attenuation SuDS would be required to ensure no increase in run off rates from the developed site. |

| Area(s) of Search: | Component | Is development an option? | Comments | How many residential units? | Timeline | Additional infrastructure required |
|---|---|---|---|---|---|---|
| Wickford Town Centre | Water Resources | ✓ | ESW has predicted that the implementation of the Abberton scheme will provide the additional water resources required for growth within the Essex Resource Zone, and hence also the study area, until 2031. | Unlimited | 2014/2015 onwards (after construction of the Abberton scheme) | None |
| | Water Supply Network | ✓ | New connection to the water supply would form part of ESW's 'business as usual' supply arrangements. The costs of new development would either be passed to the developer or funded by ESW, depending on the individual development's circumstances. | Not known at this point. | Would need approval and funding through the planning process; this could take a number of years depending on the individual development's circumstances. | Connection from existing main to new development area – to be funded by developer. |
| | Wastewater Network | ✓ | Analysis of existing network models is required to determine the feasibility of new housing at this location in terms of reviewing the capacity of the existing sewer network to receive additional flows. | Not known at this point. | Modelling required by AWS and any new or upgraded infrastructure would need approval and funding through the planning process; this could take a number of years depending on the individual development's circumstances. | Upgrades to existing network may be required. |
| | Wastewater Treatment | ✓ | Wickford WwTW nearby has enough processing capacity to accommodate approximately 3600 new households, although the proposed Runwell Hospital development within the Wickford WwTW catchment will reduce the capacity by 624 dwellings. | Approximately 3,000 000 across the entire Wickford WwTW catchment | If >3,000 new houses are proposed, works upgrades may be required, which would need funding through the AMP process. The earliest the work could commence would be during AMP6 (2015-2020). | None |
| | Wastewater Consents | ✓ | The discharge consent limits give the potential for increases to flows without affecting the downstream water quality. However, this could require significant upgrades to the WwTW to enable the discharge quality to be improved. | Approximately 3,000 across the entire Wickford WwTW catchment | If works upgrades are required, this would need funding through the AMP process. The earliest the work could commence would be during AMP6 (2015-2020). | Upgrades to the WwTW (funded by AWS through AMP) may be needed |
| | Ecology | ✓ | The Appropriate Assessment of the Abberton scheme concluded that there would be no significant effects; therefore the increased water demand would not impact on designated sites. No increases in polluting loads would result from increased flows from Wickford WwTW, if the standard of treatment were improved to the limits of conventional wastewater treatment, and there would therefore be no impacts on designated sites. | N/A | N/A | None |
| | Flood Risk Management | ✓ | The Urban Area lies within Flood Zone 1. | N/A | N/A | None |
| | Surface water management and SuDS potential | ✓ | Due to largely impermeable soils and geology across the Borough the use of infiltration systems is not appropriate and attenuation SuDS should be used in development sites across the Borough. These should be sized according to the proposed development and a drainage strategy will be required for all proposed developments. | N/A | Would need approval and funding through the planning process; this could take a number of years depending on the individual development's circumstances. | Attenuation SuDS would be required to ensure no increase in run off rates from the developed site. |

| Area(s) of Search: | Component | Is development an option? | Comments | How many residential units? | Timeline | Additional infrastructure required |
|---|---|---|---|---|---|---|
| Pitsea Town Centre | Water Resources | ✓ | ESW has predicted that the implementation of the Abberton scheme will provide the additional water resources required for growth within the Essex Resource Zone, and hence also the study area, until 2031. | Unlimited | 2014/2015 onwards (after construction of the Abberton scheme) | None |
| | Water Supply Network | ✓ | New connection to the water supply would form part of ESW's 'business as usual' supply arrangements. The costs of new development would either be passed to the developer or funded by ESW, depending on the individual development's circumstances. | Not known at this point. | Would need approval and funding through the planning process; this could take a number of years depending on the individual development's circumstances. | Connection from existing main to new development area – to be funded by developer. |
| | Wastewater Network | ✓ | Analysis of existing network models is required to determine the feasibility of new housing at this location in terms of reviewing the capacity of the existing sewer network to receive additional flows. | Not known at this point. | Modelling required by AWS and any new or upgraded infrastructure would need approval and funding through the planning process; this could take a number of years depending on the individual development's circumstances. | Upgrades to existing network may be required. |
| | Wastewater Treatment | ✓ | Pitsea WwTW nearby has enough processing capacity to accommodate approximately 10,600 new households. | Approximately 10,600 across the entire Pitsea WwTW catchment | If >10,600 new houses are proposed, works upgrades may be required, which would need funding through the AMP process. The earliest the work could commence would be during AMP6 (2015-2020). | None |
| | Wastewater Consents | ✓ | The discharge consent limits give the potential for increases to flows without affecting the downstream water quality. However, this could require significant upgrades to the WwTW to enable the discharge quality to be improved. | Approximately 10,600 across the entire Pitsea WwTW catchment | If works upgrades are required, this would need funding through the AMP process. The earliest the work could commence would be during AMP6 (2015-2020). | Upgrades to the WwTW (funded by AWS through AMP) may be needed |
| | Ecology | ✓ | The Appropriate Assessment of the Abberton scheme concluded that there would be no significant effects; therefore the increased water demand would not impact on designated sites. No increases in polluting loads would result from increased flows from Pitsea WwTW and there would therefore be no impacts on designated sites. | N/A | N/A | None |
| | Flood Risk Management | ✓ | The Urban Area lies within Flood Zone 1. | N/A | N/A | None |
| | Surface water management and SuDS potential | ✓ | Due to largely impermeable soils and geology across the Borough the use of infiltration systems is not appropriate and attenuation SuDS should be used in development sites across the Borough. These should be sized according to the proposed development and a drainage strategy will be required for all proposed developments. | N/A | Would need approval and funding through the planning process; this could take a number of years depending on the individual development's circumstances. | Attenuation SuDS would be required to ensure no increase in run off rates from the developed site. |

| Area(s) of Search: | Component | Is development an option? | Comments | How many residential units? | Timeline | Additional infrastructure required |
|---|---|---|---|---|---|---|
| Gardiners Lane South | Water Resources | ✓ | ESW has predicted that the implementation of the Abberton scheme will provide the additional water resources required for growth within the Essex Resource Zone, and hence also the study area, until 2031. | Unlimited | 2014/2015 onwards (after construction of the Abberton scheme) | None |
| | Water Supply Network | ✓ | New connection to the water supply would form part of ESW's 'business as usual' supply arrangements. The costs of new development would either be passed to the developer or funded by ESW, depending on the individual development's circumstances. | Not known at this point. | Would need approval and funding through the planning process; this could take a number of years depending on the individual development's circumstances. | Connection from existing main to new development area – to be funded by developer. |
| | Wastewater Network | ✓ | Modelling is required to determine whether additional capacity in existing sewers is actually available or whether there would be any negative impact on the existing network. | Not known at this point. | Modelling required by AWS and any new or upgraded infrastructure would need approval and funding through the planning process; this could take a number of years depending on the individual development's circumstances. | Connection from existing main to new development area – to be funded by developer. Upgrades to existing network may also be required. |
| | Wastewater Treatment | ✓ | Basildon WwTW was identified during the AWS flow audit as operating at DWF capacity and is therefore deemed to have no volumetric capacity. | Not known at this point. | If works upgrades are required, these would need funding through the AMP process. The earliest the work could commence would be during AMP6 (2015-2020). | Upgrades to the WwTW (funded by AWS through AMP) may be needed |
| | Wastewater Consents | ✓ | There is capacity to increase discharges from Basildon WwTW without affecting the receiving watercourse, assuming discharge standards can be improved | Not known at this point. | If works upgrades are required, this would need funding through the AMP process. The earliest the work could commence would be during AMP6 (2015-2020). | Upgrades to the WwTW (funded by AWS through AMP) may be needed |
| | Ecology | ✓ | The Appropriate Assessment of the Abberton scheme concluded that there would be no significant effects; therefore the increased water demand would not impact on designated sites. No increases in polluting loads would result from increased flows from Basildon WwTW, if the standard of treatment were improved to the limits of conventional wastewater treatment, and there would therefore be no impacts on designated sites. | N/A | N/A | None |
| | Flood Risk Management | ✓ | The Urban Area lies within Flood Zone 1. | N/A | N/A | None |
| | Surface water management and SuDS potential | ✓ | Due to largely impermeable soils and geology across the Borough the use of infiltration systems is not appropriate and attenuation SuDS should be used in development sites across the Borough. These should be sized according to the proposed development and a drainage strategy will be required for all proposed developments. | N/A | Would need approval and funding through the planning process; this could take a number of years depending on the individual development's circumstances. | Attenuation SuDS would be required to ensure no increase in run off rates from the developed site. |

| Area(s) of Search: | Component | Is development an option? | Comments | How many residential units? | Timeline | Additional infrastructure required |
|---|---|---|---|---|---|---|
| Basildon Town Centre | Water Resources | ✓ | ESW has predicted that the implementation of the Abberton scheme will provide the additional water resources required for growth within the Essex Resource Zone, and hence also the study area, until 2031. | Unlimited | 2014/2015 onwards (after construction of the Abberton scheme) | None |
| | Water Supply Network | ✓ | New connection to the water supply would form part of ESW's 'business as usual' supply arrangements. The costs of new development would either be passed to the developer or funded by ESW, depending on the individual development's circumstances. | Not known at this point. | Would need approval and funding through the planning process; this could take a number of years depending on the individual development's circumstances. | Connection from existing main to new development area – to be funded by developer. |
| | Wastewater Network | ✓ | Detailed network modelling would be required to assess the capacity of the existing system and the impact of additional flows on the network. | Not known at this point. | Modelling required by AWS and any new or upgraded infrastructure would need approval and funding through the planning process; this could take a number of years depending on the individual development's circumstances. | Upgrades to existing network may be required. |
| | Wastewater Treatment | ✓ | Basildon WwTW was identified during the AWS flow audit as operating at DWF capacity and is therefore deemed to have no volumetric capacity. | Not known at this point. | If works upgrades are required, these would need funding through the AMP process. The earliest the work could commence would be during AMP6 (2015-2020). | Upgrades to the WwTW (funded by AWS through AMP) may be needed |
| | Wastewater Consents | ✓ | There is capacity to increase discharges from Basildon WwTW without affecting the receiving watercourse, assuming discharge standards can be improved | Not known at this point. | If works upgrades are required, this would need funding through the AMP process. The earliest the work could commence would be during AMP6 (2015-2020). | Upgrades to the WwTW (funded by AWS through AMP) may be needed |
| | Ecology | ✓ | The Appropriate Assessment of the Abberton scheme concluded that there would be no significant effects; therefore the increased water demand would not impact on designated sites. No increases in polluting loads would result from increased flows from Basildon WwTW, if the standard of treatment were improved to the limits of conventional wastewater treatment, and there would therefore be no impacts on designated sites. | N/A | N/A | None |
| | Flood Risk Management | ✓ | The Urban Area lies within Flood Zone 1. | N/A | N/A | None |
| | Surface water management and SuDS potential | ✓ | Due to largely impermeable soils and geology across the Borough the use of infiltration systems is not appropriate and attenuation SuDS should be used in development sites across the Borough. These should be sized according to the proposed development and a drainage strategy will be required for all proposed developments. | N/A | Would need approval and funding through the planning process; this could take a number of years depending on the individual development's circumstances. | Attenuation SuDS would be required to ensure no increase in run off rates from the developed site. |

