Dover District Council

Water Cycle Study

Final Report

27 January 2009










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Entec UK Limited

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Executive Summary

Development Plans and Council Priorities

Dover District Council is preparing its Core Strategy Delivery Plan to plan for the local development that the South East Plan (formerly known as the South East Regional Spatial Strategy, RSS) has identified as necessary. The emerging South East Plan will make provision for at least 10,100 new dwellings in the study area between 2006 and 2026. The region requires investment in additional residential and commercial development to stimulate and accommodate economic growth and improve the quality of life in the area. The long term success of this development depends on appropriate locations being selected at the planning stage. Development will not contribute to economic and social well being unless future demand for water can be met, wastewater can be treated adequately, river water quality does not deteriorate, and drainage systems can cope with runoff.

The Core Strategy and supporting planning documents identifies proposed site allocations for residential and commercial development. These sites must offer the best planning solution both now and in the future. The Council is required to justify its site selections to the Planning Inspectorate by demonstrating an objective and robust selection process.

Purpose of this Report

The purpose of this Water Cycle Study is to identify if there are any water related issues that present significant obstacles to the success of development in the Dover District area and where and when these issues may occur. This is to prevent wasting time and money developing detailed plans only to discover they are unsuitable at a later point. The study has involved working with the key stakeholders, the Water Companies, the Environment Agency and the Council to establish the key constraints within the water cycle to identify integrated solutions in order to achieve sustainable development.

This study examines how much growth can be accommodated within the existing infrastructure. It examines whether sufficient water resources are available to supply forecast demand, how much growth the existing drainage and wastewater treatment works (WwTW) can accommodate, and whether or not the streams, rivers, and coastal waters in the area have sufficient capacity to meet any additional discharges, or varied discharge concentrations without water quality deteriorating.

The study examines each of these issues in general across the whole study area, and then takes a closer look to prioritise areas that are more and less suitable for development, in terms of the water cycle. Where constraints are identified these are explored further and conclusions are made on the options to resolve these problems.

Study Area

Dover District is located on the south coast of Kent, bordered by the English Channel for much of its boundary, the Stour Estuary to the north and Shepway District to the south. The main towns include Deal, Sandwich and Dover, which is one of the busiest industrial and ferry ports in the UK. The District is underlain by Chalk, which provides groundwater resource for public water supply. As a result of the permeable geology, there are few main rivers in the District, other than the River Dour, River Wingham and River Stour. The proposed future development will be focussed in the Dover and Whitfield area.

Water Resources and Demand Management

Drinking water is supplied wholly by groundwater sources from the underlying Chalk in Kent. Dover is located in the Agency's Stour Catchment Abstraction Management Strategy, which identifies that all the groundwater sources are over-abstracted. This means that the Agency is unlikely to permit any increase in licensed abstraction volumes for both water companies. Folkestone and Dover Water has been awarded Water Scarcity Status, reflecting the pressure on water resources in the region, and enabling it to enforce compulsory water metering across the majority of its customers. Future demand must therefore be met by firstly increasing water efficiency and reducing leakage, followed by making more efficient use of existing resources.

Future demand is uncertain but will be greatly affected by the water efficiency of new and existing homes. The water companies have advised that meeting future demand will not constrain development, however the pressure on the water environment and competing demand for supply will depend on the actual per capita consumption figures achieved through water efficiency measures. The Water Companies draft Water Resources Management Plans have been based on growth targets from the draft South East Plan. The final plans will be redrafted to allow for revised growth targets in the emerging South East Plan. Provided that Folkestone and Dover Water and Southern Water are able to implement their 25 year plans, water resources should be available to supply the area in the future provided that new developments meet water efficiency standards proposed in this report.

Significant work is required to engage with developers to ensure that new homes incorporate water efficient design. Currently, developers are not legally obliged to build homes incorporating water efficient design. All socially funded housing is now designed to CSH level 3 / 4 (equating to 105 l/h/d), and the Building Regulations advise that all other homes should be built to a standard of 125 l/h/d. It is recommended that Dover implements a policy for all new homes, including both social and private developments to comply with CSH Level 3 / 4 (per capita consumption of 105 l/h/d). This sets a higher standard than the Building Regulations that will assist in the implementation of water efficiency and water saving for all homes in Dover District, not just social housing. Furthermore, it is recommended that the District aims to meet an average residential water consumption target of 130 l/h/d for all development, including both new and existing houses. This figure is set by the government as an aspiration for a national average water consumption in the DEFRA document Future Water. For Dover this target should be easily met through averaging the new homes set at 105l/h/d and existing homes, for which consumption is likely to be higher than 130l/h/d.

Growth in the Whitfield area will need to be supported by significant water infrastructure, including a new trunk main, a service reservoir and a booster station. The timescale of commissioning a reservoir is in the order of 2-3 years; this infrastructure would need to be in place before the development can proceed, thereby indicating the possibility of phasing issues with DDC's Preferred Options 3 and 4. Approximate costing details for the new water assets have been provided to the Council to indicate the proportion that would be sought by a Growth Point fund contribution, with the resulting balance funded through the regulatory mechanism and from developer contributions.

Wastewater Treatment and Water Quality

The baseline assessment of routine water quality monitoring data across the district demonstrates that whilst the River Dour catchment has good water quality, data for the lower reaches of the River Stour illustrates the poor water quality, both in recent years and historically. The main issue, as is the case for many rivers particularly in southern and eastern England, are the elevated nutrient concentrations (nitrates and phosphates). Nutrients are derived from both point and diffuse sources and since they commonly limit plant and algal growth they can have a significant impact on the ecology. Evidence of this is provided where data is available which illustrates the poor biology status majority of rivers flowing through the study area. The high levels of phosphates and nitrates in the Stour catchment potentially limit environmental capacity of the receiving water to assimilate any additional pollution load. The main failures in chemistry along the Little Stour and the River Wingham could partly be attributed to wastewater and private discharges, but it is also important to note that diffuse sources, and particularly runoff from agricultural land, as well as urban areas, contribute (to a greater or lesser extent) to these failures

Forecast flows to wastewater treatment works (WwTW) from proposed growth targets will not provide a constraint for development. Despite the high level of proposed development under Options 3 and 4, relatively small increases in wastewater flows are forecast across much of the study area. This is largely due to the expected reduction in both occupancy rates and per capita consumption, although, Broomfield Bank and Weatherlees Hill WwTWs are subject to small increases as a result of growth in neighbouring Folkestone and Ramsgate. However, the capacity of the sewerage network potentially poses a constraint as upgrading and extensions of sewers will be required to meet certain development needs, particularly for development at Whitfield. These will generally be funded through the regulatory mechanism, via the Ofwat periodic review process for trunk mains. Local infrastructure is the responsibility of the developer who will be expected to fund a connection to the trunk sewerage system at a point of adequate capacity via a requisitioning process. It is recommended that policies are developed in the Core Strategy to support the requisitioning process to ensure infrastructure is provided ahead of development. Individual treatment works have varying capacities and those serving the main towns (Broomfield Bank) where significant growth is planned will see a marginal increase. Additional demand from the commercial sector also has the potential to increase the strain on individual treatment works. The capacity of individual treatment works and the feasibility of conveying additional wastewater flows to the works should be a key consideration when choosing the location of large development sites.

Drainage and Flood Risk

Drainage plans must be integrated to specific developments. Effective drainage reduces the problems of surface water flooding during heavy rain and can also be used to enhance the visual environment by providing ponds and reed beds for example. Drainage schemes must consider the