| Area(s) of Search: | Component | Is development an option? | Comments | How many residential units? | Timeline | Additional infrastructure required |
|---|---|---|---|---|---|---|
| Dry Street & College | Water Resources | ✓ | ESW has predicted that the implementation of the Abberton scheme will provide the additional water resources required for growth within the Essex Resource Zone, and hence also the study area, until 2031. | Unlimited | 2014/2015 onwards (after construction of the Abberton scheme) | None |
| | Water Supply Network | ✓ | New connection to the water supply would form part of ESW's 'business as usual' supply arrangements. The costs of new development would either be passed to the developer or funded by ESW, depending on the individual development's circumstances. | Not known at this point. | Would need approval and funding through the planning process; this could take a number of years depending on the individual development's circumstances. | Connection from existing main to new development area – to be funded by developer. |
| | Wastewater Network | ✓ | Small diameter sewers to the north of the development site may have limited capacity to take additional flows; this requires network modelling to confirm. | Not known at this point. | Modelling required by AWS and any new or upgraded infrastructure would need approval and funding through the planning process; this could take a number of years depending on the individual development's circumstances. | Upgrades to existing network may be required. |
| | Wastewater Treatment | ✓ | Basildon WwTW was identified during the AWS flow audit as operating at DWF capacity and is therefore deemed to have no volumetric capacity. | Not known at this point. | If works upgrades are required, these would need funding through the AMP process. The earliest the work could commence would be during AMP6 (2015-2020). | Upgrades to the WwTW (funded by AWS through AMP) may be needed |
| | Wastewater Consents | ✓ | There is capacity to increase discharges from Basildon WwTW without affecting the receiving watercourse, assuming discharge standards can be improved | Not known at this point. | If works upgrades are required, this would need funding through the AMP process. The earliest the work could commence would be during AMP6 (2015-2020). | Upgrades to the WwTW (funded by AWS through AMP) may be needed |
| | Ecology | ✓ | The Appropriate Assessment of the Abberton scheme concluded that there would be no significant effects; therefore the increased water demand would not impact on designated sites. No increases in polluting loads would result from increased flows from Basildon WwTW, if the standard of treatment were improved to the limits of conventional wastewater treatment, and there would therefore be no impacts on designated sites. | N/A | N/A | None |
| | Flood Risk Management | ✓ | The Urban Area lies within Flood Zone 1. | N/A | N/A | None |
| | Surface water management and SuDS potential | ✓ | Due to largely impermeable soils and geology across the Borough the use of infiltration systems is not appropriate and attenuation SuDS should be used in development sites across the Borough. These should be sized according to the proposed development and a drainage strategy will be required for all proposed developments. | N/A | Would need approval and funding through the planning process; this could take a number of years depending on the individual development's circumstances. | Attenuation SuDS would be required to ensure no increase in run off rates from the developed site. |

| Area(s) of Search: | Component | Is development an option? | Comments | How many residential units? | Timeline | Additional infrastructure required |
|---|---|---|---|---|---|---|
| Laindon Town Centre | Water Resources | ✓ | ESW has predicted that the implementation of the Abberton scheme will provide the additional water resources required for growth within the Essex Resource Zone, and hence also the study area, until 2031. | Unlimited | 2014/2015 onwards (after construction of the Abberton scheme) | None |
| | Water Supply Network | ✓ | New connection to the water supply would form part of ESW's 'business as usual' supply arrangements. The costs of new development would either be passed to the developer or funded by ESW, depending on the individual development's circumstances. | Not known at this point. | Would need approval and funding through the planning process; this could take a number of years depending on the individual development's circumstances. | Connection from existing main to new development area – to be funded by developer. |
| | Wastewater Network | ✓ | Network modelling is required for the proposed development, as the network is a large combined system and additional flows from new development would need to be assessed | Not known at this point. | Modelling required by AWS and any new or upgraded infrastructure would need approval and funding through the planning process; this could take a number of years depending on the individual development's circumstances. | Upgrades to existing network may be required. |
| | Wastewater Treatment | ✓ | Basildon WwTW was identified during the AWS flow audit as operating at DWF capacity and is therefore deemed to have no volumetric capacity. | Not known at this point. | If works upgrades are required, these would need funding through the AMP process. The earliest the work could commence would be during AMP6 (2015-2020). | Upgrades to the WwTW (funded by AWS through AMP) may be needed |
| | Wastewater Consents | ✓ | There is capacity to increase discharges from Basildon WwTW without affecting the receiving watercourse, assuming discharge standards can be improved | Not known at this point. | If works upgrades are required, this would need funding through the AMP process. The earliest the work could commence would be during AMP6 (2015-2020). | Upgrades to the WwTW (funded by AWS through AMP) may be needed |
| | Ecology | ✓ | The Appropriate Assessment of the Abberton scheme concluded that there would be no significant effects; therefore the increased water demand would not impact on designated sites. No increases in polluting loads would result from increased flows from Basildon WwTW, if the standard of treatment were improved to the limits of conventional wastewater treatment, and there would therefore be no impacts on designated sites. | N/A | N/A | None |
| | Flood Risk Management | ✓ | The Urban Area lies within Flood Zone 1. | N/A | N/A | None |
| | Surface water management and SuDS potential | ✓ | Due to largely impermeable soils and geology across the Borough the use of infiltration systems is not appropriate and attenuation SuDS should be used in development sites across the Borough. These should be sized according to the proposed development and a drainage strategy will be required for all proposed developments. | N/A | Would need approval and funding through the planning process; this could take a number of years depending on the individual development's circumstances. | Attenuation SuDS would be required to ensure no increase in run off rates from the developed site. |

| Area(s) of Search: | Component | Is development an option? | Comments | How many residential units? | Timeline | Additional infrastructure required |
|---|---|---|---|---|---|---|
| Fords Dunton | Water Resources | ✓ | ESW has predicted that the implementation of the Abberton scheme will provide the additional water resources required for growth within the Essex Resource Zone, and hence also the study area, until 2031. | Unlimited | 2014/2015 onwards (after construction of the Abberton scheme) | None |
| | Water Supply Network | ✓ | New connection to the water supply would form part of ESW's 'business as usual' supply arrangements. The costs of new development would either be passed to the developer or funded by ESW, depending on the individual development's circumstances. | Not known at this point. | Would need approval and funding through the planning process; this could take a number of years depending on the individual development's circumstances. | Connection from existing main to new development area – to be funded by developer. |
| | Wastewater Network | ✓ | No existing sewage infrastructure, although privately owned infrastructure may exist, but it is surrounded by an existing network. Balancing storage within the existing network suggests there may be limited capacity within the network. | Not known at this point. | Modelling required by AWS and any new or upgraded infrastructure would need approval and funding through the planning process; this could take a number of years depending on the individual development's circumstances. | Connection from existing main to new development area – to be funded by developer. Upgrades to existing network may also be required. |
| | Wastewater Treatment | ✓ | Basildon WwTW was identified during the AWS flow audit as operating at DWF capacity and is therefore deemed to have no volumetric capacity. | Not known at this point. | If works upgrades are required, these would need funding through the AMP process. The earliest the work could commence would be during AMP6 (2015-2020). | Upgrades to the WwTW (funded by AWS through AMP) may be needed |
| | Wastewater Consents | ✓ | There is capacity to increase discharges from Basildon WwTW without affecting the receiving watercourse, assuming discharge standards can be improved | Not known at this point. | If works upgrades are required, this would need funding through the AMP process. The earliest the work could commence would be during AMP6 (2015-2020). | Upgrades to the WwTW (funded by AWS through AMP) may be needed |
| | Ecology | ✓ | The Appropriate Assessment of the Abberton scheme concluded that there would be no significant effects; therefore the increased water demand would not impact on designated sites. No increases in polluting loads would result from increased flows from Basildon WwTW, if the standard of treatment were improved to the limits of conventional wastewater treatment, and there would therefore be no impacts on designated sites. | N/A | N/A | None |
| | Flood Risk Management | ✓ | The Urban Area lies within Flood Zone 1. | N/A | N/A | None |
| | Surface water management and SuDS potential | ✓ | Due to largely impermeable soils and geology across the Borough the use of infiltration systems is not appropriate and attenuation SuDS should be used in development sites across the Borough. These should be sized according to the proposed development and a drainage strategy will be required for all proposed developments. | N/A | Would need approval and funding through the planning process; this could take a number of years depending on the individual development's circumstances. | Approximately 44,100 to 57,600 $m^3$ of attenuation SuDS would be required to ensure no increase in run off rates from the developed site. |

| Area(s) of Search: | Component | Is development an option? | Comments | How many residential units? | Timeline | Additional infrastructure required |
|---|---|---|---|---|---|---|
| Billericay Town Centre | Water Resources | ✓ | ESW has predicted that the implementation of the Abberton scheme will provide the additional water resources required for growth within the Essex Resource Zone, and hence also the study area, until 2031. | Unlimited | 2014/2015 onwards (after construction of the Abberton scheme) | None |
| | Water Supply Network | ✓ | New connection to the water supply would form part of ESW's 'business as usual' supply arrangements. The costs of new development would either be passed to the developer or funded by ESW, depending on the individual development's circumstances. | Not known at this point. | Would need approval and funding through the planning process; this could take a number of years depending on the individual development's circumstances. | Connection from existing main to new development area – to be funded by developer. |
| | Wastewater Network | ✓ | Model runs are required to determine whether additional flows can be accommodated within the network | Not known at this point. | Modelling required by AWS and any new or upgraded infrastructure would need approval and funding through the planning process; this could take a number of years depending on the individual development's circumstances. | Upgrades to existing network may be required. |
| | Wastewater Treatment | ✓ | There is volumetric capacity for approximately 2,100 new dwellings at Billericay WwTW, although increases beyond this would not be permitted. There is volumetric capacity for approximately 18,450 new dwellings at Shenfield and Hutton WwTW | Approximately 2,100 across the entire Billericay WwTW catchment (20,550 with additional capacity from Shenfield and Hutton) assuming a connection could be made | If works upgrades are required, this would need funding through the AMP process. The earliest the work could commence would be during AMP6 (2015-2020). | If >2,100 new houses are proposed, connection to Shenfield & Hutton WwTW would be required if growth exceeds the capacity of Billericay WwTW. |
| | Wastewater Consents | ✓ | No increases to consented DWF would be permitted at Billericay WwTW | Approximately 2,100 across the entire Billericay WwTW catchment (20,550 with additional capacity from Shenfield and Hutton) assuming a connection could be made | If works upgrades are required, this would need funding through the AMP process. The earliest the work could commence would be during AMP6 (2015-2020). | Connection to Shenfield & Hutton WwTW would be required if growth exceeds the capacity of Billericay WwsTW. |
| | Ecology | ✓ | The Appropriate Assessment of the Abberton scheme concluded that there would be no significant effects; therefore the increased water demand would not impact on designated sites. There is capacity within the current consented DWF at Billericay and Shenfield and Hutton WwTWs and as long as the level of proposed growth is below this, there would be no impacts on designated sites. | N/A | N/A | None |
| | Flood Risk Management | ✓ | The Urban Area lies within Flood Zone 1. | N/A | N/A | None |
| | Surface water management and SuDS potential | ✓ | Due to largely impermeable soils and geology across the Borough the use of infiltration systems is not appropriate and attenuation SuDS should be used in development sites across the Borough. These should be sized according to the proposed development and a drainage strategy will be required for all proposed developments. | N/A | Would need approval and funding through the planning process; this could take a number of years depending on the individual development's circumstances. | Approximately 5,000 to 6,500 $m^3$ of attenuation SuDS would be required to ensure no increase in run off rates from the developed site. |

## 7.3 Castle Point Borough

| Proposed Growth Location | Water resources | Wastewater treatment and transmission | Ecology | Flood risk management | Surface water management and SuDS potential | Additional infrastructure required |
|---|---|---|---|---|---|---|
| Canvey Island | ESW has predicted that the implementation of the Abberton scheme will provide the additional water resources required for growth within the Essex Resource Zone, and hence also the study area, until 2031. | **Wastewater treatment**<br>There is adequate volumetric capacity at Canvey WwTW to treat the additional flows from the proposed growth.<br>**Environmental capacity**<br>No increase in consented volume is required for the proposed level of growth.<br>**Wastewater transmission**<br>The sewage network, including pumping stations, gravity sewers and rising mains is likely to need upgrading. Due to the spread of the proposed housing growth areas, AWS's existing network model for the sewer catchment should be re-run to assess capacity of the sewer network. | The Appropriate Assessment of the Abberton scheme concluded that there would be no significant effects, therefore the increased water demand would not impact on designated sites.<br>Canvey WwTW discharges into the River Thames approximately 2 km upstream of Benfleet & Southend Marshes SPA/Ramsar site. However, no increase in consented DWF will be required as a result of the growth and there will therefore be no impact on the designated site. | Canvey Island lies entirely within defended Flood Zone 3, the SFRA has shown that in the event of a breach of defences flood depths could reach up to 2 metres adjacent to river channels. Mitigation would therefore need to be provided for residual flood risk. | Due to largely impermeable soils and geology across the Borough the use of infiltration systems is not appropriate and attenuation SuDS should be used in development sites across the Borough. These should be sized according to the proposed development and a drainage strategy will be required for all proposed developments. | Connection from existing main to new development area, to be funded by developer, will be required and upgrades to existing network may be needed.<br>Maintenance and possibly upgrades to the existing flood defences will be needed, to ensure the standard of protection is maintained with the effects of climate change.<br>Attenuation SuDS would be required to ensure no increase in run off rates from the developed site. |
| South Benfleet | ESW has predicted that the implementation of the Abberton scheme will provide the additional water resources required for growth within the Essex Resource Zone, and hence also the study area, until 2031. | **Wastewater treatment**<br>There is adequate volumetric capacity at Benfleet WwTW to treat the additional flows from the proposed growth.<br>**Environmental capacity**<br>Modelling has shown that it is theoretically possible to increase discharge quality and apply tighter discharge consent limits to ensure there is no change to the load of pollutants discharged.<br>**Wastewater transmission**<br>Both high and low predicted housing growth rates will need extensive upgrades of the sewer network and AWS's existing network model for the sewer catchment should be re-run to assess capacity of the sewer network. | The Appropriate Assessment of the Abberton scheme concluded that there would be no significant effects, therefore the increased water demand would not impact on designated sites.<br>Benfleet WwTW discharges into the Benfleet approximately 3.5 km upstream of Management Unit 6 of Benfleet & Southend Marshes SSSI/SPA/Ramsar site. Increased discharges from the WwTW therefore have the potential to impact on this site, although modelling shows that it is theoretically possible to increase discharge quality to ensure there is no change to the load of pollutants discharged. No impact on the designated site is therefore anticipated. | South Benfleet lies mainly in Flood Zone 1, apart from a small area at Hope's Green associated with a tributary of the Benfleet Creek. Development should be steered away from this area. | Due to largely impermeable soils and geology across the Borough the use of infiltration systems is not appropriate and attenuation SuDS should be used in development sites across the Borough. These should be sized according to the proposed development and a drainage strategy will be required for all proposed developments. | Connection from existing main to new development area, to be funded by developer, will be required and upgrades to existing network may be needed.<br>Attenuation SuDS would be required to ensure no increase in run off rates from the developed site. |
| Thundersley | ESW has predicted that the implementation of the Abberton scheme will provide the additional water resources | **Benfleet WwTW - Wastewater treatment**<br>The west of Thundersley drains to Benfleet WwTW. There is adequate volumetric capacity at Benfleet WwTW to treat the additional flows from the proposed growth. | The Appropriate Assessment of the Abberton scheme concluded that there would be no significant effects, therefore the increased water demand would not impact on designated sites. | Thundersley lies almost entirely within Flood Zone 1, with very a small area of FZ2 and 3 adjacent to the A130, associated with the tributary of the river | Due to largely impermeable soils and geology across the Borough the use of infiltration systems is not appropriate and attenuation SuDS should be used in development sites across the | Connection from existing main to new development area, to be funded by developer, will be required. If the proposed development is connected to Benfleet |

| Proposed Growth Location | Water resources | Wastewater treatment and transmission | Ecology | Flood risk management | Surface water management and SuDS potential | Additional infrastructure required |
|---|---|---|---|---|---|---|
| | required for growth within the Essex Resource Zone, and hence also the study area, until 2031. | **Benfleet WwTW - Environmental capacity**<br>Modelling has shown that shows that it is theoretically possible to increase discharge quality and apply tighter discharge consent limits to ensure there is no change to the load of pollutants discharged.<br><br>**Benfleet WwTW - Wastewater transmission**<br>It is likely that sewer network upgrades will be required to accommodate increased flows and AWS's existing network model for the sewer catchment should be re-run to assess capacity of the sewer network.<br><br>**Southend WwTW - Wastewater treatment**<br>The east of Thundersley drains to Southend WwTW, the west drains to Benfleet WwTW. There is no capacity at Southend WwTW and in order to treat additional flows, expansion of the works would be required, however, the works is a very constrained site, with no room to expand the treatment process.<br><br>**Southend WwTW - Environmental capacity**<br>There is environmental capacity to accept additional treated wastewater discharges from Southend works, although as an upgrade to the works is not possible this would not be relevant.<br><br>**Southend WwTW - Wastewater transmission**<br>There are critical flooding problems within the network, which is operating at, or even above, capacity. In order to treat additional flows, expansion of the works would be required, however, the works is a very constrained site, with no room to expand the treatment process.<br><br>**Rayleigh East WwTW - Wastewater treatment**<br>An area to the north of Thundersley drains to Rayleigh East WwTW. While the extent of the growth within this area is not know, there is adequate volumetric capacity for an additional estimated 1,800 houses within the entire Rayleigh East catchment.<br><br>**Rayleigh East WwTW - Environmental capacity**<br>It is assumed that no increase in consented volume is required for the proposed level of | Benfleet WwTW discharges into the Benfleet approximately 3.5 km upstream of Management Unit 6 of Benfleet & Southend Marshes SSSI/SPA/Ramsar site. Increased discharges from the WwTW therefore have the potential to impact on this site, although modelling shows that it is theoretically possible to increase discharge quality to ensure there is no change to the load of pollutants discharged. No impact on the designated site is therefore anticipated.<br><br>No increased discharges from Southend WwTW should result from the proposed development, as there is no capacity within the works or network to accept additional flows. There will therefore be no impact on designated sites. | Crouch. | Borough. These should be sized according to the proposed development and a drainage strategy will be required for all proposed developments. | WwTW, upgrades to he existing network may be needed. Connection to Southend WwTW would not be possible.<br><br>Attenuation SuDS would be required to ensure no increase in run off rates from the developed site. |

| Proposed Growth Location | Water resources | Wastewater treatment and transmission | Ecology | Flood risk management | Surface water management and SuDS potential | Additional infrastructure required |
|---|---|---|---|---|---|---|
| | | growth. | | | | |
| Hadleigh | ESW has predicted that the implementation of the Abberton scheme will provide the additional water resources required for growth within the Essex Resource Zone, and hence also the study area, until 2031. | **Wastewater treatment**<br>Hadleigh drains to Southend WwTW. There is no capacity at Southend WwTW and in order to treat additional flows, expansion of the works would be required, however, the works is a very constrained site, with no room to expand the treatment process.<br>**Environmental capacity**<br>There is environmental capacity to accept additional treated wastewater discharges from Southend works, although as an upgrade to the works is not possible this would not be relevant.<br>**Wastewater transmission**<br>There are critical flooding problems within the network, which is operating at, or even above, capacity. In order to treat additional flows, expansion of the works would be required, however, the works is a very constrained site, with no room to expand the treatment process. | The Appropriate Assessment of the Abberton scheme concluded that there would be no significant effects, therefore the increased water demand would not impact on designated sites.<br>No increased discharges from Southend WwTW should result from the proposed development, as there is no capacity within the works or network to accept additional flows. There will therefore be no impact on designated sites. | Hadleigh lies almost entirely within Flood Zone 1, with very a small area of FZ2 and 3 associated with Prittlewell Brook. Development should be steered away from this area. | Due to largely impermeable soils and geology across the Borough the use of infiltration systems is not appropriate and attenuation SuDS should be used in development sites across the Borough. These should be sized according to the proposed development and a drainage strategy will be required for all proposed developments. | Connection from existing main to new development area, to be funded by developer, will be required. Connection to Southend WwTW would not be possible.<br>Attenuation SuDS would be required to ensure no increase in run off rates from the developed site. |

## 7.4 Rochford District

| Proposed Growth Location | Water resources | Wastewater treatment and transmission | Ecology | Flood risk management | Surface water management and SuDS potential | Additional infrastructure required |
|---|---|---|---|---|---|---|
| North of London Road, Rayleigh | ESW has predicted that the implementation of the Abberton scheme will provide the additional water resources required for growth within the Essex Resource Zone, and hence also the study area, until 2031. | **Wastewater treatment**<br>There is sufficient volumetric capacity at Rayleigh West WwTW for the proposed growth.<br>**Environmental capacity**<br>No increased in consented discharge volume is required for the proposed level of growth.<br>**Wastewater transmission**<br>The sewer network is combined. Although there are no DG5 flood events recorded, it is probable that the sewer infrastructure will not need upgrading. | The Appropriate Assessment of the Abberton scheme concluded that there would be no significant effects, therefore the increased water demand would not impact on designated sites.<br>There will be no increased discharges from Rayleigh West WwTW from the proposed development and there will therefore be no impact on designated sites. | Rayleigh lies almost entirely within Flood Zone 1, with areas of FZ2 and 3 associated with the river Roach. Development should be steered away from this area. | Due to largely impermeable soils and geology across the Borough the use of infiltration systems is not appropriate and attenuation SuDS should be used in development sites across the Borough. These should be sized according to the proposed development and a drainage strategy will be required for all proposed developments. | Attenuation SuDS would be required to ensure no increase in run off rates from the developed site. |
| West Rochford | ESW has predicted that the implementation of the Abberton scheme will provide the additional water resources required for growth within the Essex Resource Zone, and hence also the study area, until 2031. | **Wastewater treatment**<br>This site drains to Rochford WwTW via a pumped main sewer. There is sufficient volumetric capacity at Rochford WwTW for the proposed growth.<br>**Environmental capacity**<br>No increased in consented discharge volume is required for the proposed level of growth.<br>**Wastewater transmission**<br>The network will need modelling due to adjacent developments in the same catchment and the downstream transfer pumping station is likely to already be at capacity due to the number of sewer discharge/flood events in close proximity. | The Appropriate Assessment of the Abberton scheme concluded that there would be no significant effects, therefore the increased water demand would not impact on designated sites.<br>There will be no increased discharges from Rochford WwTW from the proposed development and there will therefore be no impact on designated sites. | Rayleigh lies almost entirely within Flood Zone 1, although there are areas of FZ2 and 3 associated with the river Roach to the west of the town, west of the railway line. Development should be steered away from this area. | Due to largely impermeable soils and geology across the Borough the use of infiltration systems is not appropriate and attenuation SuDS should be used in development sites across the Borough. These should be sized according to the proposed development and a drainage strategy will be required for all proposed developments. | Connection from existing main to new development area, to be funded by developer, will be required and upgrades to existing network may be needed.<br>Attenuation SuDS would be required to ensure no increase in run off rates from the developed site. |
| West Hockley | ESW has predicted that the implementation of the Abberton scheme will provide the additional water resources required for growth within the Essex Resource Zone, and hence also the study area, until 2031. | **Wastewater treatment**<br>This site drains to Rochford WwTW via a pumped main sewer. There is sufficient volumetric capacity at Rochford WwTW for the proposed growth.<br>**Environmental capacity**<br>No increased in consented discharge volume is required for the proposed level of growth.<br>**Wastewater transmission**<br>The proposed number of houses likely to be accommodate in existing network with little or no upgrade. | The Appropriate Assessment of the Abberton scheme concluded that there would be no significant effects, therefore the increased water demand would not impact on designated sites.<br>There will be no increased discharges from Rochford WwTW from the proposed development and there will therefore be no impact on designated sites. | The only areas of Hockley that are not in Flood Zone 1 lie to the east of the town; development in West Hockley would therefore all be located within Flood Zone 1. | Due to largely impermeable soils and geology across the Borough the use of infiltration systems is not appropriate and attenuation SuDS should be used in development sites across the Borough. These should be sized according to the proposed development and a drainage strategy will be required for all proposed developments. | Attenuation SuDS would be required to ensure no increase in run off rates from the developed site. |

| Proposed Growth Location | Water resources | Wastewater treatment and transmission | Ecology | Flood risk management | Surface water management and SuDS potential | Additional infrastructure required |
|---|---|---|---|---|---|---|
| South Hawkwell | ESW has predicted that the implementation of the Abberton scheme will provide the additional water resources required for growth within the Essex Resource Zone, and hence also the study area, until 2031. | **Wastewater treatment**<br>There is sufficient volumetric capacity at Rochford WwTW for the proposed growth.<br>**Environmental capacity**<br>No increased in consented discharge volume is required for the proposed level of growth.<br>**Wastewater transmission**<br>This site drains to Rochford WwTW via a combined and pumped network. There are numerous DG5 sewer flooding events on downstream network within Rochford, which could be exacerbated by the proposed growth. The network should be modelled to assess capacity. | The Appropriate Assessment of the Abberton scheme concluded that there would be no significant effects, therefore the increased water demand would not impact on designated sites.<br>There will be no increased discharges from Rochford WwTW from the proposed development and there will therefore be no impact on designated sites. | The majority of South Hawkwell lies within Flood Zone 1, with the exception of small areas to he south of the village. Development in South Hawkwell would therefore all be located within Flood Zone 1. | Due to largely impermeable soils and geology across the Borough the use of infiltration systems is not appropriate and attenuation SuDS should be used in development sites across the Borough. These should be sized according to the proposed development and a drainage strategy will be required for all proposed developments. | Connection from existing main to new development area, to be funded by developer, will be required and upgrades to existing network may be needed.<br>Attenuation SuDS would be required to ensure no increase in run off rates from the developed site. |
| East Ashingdon | ESW has predicted that the implementation of the Abberton scheme will provide the additional water resources required for growth within the Essex Resource Zone, and hence also the study area, until 2031. | **Wastewater treatment**<br>There is sufficient volumetric capacity at Rochford WwTW for the proposed growth.<br>**Environmental capacity**<br>No increased in consented discharge volume is required for the proposed level of growth.<br>**Wastewater transmission**<br>This site drains to Rochford WwTW via a combined and pumped network. There are numerous DG5 sewer flooding events on downstream network within Rochford, which could be exacerbated by the proposed growth. The network should be modelled to assess capacity. | The Appropriate Assessment of the Abberton scheme concluded that there would be no significant effects, therefore the increased water demand would not impact on designated sites.<br>There will be no increased discharges from Rochford WwTW from the proposed development and there will therefore be no impact on designated sites. | The area to the east of Ashingdon lies within Flood Zone 1, although there is an extensive area of Flood Zone 3 to the north east; development should be steered away from this area. | Due to largely impermeable soils and geology across the Borough the use of infiltration systems is not appropriate and attenuation SuDS should be used in development sites across the Borough. These should be sized according to the proposed development and a drainage strategy will be required for all proposed developments. | Connection from existing main to new development area, to be funded by developer, will be required and upgrades to existing network may be needed.<br>Attenuation SuDS would be required to ensure no increase in run off rates from the developed site. |
| South East Ashingdon | ESW has predicted that the implementation of the Abberton scheme will provide the additional water resources required for growth within the Essex Resource Zone, and hence also the study area, until 2031. | **Wastewater treatment**<br>There is sufficient volumetric capacity at Rochford WwTW for the proposed growth.<br>**Environmental capacity**<br>No increased in consented discharge volume is required for the proposed level of growth.<br>**Wastewater transmission**<br>This site drains to Rochford WwTW via a combined and pumped network. There are numerous DG5 sewer flooding events on downstream network within Rochford, which could be exacerbated by the proposed growth. The network should be modelled to assess capacity. | The Appropriate Assessment of the Abberton scheme concluded that there would be no significant effects, therefore the increased water demand would not impact on designated sites.<br>There will be no increased discharges from Rochford WwTW from the proposed development and there will therefore be no impact on designated sites. | South East Ashingdon lies within Flood Zone 1. | Due to largely impermeable soils and geology across the Borough the use of infiltration systems is not appropriate and attenuation SuDS should be used in development sites across the Borough. These should be sized according to the proposed development and a drainage strategy will be required for all proposed developments. | Connection from existing main to new development area, to be funded by developer, will be required and upgrades to existing network may be needed.<br>Attenuation SuDS would be required to ensure no increase in run off rates from the developed site. |

| Proposed Growth Location | Water resources | Wastewater treatment and transmission | Ecology | Flood risk management | Surface water management and SuDS potential | Additional infrastructure required |
|---|---|---|---|---|---|---|
| South Canewdon | ESW has predicted that the implementation of the Abberton scheme will provide the additional water resources required for growth within the Essex Resource Zone, and hence also the study area, until 2031. | **Wastewater treatment**<br>There is sufficient volumetric capacity at Rochford WwTW for the proposed growth.<br>**Environmental capacity**<br>No increased in consented discharge volume is required for the proposed level of growth.<br>**Wastewater transmission**<br>This site drains to Rochford WwTW via a small combined foul and surface water network; the downstream sewers are likely to need upgrade. | The Appropriate Assessment of the Abberton scheme concluded that there would be no significant effects, therefore the increased water demand would not impact on designated sites.<br>There will be no increased discharges from Rochford WwTW from the proposed development and there will therefore be no impact on designated sites. | South Canewdon lies within Flood Zone 1. | Due to largely impermeable soils and geology across the Borough the use of infiltration systems is not appropriate and attenuation SuDS should be used in development sites across the Borough. These should be sized according to the proposed development and a drainage strategy will be required for all proposed developments. | Connection from existing main to new development area, to be funded by developer, will be required and upgrades to existing network may be needed.<br>Attenuation SuDS would be required to ensure no increase in run off rates from the developed site. |
| South West Hullbridge | ESW has predicted that the implementation of the Abberton scheme will provide the additional water resources required for growth within the Essex Resource Zone, and hence also the study area, until 2031. | **Wastewater treatment**<br>There is sufficient volumetric capacity at Rayleigh West WwTW for the proposed growth.<br>**Environmental capacity**<br>No increased in consented discharge volume is required for the proposed level of growth.<br>**Wastewater transmission**<br>This site drains to Rayleigh West WwTW via a combined sewer network. Due to the large proportional increase in flow through the sewer network it is likely to require an upgrade. | The Appropriate Assessment of the Abberton scheme concluded that there would be no significant effects, therefore the increased water demand would not impact on designated sites.<br>There will be no increased discharges from Rayleigh West WwTW from the proposed development and there will therefore be no impact on designated sites. | Hullbridge lies almost entirely within Flood Zone 1, although there are areas of FZ2 and 3 associated with the river Crouch to the north of the town. However, development to the south west of the village would be located within Flood Zone 1. | Due to largely impermeable soils and geology across the Borough the use of infiltration systems is not appropriate and attenuation SuDS should be used in development sites across the Borough. These should be sized according to the proposed development and a drainage strategy will be required for all proposed developments. | Connection from existing main to new development area, to be funded by developer, will be required and upgrades to existing network may be needed.<br>Attenuation SuDS would be required to ensure no increase in run off rates from the developed site. |
| West Great Wakering | ESW has predicted that the implementation of the Abberton scheme will provide the additional water resources required for growth within the Essex Resource Zone, and hence also the study area, until 2031. | **Wastewater treatment**<br>A revised DWF consent has been issued for Southend WwTW, which is therefore deemed to have no capacity and would require expansion to accept and treat additional flows. However, the works is a very constrained site, with no room to expand the treatment process.<br>**Environmental capacity**<br>There is environmental capacity to accept additional treated wastewater discharges from Southend works, although as an upgrade to the works is not possible this would not be relevant.<br>**Wastewater transmission**<br>There are critical flooding problems within the network, which is operating at, or even above, capacity. In order to treat additional flows, expansion of the works would be required, however, the works is a very constrained site, with no room to expand the treatment process. | The Appropriate Assessment of the Abberton scheme concluded that there would be no significant effects, therefore the increased water demand would not impact on designated sites.<br>No increased discharges from Southend WwTW should result from the proposed development, as there is no capacity within the works or network to accept additional flows. There will therefore be no impact on designated sites. | Great Wakering lies mainly within Flood Zone 1, although there are extensive areas of FZ2 and 3 associated to the north, east and south of the town. However, development to the south west of the village would be located within Flood Zone 1. | Due to largely impermeable soils and geology across the Borough the use of infiltration systems is not appropriate and attenuation SuDS should be used in development sites across the Borough. These should be sized according to the proposed development and a drainage strategy will be required for all proposed developments. | Connection from existing main to new development area, to be funded by developer, will be required. Connection to Southend WwTW would not be possible.<br>Attenuation SuDS would be required to ensure no increase in run off rates from the developed site. |

| Proposed Growth Location | Water resources | Wastewater treatment and transmission | Ecology | Flood risk management | Surface water management and SuDS potential | Additional infrastructure required |
|---|---|---|---|---|---|---|
| Stambridge Mills, Rochford | ESW has predicted that the implementation of the Abberton scheme will provide the additional water resources required for growth within the Essex Resource Zone, and hence also the study area, until 2031. | **Wastewater treatment**<br>There is sufficient volumetric capacity at Rochford WwTW for the proposed growth.<br>**Environmental capacity**<br>No increased in consented discharge volume is required for the proposed level of growth.<br>**Wastewater transmission**<br>It is likely that the pumping stations and already operating at capacity and may therefore require an upgrade to accommodate new flows. | The Appropriate Assessment of the Abberton scheme concluded that there would be no significant effects; therefore the increased water demand would not impact on designated sites.<br>There will be no increased discharges from Rochford WwTW from the proposed development and there will therefore be no impact on designated sites. | The Stambridge Mills site lies within Flood Zones 2 and 3 and therefore may not be suitable for residential development under the requirement of PPS25. A Flood Risk Assessment should be carried out to establish the exact boundary of the Flood Zone and therefore whether the development would be appropriate. | Due to largely impermeable soils and geology across the Borough the use of infiltration systems is not appropriate and attenuation SuDS should be used in development sites across the Borough. These should be sized according to the proposed development and a drainage strategy will be required for all proposed developments. | Connection from existing main to new development area, to be funded by developer, will be required and upgrades to existing network may be needed.<br>Attenuation SuDS would be required to ensure no increase in run off rates from the developed site. |
| Rawreth Industrial Estate | ESW has predicted that the implementation of the Abberton scheme will provide the additional water resources required for growth within the Essex Resource Zone, and hence also the study area, until 2031. | **Wastewater treatment**<br>There is sufficient volumetric capacity at Rayleigh West WwTW for the proposed growth.<br>**Environmental capacity**<br>No increased in consented discharge volume is required for the proposed level of growth.<br>**Wastewater transmission**<br>There are several sewer discharge and DG5 flooding events recorded within the network and modelling will be required for the development proposal. | The Appropriate Assessment of the Abberton scheme concluded that there would be no significant effects, therefore the increased water demand would not impact on designated sites.<br>There will be no increased discharges from Rayleigh West WwTW from the proposed development and there will therefore be no impact on designated sites. | Rawreth Industrial Estate is located within Flood Zone 1, although there is an area of Flood Zone 2 to the south of the industrial estate. Development should be steered away from Flood Zone 2 where possible. | Due to largely impermeable soils and geology across the Borough the use of infiltration systems is not appropriate and attenuation SuDS should be used in development sites across the Borough. These should be sized according to the proposed development and a drainage strategy will be required for all proposed developments. | Connection from existing main to new development area, to be funded by developer, will be required and upgrades to existing network may be needed.<br>Attenuation SuDS would be required to ensure no increase in run off rates from the developed site. |
| Star Lane, Great Wakering | ESW has predicted that the implementation of the Abberton scheme will provide the additional water resources required for growth within the Essex Resource Zone, and hence also the study area, until 2031. | **Wastewater treatment**<br>A revised DWF consent has been issued for Southend WwTW, which is therefore deemed to have no capacity and would require expansion to accept and treat additional flows. However, the works is a very constrained site, with no room to expand the treatment process.<br>**Environmental capacity**<br>There is environmental capacity to accept additional treated wastewater discharges from Southend works, although as an upgrade to the works is not possible this would not be relevant.<br>**Wastewater transmission**<br>There are critical flooding problems within the network, which is operating at, or even above, capacity. In order to treat additional flows, expansion of the works would be required; however, the works is a very constrained site, with no room to expand the treatment process. | The Appropriate Assessment of the Abberton scheme concluded that there would be no significant effects, therefore the increased water demand would not impact on designated sites.<br>No increased discharges from Southend WwTW should result from the proposed development, as there is no capacity within the works or network to accept additional flows. There will therefore be no impact on designated sites. | Star Lane lies within Flood Zone 1. | Due to largely impermeable soils and geology across the Borough the use of infiltration systems is not appropriate and attenuation SuDS should be used in development sites across the Borough. These should be sized according to the proposed development and a drainage strategy will be required for all proposed developments. | Connection from existing main to new development area, to be funded by developer, will be required. Connection to Southend WwTW would not be possible.<br>Attenuation SuDS would be required to ensure no increase in run off rates from the developed site. |

| Proposed Growth Location | Water resources | Wastewater treatment and transmission | Ecology | Flood risk management | Surface water management and SuDS potential | Additional infrastructure required |
|---|---|---|---|---|---|---|
| Hockley Centre | ESW has predicted that the implementation of the Abberton scheme will provide the additional water resources required for growth within the Essex Resource Zone, and hence also the study area, until 2031. | **Wastewater treatment**<br>There is sufficient volumetric capacity at Rochford WwTW for the proposed growth.<br>**Environmental capacity**<br>No increased in consented discharge volume is required for the proposed level of growth.<br>**Wastewater transmission**<br>There are several sewer discharge and DG5 flooding events recorded within the network and modelling will be required for the development proposal. | The Appropriate Assessment of the Abberton scheme concluded that there would be no significant effects, therefore the increased water demand would not impact on designated sites.<br>There will be no increased discharges from Rochford WwTW from the proposed development and there will therefore be no impact on designated sites. | Hockley Centre lies within Flood Zone 1. | Due to largely impermeable soils and geology across the Borough the use of infiltration systems is not appropriate and attenuation SuDS should be used in development sites across the Borough. These should be sized according to the proposed development and a drainage strategy will be required for all proposed developments. | Connection from existing main to new development area, to be funded by developer, will be required and upgrades to existing network may be needed.<br>Attenuation SuDS would be required to ensure no increase in run off rates from the developed site. |

# 8 Infrastructure Funding Options

It is important that the Outline WCS considers mechanisms for obtaining and securing funding toward water infrastructure that the developers can contribute to. The following sections describe possible options in relation to limitations placed on developer contribution to water services under the Water Resources Act 1991, which the Councils should consider. The WCS has highlighted that there is a need for expenditure on new infrastructure in the following areas:

- water supply and water resources;
- wastewater treatment and sewerage; and
- flood risk management (surface water attenuation).

Water supply (treatment) is the responsibility of ESW and wastewater treatment is the responsibility of AWS within the South Essex WCS area. At present, the Water Industry Act 1991, and agreements between Ofwat and water companies prevent developers contributing towards the provision of water resource schemes, water treatment and wastewater treatment facilities. These elements of the WCS will be funded by customer charges which are set by Ofwat over the 5 year AMP periods through the Periodic Review process (PR process). Customer charges are set across a companies supply area and the same charges apply for all customers equally (i.e. customers in one area will not pay more than in another area even if costs for new infrastructure to service that area are higher).

Despite this, there are mechanisms that would allow developer contributions to be made towards the funding of water supply and wastewater networks or mains infrastructure on a scale commensurate with the number of houses proposed by each developer. If investment is required to local water or wastewater networks, Ofwat takes the view that water and wastewater companies should seek to finance this work through contributions from developers. This reduces the financing burden on existing customers, who would otherwise have to pay through increases in general charges. Developer contributions can be sought for this infrastructure and the options for it are detailed below.

In addition, flood risk infrastructure required to service a development can be entirely funded from developer contributions. Although the level of this study has meant that it has not been appropriate to identify specific flood risk infrastructure such as flood defences, it has highlighted that the provision of SuDS and surface water attenuation will be required for development areas to minimise flood risk elsewhere and comply with PPS25. Developer contributions can be sought for this infrastructure and the options for it are detailed below.

## 8.1 Suggested Developer Contribution Options

### 8.1.1 s106 Contributions

Under Section 106 of the Town and Country Planning Act 1990, developer contributions, also known as planning obligations, may be sought when planning conditions are inappropriate to enhance the quality of development and to enable proposals that might otherwise have been refused to go ahead in a sustainable manner.

Developer contributions are intended to ensure that developers make appropriate provision for any losses or supply additional facilities and services that are required to mitigate the impact of a development. For example affordable housing, school places, roads, pedestrian crossings and other transport facilities, open spaces or equipped playgrounds or new long term

maintenance of open space, travel plans, residents parking schemes, public art, libraries and other community buildings.

Government Circular 05/2005 includes a necessity test that ensures that all developer contributions are directly linked to a specific impact of the development and that the funds acquired are to be used for that purpose. The circular states that the obligations will be:

- necessary;
- relevant to planning;
- directly related to the proposed development;
- fairly and reasonably related in scale and kind to the proposed development; and
- reasonable in all other respects.

Planning permission cannot be granted without a completed agreement in place. Developer contributions may be used to:

- restrict development or use of the land in a specified way;
- require specified operations or activities to be carried out on the land;
- require land to be used in any specified way; and
- require a sum or sums to be paid to the authority on a specified date or dates.

s106 agreements are very frequently used in the strategic planning process for provision of key infrastructure requirements. However, in general the charge levied is required to be commensurate with the developer's impact.

Therefore, In the case of wastewater network, water supply network and surface water attenuation provision, a single s106 levy cannot be applied to all new development and a cost apportionment mechanism would have to be derived dependent on the level of impact each development is likely to have and this is not always a straightforward process.

### 8.1.2 Community Infrastructure Levy

The Community Infrastructure Levy (CIL) regulations came into force on 6 April 2010 and give local councils the power to apply a levy on new developments to support infrastructure delivery within their authority[119]. The money can be used to support development by funding infrastructure that the council, local community and neighbourhoods want. Authorities that wish to charge a CIL need to develop and adopt a CIL charging schedule.

In implementing a CIL, the Councils will need to ensure that the processes for infrastructure planning (e.g. through the Infrastructure Delivery Plan (IDP)) and development of the CIL charging schedule are fully integrated, involving the full range of partners, including the local strategic partnership, and with clear governance arrangements. The output should be a rolling delivery programme which will provide the basis for the CIL schedule and for review and monitoring of infrastructure delivery.

An example of the successful use of a CIL is the Milton Keynes Infrastructure Tariff Scheme, which means that for every property built within the defined Urban Development Area (UDA), the developer will pay £18,500 to Milton Keynes Partnership for each new house or around £260,000 per hectare of employment space. All told, developers will provide over £310 million

[119] Planning Advisory Service, Community Infrastructure Levy, http://www.pas.gov.uk/pas/core/page.do?pageId=122677

which will be used to help fund community facilities and infrastructure. By topping up this funding with money from Central Government, Milton Keynes Partnership and its delivery partners can ensure that new communities will have the infrastructure they need.

The overarching legal agreement which sets out the facilities required and how they will be provided is the Framework Section 106 Agreement. Each development in the UDA will be linked to this agreement.

### 8.1.3 Tariff System

Similar to a s106 agreement and used successfully by the Milton Keynes Partnership and Sedgemoor District Council, a tariff system charges a single per dwelling fee to a developer to contribute towards the strategic infrastructure required to service it. Generally, this does not include for water infrastructure but several WCSs are considering this as a potential option for providing a pot of funds to pay for strategic flood risk management infrastructure such as strategic SuDS and greywater recycling systems on a community level.

### 8.1.4 Planning Gain Supplement

A Planning Gain Supplement (PGS) takes advantage of the increase in land value that accrues when planning permission is granted for development by applying a tax to that increase in value. The revenue generated from the tax can then be used as pot to fund infrastructure requirements.

### 8.1.5 Unilateral Undertaking

A Unilateral Undertaking is an offer of specific undertaking from a developer. It is usually considered to be quicker, less costly and advantageous to the applicant/owner, as the council does not need to be a party to such a deed. It is preferable to use this rather than s106 when:

- there is a straightforward contribution required;
- there is no requirement for the Council to covenant to do something;
- no payback requirement is necessary; or
- no affordable housing is required;

This system could work well for providing developer sums towards strategic wastewater and water supply network infrastructure as the Councils do not necessarily need to covenant to provide the funding mechanism for water company infrastructure.

## 8.2 Proposed Funding Process

s106 or tariff systems are likely to be the best mechanism for providing funding to pay for strategic level flood risk management infrastructure such as SuDS. However, for funding the strategic wastewater mains, the situation is not so straightforward.

Under the Water Industry Act 1991, an infrastructure charge may be levied on new and existing property connected to the public sewerage system for the first time. In cases where this is required in the South Essex area, this charge will be applied directly by AWS for new development that does not need new offsite infrastructure.

However, if the existing network infrastructure (water supply or wastewater) is not adjacent to a proposed site, the developer will be required to fund or at least contribute to this infrastructure through the requisition process under the Water Industry Act. The formal requisition procedures

as set out in the Act (sections 41 and 98) a legal mechanism for developers to provide the necessary infrastructure to service their site.

## 8.3 Further Cost Considerations

### 8.3.1 Minimisation of Cost

Even where direct funding of infrastructure is not an option, developers can at least contribute to minimising the capital cost of water infrastructure and policy can be developed to ensure that this be achieved.

It can be seen from this WCS that a key variable to provision of water services infrastructure is water consumption. To a large extent, developers can be encouraged to reduce this through initiatives such as grey water recycling, having developments with less impermeable surfaces, specifying higher quality materials for pipework etc. By way of example, if the percentage return to sewer can be reduced from 90% to 75%, the number of additional properties that can be accommodated per 1 $m^3$/d headroom at an existing sewage treatment works is 0.8. If reducing the infiltration of ground water into drains supports the reduction in percentage return to drain by using higher quality drain pipes, the number of additional properties that can be supported per 1 $m^3$/d headroom at the same WwTW can be further increased.

### 8.3.2 Water Resource Provision - Employment

Since December 2005, non-household customers who are likely to be supplied with at least 50 mega litres of water per year at their premises are now able to benefit from a new Water Supply Licensing mechanism. If eligible, they may be able to choose their water supplier from a range of new companies entering the market. The Water Supply Licensing mechanism enables new companies to supply water once Ofwat has granted them a licence. These companies can compete in two ways:

- by developing their own water source and using the supply systems of appointed water companies (such as AWS) to supply water to customers' premises. This would be carried out under the combined water supply licence; or
- by buying water 'wholesale' from appointed water companies (such as AWS) and selling it on to customers. This would be done under a retail water supply licence.

# 9 Outline Policy Guidance

## 9.1 Introduction

The following policy recommendations are made to ensure that the three authorities consider potential limitations (and opportunities) presented by the water environment and water infrastructure on growth, and phasing of growth. The policy is also recommended as a starting point to the replacement of the regional WAT (water based) policies of the revoked RSS.

## 9.2 Policy Guidance

### 9.2.1 General

**Policy Recommendation 1: Development Phasing**

New homes should not be built until agreement has been reached with the water and wastewater provider that sufficient capacity in existing or future water services infrastructure is available in accordance with the South Essex Outline WCS 2011.

*Reason: The WCS has demonstrated some capacity within existing infrastructure; however this capacity is limited and upgrades (or new) infrastructure is required in some places to deliver full housing requirements up to 2031. Development must not be permitted to develop until the water services infrastructure is in place to service it, otherwise it is at risk of contravening its legal consents which protect the water environment from otherwise adverse effects. .*

### 9.2.2 Wastewater treatment

**Policy Recommendation 2: Strategic Wastewater Treatment**

Recognition is made that the provision of upgrades to wastewater treatment facilities at the following WwTWs in each district/ borough is required in order for demands of future growth to be met. Increased DWF consents, and possibly expansion of the following works will be required:

- Basildon*;
- Pitsea*;
- Billericay*;
- Wickford*; and
- Southend-on-Sea.

**Dependent on level of proposed growth, these WwTW may have capacity. Further modelling will be required through a Detailed WCS.*

*Reason: The WCS has demonstrated that some of the WwTW will need increases to consented DWF (with the possibility of the requirement for the addition of process streams or expansion the capacity of processes in order to treat the additional flow or to higher standards to meet current and future water legislation, namely WFD and HD standards). LDFs need to ensure that the expansion of WwTW sites, where required, is fully supported by safeguarding land.*

**Policy Recommendation 3: Southend-on-Sea WwTW and network**

No development should be permitted in areas which drain to Southend-on-Sea WwTW without the developer ensuring that as a minimum a commensurate volume of surface water flow is removed from the flow to Southend-on-Sea WwTW.

*Reason: Southend-on-Sea suffers from capacity issues at both the WwTW and in the sewer network. Any future development must not exacerbate this problem and should, where possible, seek to improve the current situation by reducing flows to the network*

### 9.2.3 Water Resources & Supply

**Policy Recommendation 4: Water demand management**

New development should aim to achieve the water use target under Code Levels 3 & 4 of the Code for Sustainable Homes, and where possible reduce domestic daily consumption even further from 2021-2031 to achieve the Environment Agency target for water neutrality of 95 litres per head per day.

*Reason: The WCS has highlighted that while sufficient potable water will be available once the Abberton scheme is in place, there is a deficit until this point. In addition, the area is reliant on transfers from outside the region, which is unsustainable in the long-term. Water use should therefore be minimised where possible and all new development must be as water efficient as possible.*

### 9.2.4 Flood risk and drainage

**Policy Recommendation 5: Site drainage**

All new development, including that on brownfield development, should be served by separate surface water and wastewater drainage. No new development will be permitted to discharge runoff to foul drainage connections. An assessment carried out on all receiving watercourses to ensure adequate capacity is available.

*Reason: The WCS has highlighted that sewer flooding and Combined Sewer Overflows are an existing concern in several growth areas in all districts/ Boroughs and that with climate change, capacity will be limited. Therefore further discharges of surface water to foul or combined drainage should not be permitted to prevent exacerbation of existing problems. Wherever possible, improvement should be sought to the existing system.*

**Policy Recommendation 6: Strategic Flood Risk Assessments**

All new development should adhere to the recommendations of the relevant Strategic Flood Risk Assessment for the District/Borough.

*Reason: To ensure a coordinated approach to flood risk management across the WCS area, in accordance with the requirements of PPS25.*

**Policy Recommendation 7: Surface Water Management Plans**

All new development should adhere to the recommendations of the relevant Surface Water Management Plan for the District/Borough.

*Reason: To ensure a coordinated approach to surface water flood risk management across the WCS area, in accordance with the Flood and Water Management Act.*

# 10 Developer Checklist

The overall intention is that all developers would be asked to use the water cycle Developer Checklist as part of the planning application process and to submit a completed version with their planning applications. The Environment Agency is a statutory consultee with regards to flood risk and the water environment and as such it will need to sign up to the checklist, as will BBC, CPDC and RBC, Natural England and the local water undertakers AWS and ESW. The checklist provided in this WCS has been developed from examples used in previous WCS as well as the Environment Agency's national standard checklist available on their website. The checklist refers to different levels of policy to make it clearer to the developer as to which are driven by mandatory national policy, which are driven by Environment Agency requirements and which are driven by local policy.

This checklist has been provided as a 'working document' which should be revised in the Detailed WCS (if carried out), once more is known about the development scenarios and housing numbers to be taken forward for detailed assessment. More relevant site specific details can then be included to make it a document which can be used as part of the planning process for developers.

**Key**

Water Cycle Strategy Recommended Policy
Environment Agency and Natural England policy and recommendations
National Policy or Legislation

| | Flood Risk Assessment requirement checklist | | Policy or Legislation |
|---|---|---|---|
| 1 | Is the Development within Flood Zones 2 or 3 as defined by the flood zone mapping in the relevant SFRA? | Y - go to 5<br>N - go to 2 | PPS25 |
| 2 | Development is within Flood Zone 1:<br>• Site larger than 1 Ha?<br>• Site smaller than 1 Ha? | <br>go to 5<br>go to 3 | |
| 3 | Is the development residential with 10 or more dwellings or is the site between 0.5Ha and 1Ha? | Y - go to 6<br>N - go to 4 | |
| 4 | Is the development non-residential where new floorspace is 1,000m$^2$ or the site is 1 Ha or more | Y - go to 6<br>N - go to 7 | |
| 5 | The development constitutes major development and requires a Flood Risk Assessment (in accordance with PPS25 and the relevant SFRA) and the Environment Agency are required to be consulted. | Go to 8 | |
| 6 | The development constitutes major development and is likely to require a Flood Risk Assessment (in accordance with PPS25 and the relevant SFRA) but the Environment Agency may not be required to be consulted. | Go to 8 | |
| 7 | An FRA is unlikely to be required for this development, although a check should be made against the SFRA and the LPA to ensure that there is no requirement for a FRA on the grounds of critical drainage issues identified in the SWMP. Does the SFRA or does the LPA consider a Flood Risk Assessment (FRA) is required? | Y – go to 8<br>N – go to 9 | |
| 8 | Has an FRA been produced in accordance with PPS25 and the relevant SFRA? | Y/N or N/A | |
| | **Surface water runoff** | | |
| 9 | A) What was the previous use of the site?<br><br>B) What was the extent of impermeable areas both before and | <br><br>% before | EA requirement for FRA. |

| | | | |
|---|---|---|---|
| | after development? | % after | |
| 10 | If development is on a greenfield site, have you provided evidence that post development run-off will not be increased above the greenfield runoff rates and volumes using SuDS attenuation features where feasible (see also 18 onwards).<br><br>If development is on a brownfield site, have you provided evidence that the post development run-off rate has not been increased, and as far as practical, will be decreased below existing site runoff rates using SuDS attenuation features where feasible (see also 17 onwards). | Y/N or N/A<br><br>Y/N or N/A | PPS25 |
| 11 | Is the discharged water only surface water (e.g. not foul or from highways)?<br><br>If no, has a discharge consent been applied for? | Y/N<br><br>Y/N | Water Resources Act 1991 |
| 12 | A) Does your site increase run-off to other sites?<br><br>B) Which method to calculate run-off have you used? | Y/N | PPS 25 |
| 12 | Have you confirmed that any surface water storage measures are designed for varying rainfall events, up to and including, a 1 in 100 year + climate change event (see PPS25 Annex B, table B.2)? | Y/N | PPS25 |
| 13 | For rainfall events greater than the 1 in 100 year + climate change, have you considered the layout of the development to ensure that there are suitable routes for conveyance of surface flows that exceed the drainage design? | Y/N | PPS25 Guidance Notes |
| 14 | Have you provided layout plans, cross section details and long section drawings of attenuation measures, where applicable? | Y/N | |
| 15 | If you are proposing to work within 8 m of a watercourse have you applied, and received Flood Defence Consent from the Environment Agency? | Y/N or N/A | Water Resources Act 1991 Land Drainage Act 1991 |
| 16 | The number of outfalls from the site should be minimised. Any new or replacement outfall designs should adhere to standard guidance form SD13, available from the local area Environment Agency office. Has the guidance been followed? | Y/N | Guidance Driven by the Water Resources Act 1991 |
| | **Sustainable Drainage Systems (SuDS)** | | |
| 17 | A) Has the SuDS hierarchy been considered during the design of the attenuation and site drainage? Provide evidence for reasons why SuDS near the top of the hierarchy have been disregarded.<br><br>B) Have you provided detail of any SuDS proposed with supporting information, for example, calculations for sizing of features, ground investigation results and soakage tests? See CIRIA guidance for more information.<br><br>http://www.ciria.org.uk/suds/697.htm | Y/N | PPS25 Guidance |
| 18 | A) Are Infiltration SuDS to be promoted as part of the development? If Yes, the base of the system should be set at least 1m above the groundwater level and the depth of the unsaturated soil zones between the base of the SuDS and the groundwater should be maximised.<br><br>B) If Yes – has Infiltration testing been undertaken to confirm the effective drainage rate of the SuDS? | Y/N<br><br>Y/N | |

| | | | |
|---|---|---|---|
| 19 | A) Are there proposals to discharge clean roof water direct to ground (aquifer strata)?<br><br>B) If Yes, have all water down-pipes been sealed against pollutants entering the system form surface runoff or other forms of discharge? | Y/N<br><br>Y/N | |
| 20 | Is the development site above a Source Protection Zone (SPZ)? | If Y go to 22<br>If N go to 23 | Groundwater Regulations 1998 |
| 21 | A) Is the development site above an inner zone (SPZ1)?<br><br>B) If yes, discharge of Infiltration of runoff from car parks, roads and public amenity areas is likely to be restricted – has there been discussion with the Environment Agency as to suitability of proposed infiltration SuDS? | Y/N<br><br>Y/N | Groundwater Regulations 1998 |
| 22 | A) For infill development, has the previous use of the land been considered?<br><br>B) Is there the possibility of contamination?<br><br>C) If yes, infiltration SuDS may not be appropriate and remediation may be required. A groundwater Risk Assessment is likely to be required (Under PPS23) Has this been undertaken before the drainage design is considered in detail? | Y/N<br><br>Y/N<br><br>Y/N | PPS23 |
| 23 | Have oil separators been designed into the highway and car parking drainage? PPG23: http://publications.environment-agency.gov.uk/pdf/PMHO0406BIYL-e-e.pdf | Y/N | PPG23 |
| | **Water Consumption** | | |
| 26 | A) Have you provided the expected level of water consumption and hence the level to be attained in the Code for Sustainable Homes<br>B) Have you considered whether the development can achieve a water consumption lower than 120 l/h/d (105 l/h/d for Levels 3 & 4 in the Code for Sustainable Homes, or the Environment Agency target of 95l/h/d as required for Levels 5 & 6) | Y/N | Outline WCS 2011 |
| 28 | Have you Provided details of water efficiency methods to be installed in houses? | Y/N | |
| | **Pollution prevention** | | |
| 33 | Have you provided details of construction phase works method statement, outlining pollution control and waste management measures? | Y/N | PPG1, PPG2, PPG3, PPS5, PPG6, PPG21 |
| | **Water Supply and Wastewater Treatment** | | |
| 35 | Have you provided evidence to confirm that water supply capacity is available, and that demand can be met in accordance with the South Essex Outline Water Cycle Strategy? | Y/N | Outline WCS 2011 |
| 36 | Have you provided evidence to confirm that sewerage and wastewater treatment capacity is available, and that demand can be met in accordance with the South Essex Outline Water Cycle Strategy? | Y/N | |
| | **Conservation / Enhancement of Ecological Interest** | | |
| 39 | A) Have you shown the impacts your development may have on the water environment?<br><br>B) Is there the potential for beneficial impacts? | Y/N<br><br>Y/N | Town and Country Planning Regulations 1999. |

# 11 Recommendations & Phase 2 Scope

This Outline WCS has identified the key constraints to growth in Basildon Borough, Castle Point Borough and Rochford District; it has identified:

- where there are solutions to utilise existing infrastructure;
- where more detailed solutions will need to be investigated in the Detailed WCS;
- where the are potential phasing implications;
- the feasibility of achieving water neutrality and what measures might be needed; and
- the outline implications of climate change impacts and adaptation

The study has demonstrated that there are some potential limitations to achieving growth as proposed in each district, although the majority of these do not appear to absolute constraints and with further study the proposed growth may be able to proceed without an adverse effect on the water environment. Only one potentially significant limitation was identified, that is the capacity issues at Southend-on-Sea WwTW, to which some parts of the study area drain. This is the subject is a separate Detailed WCS currently underway by Scott Wilson, and reference should be made to the findings of that WCS when available (anticipated to be late 2011).

This Outline WCS has shown that while the proposed levels of growth do not exceed the limit of growth catered for in ESW's current water resource planning, targets for a reduction in water use, and a push towards water neutrality, should be promoted.

At the time of undertaking this WCS, the authorities were at different stages in the preparation of their Core Strategies and development plan documents, a situation which has been reflected in the methodologies used for this WCS and in the following recommendations are made for the Stage 2 Detailed WCS:

## 11.1 Wastewater Approach

For the areas which lie within the catchment of Southend-on-Sea WwTW, an alternative treatment option for wastewater should be investigated. This should be based on the findings of the Detailed WCS for Southend-on-Sea, which is due for completion in late 2011, although it should also consider other options. As it is known that there are significant capacity and expansion issues at Southend, it is strongly recommended that solutions other than that to be provided by the Southend WCS should be investigated. This could include, although not necessarily be limited to:

- site specific new WwTW for new development sites;
- connection to existing AWS owned WwTW in the vicinity of the proposed WwTW other than Southend, e.g. Paglesham or Rochford, and upgrades or expansion to these works that may be required; and
- separation of foul and surface water sewers, thereby removing surface water from the combined network, in areas which currently drain to Southend-on-Sea WwTW, in order to free capacity for new connections.

For Billericay WwTW, where no increase above the current consented flow can be allowed without compromising downstream water quality targets, investigation of alternative wastewater treatment options should be considered. While there is currently capacity in the WwTW's discharge consent for the level of growth proposed to 2031, additional growth beyond this date

may not be permitted. It is therefore recommended that the Detailed WCS could consider the following, amongst other options:

- transfer of existing flows from the Billericay WwTW to Shenfield and Hutton WwTW; or
- connection of new developments to Shenfield and Hutton WwTW.

Either of these two options would also require network modelling of the existing Billericay WwTW network, which should be carried out in conjunction with AWS as part of a Detailed WCS. Modelling of network capacity is required at several other key locations (once development locations are known) to determine if upgrades to sewer mains, pumping stations or new sewer provision is necessary. It is recommended that this is carried out by AWS using their existing Infoworks CS models, for the locations identified in section seven above.

For all of the suggested solution for further investigation listed above, the Detailed WCS needs to determine the impact that delivering such solutions will have on:

- phasing for key growth towns;
- sustainability in terms of energy usage; and
- deliverability of sites and infrastructure (cost and practicality).

## 11.2 Water Supply

For the South Essex area, water resource availability post-2014 is reliant on the implementation of ESW's Abberton Reservoir scheme. While this will meet the needs of the proposed growth, a more sustainable approach to water use and supply needs to be promoted and the Detailed WCS should determine the exact requirements for achieving neutrality in terms of policy, developer contributions, funding implications, community involvement and what is technically required from new development.

In addition, the Detailed WCS should investigate a phased approach to water efficiency targets, starting with the Code Levels 3 & 4 of the Code for Sustainable Homes, but continuing with a staggered solution to reduce domestic daily consumption even further from 2021-2031.

## 11.3 Flood Risk Management

More detailed SuDS requirements should be provided for preferred development sites when known, including deriving values for permitted runoff rates and options for linkage with green infrastructure. Policy recommendations need to be provided in the study to set out how sustainable drainage will be achieved by developers and how the aspiration to move to 100% separation of surface water runoff and foul water drainage can be achieved and supported.

## 11.4 Infrastructure Solutions and Phasing

A suitable sustainability assessment, incorporating carbon counting will be developed in order to produce a preferred, but sustainable overall water cycle strategy and measures to achieve water neutrality should be investigated further and costed to be considered as an option for potential solutions to wastewater treatment and provision of sustainable water supply. Infrastructure phasing timelines should be produced for each proposed development location to determine impact of infrastructure and mitigation provision on housing delivery.

# 12 Appendices

## 12.1 Appendix 1 – Further background information about international designated sites

### 12.1.1 Benfleet & Southend Marshes SPA/Ramsar site

Benfleet and Southend Marshes is located on the north bank of the Thames Estuary in Essex, and lies on the outer limits of the estuary, over 80 kilometres from the tidal limit of the River Thames at Teddington, to the west of London. It is comprised of saltmarsh, mudflats, and reclaimed freshwater grazing marshes landward of the seawall with an associated ditch system. The mudflats and saltmarsh are rich in invertebrates and form an important feeding resource for the thousands of birds which winter in the estuary.

The boundaries of the Benfleet and Southend Marshes SPA are virtually coincident with those of the Benfleet and Southend SSSI, except a small area of the SSSI around Hadleigh Marsh that is excluded from the SPA.

The site qualifies under Article 4.2 of the Birds Directive by regularly supporting in winter over 20,000 waterfowl.

The site also qualifies under Article 4.2 by supporting internationally or nationally important wintering populations of the following species of migratory waterfowl:

- Dark-bellied Brent Goose;
- Ringed Plover;
- Grey Plover;
- Knot; and
- Dunlin.

The site is designated as a Ramsar site for the same reasons that it is designated as an SPA.

### 12.1.2 Foulness SPA/Ramsar site

The site qualifies under Article 4.1 of the Birds Directive by supporting nationally important breeding populations of the following Annex 1 species: Avocet (*Recurvirostra avosetta*), Sandwich Tern (*Sterna sandvicensis*), Common Tern (*S. hirundo*) and Little Tern (*S. albifrons*).

The site also qualifies under Article 4.1 of the Birds Directive by supporting a nationally important wintering population of Hen Harrier (*Circus cyaneus*) – an Annex 1 species.

The site also qualifies under Article 4.2 by supporting in summer nationally important breeding populations of Ringed Plover (*Charadrius hiaticula*) – a regularly occurring migratory species.

The site also qualifies under Article 4.2 by supporting internationally important wintering populations of the following species of migratory waterfowl:

- Dark-bellied Brent Goose;
- Oystercatcher;
- Grey Plover;
- Knot;

- Bar-tailed Godwit; and
- Redshank.

Foulness also supports nationally important wintering populations of the following three species:

- Shelduck;
- Dunlin; and
- Curlew.

The site also qualifies under Article 4.2 of the Birds Directive as a wetland of international importance by regularly supporting in winter over 20,000 waterfowl.

Foulness also qualifies as a Ramsar site because of its waterfowl population and because of the extent and diversity of saltmarsh habitat present and the fact that it supports a number of rare plant and animal species.

### 12.1.3 Essex Estuaries SAC

The Essex Estuaries complex qualifies as an SAC for the following habitats:

**Estuaries**

This is a large estuarine site in south-east England, and is a typical, undeveloped, coastal plain estuarine system with associated open coast mudflats and sandbanks. The site comprises the major estuaries of the Colne, Blackwater, Crouch and Roach rivers and is important as an extensive area of contiguous estuarine habitat. Essex Estuaries contains a very wide range of characteristic marine and estuarine sediment communities and some diverse and unusual marine communities in the lower reaches, including rich sponge communities on mixed, tide-swept substrates. Sublittoral areas have a very rich invertebrate fauna, including the reef-building worm *Sabellaria spinulosa*, the brittlestar *Ophiothrix fragilis*, crustaceans and ascidians. The site also has large areas of saltmarsh and other important coastal habitats.

**Mudflats and sandflats not covered by seawater at low tide**

Essex Estuaries represents the range of variation of this habitat type found in south-east England and includes the extensive intertidal mudflats and sandflats of the Colne, Blackwater, Roach and Crouch estuaries, Dengie Flats and Maplin Sands. The area includes a wide range of sediment flat communities, from estuarine muds, sands and muddy sands to fully saline, sandy mudflats with extensive growths of eelgrass *Zostera spp*. on the open coast. The open coast areas of Maplin Sands and Dengie Flats have very extensive mudflats and an unusually undisturbed nature. Maplin Sands is particularly important for its large, nationally-important beds of dwarf eelgrass *Zostera noltei* and associated animal communities.

**Salicornia and other annuals colonising mud and sand**

Glasswort *Salicornia spp*. saltmarsh in the Essex estuaries on the east coast of England forms an integral part of the transition from the extensive and varied intertidal mud and sandflats through to upper saltmeadows. Although the saltmarshes in this area are generally eroding, secondary pioneer communities appear as a precursor to erosion on the seaward edge of degraded mid-marsh communities. The area of pioneer marsh includes gradation into extensive cord-grass *Spartina spp.* swards.

**Spartina swards (*Spartinion maritimae*)**

The most extensive remaining stand of the native small cord-grass Spartina maritima in the UK and possibly in Europe is found in the Essex Estuaries. The stand is located at Foulness Point and covers approximately 0.17 ha. Other smaller stands are found elsewhere in the estuary complex, notably in the Colne estuary, where it forms a major component of the upper marsh areas.

**Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)**

Although the saltmarshes in this area are generally eroding, extensive salt meadows remain and Essex Estuaries represents Atlantic salt meadows in south-east England, with floristic features typical of this part of the UK. Golden samphire *Inula crithmoides* is a characteristic species of these marshes, occurring both on the lower marsh and on the drift-line. It represents a community of south-east England also found to the south in mainland Europe.

**Mediterranean and thermo-Atlantic halophilous scrubs (*Sarcocornetea fruticosi*)**

In this complex of estuarine marshes on the east coast of England the occurrence of Mediterranean and thermo-Atlantic halophilous scrubs is currently artificially restricted by sea-walls. It now occurs principally as a strandline community or at the foot of sea-walls. Recent managed retreat schemes offer the prospect of future expansion of the habitat type. The local variant of this vegetation, which features sea-lavenders *Limonium spp.* and sea-heath *Frankenia laevis,* occurs at one location, Colne Point.

The SAC is also designated for its extensive sub-tidal sandbanks.

### 12.1.4 Crouch & Roach Estuaries SPA/Ramsar site

The site supports populations of European importance of wintering dark-bellied Brent goose and hen harrier.

### 12.1.5 Abberton Reservoir SPA/Ramsar site

Abberton Reservoir is located close to the coast of Essex in eastern England. It is a large, shallow, freshwater storage reservoir built in a long, shallow valley and is the largest freshwater body in Essex. It is one of the most important reservoirs in Britain for wintering wildfowl, with a key role as a roost for wildfowl and waders feeding in adjacent estuarine areas. The site is also important for winter feeding and autumn moulting of waterbirds. The margins of parts of the reservoir have well developed plant communities that provide important opportunities for feeding, nesting and shelter. Abberton Reservoir is important especially as an autumn arrival area for waterbirds that subsequently spend the winter elsewhere.

The reservoir is designated for supporting populations of European importance of the following migratory species:

- Golden Plover;
- Cormorant;
- Gadwall;
- Shoveler; and
- Teal.

The site also supports a bird assemblage of international importance by regularly supporting 39,155 waterfowl. Abberton Reservoir qualifies as a Ramsar site for the same reason it qualifies as an SPA.

### 12.1.6 Thames Estuary & Marshes SPA

Thames Estuary & Marshes is both a Ramsar site and a Special Protection Area (SPA) due to the nationally and internationally important numbers of wintering wildfowl and wading birds. The majority of this site is situated within Kent but one element is situated within Thurrock. The part of the site within Kent is South Thames Estuary & Marshes SSSI, while the part within Thurrock is the Mucking Flats & Marshes SSSI.

The site is designated as a SPA under Article 4.1 of the Birds Directive (79/409/EEC) due to the internationally important populations of Ringed Plover (*Charadrius hiaticula*), Avocet (*Recurvirostra avosetta*) and Hen Harrier (*Circus cyaneus*). The designated area as a whole also qualifies under Article 4.2 of the Directive (79/409/EEC) by regularly supporting at least 33,433 waterfowl.

The Thames Estuary & Marshes qualifies as a Ramsar site due to its bird interest and because the site supports one endangered plant species and at least 14 nationally scarce plants of wetland habitats. The site also supports more than 20 British Red Data Book invertebrates.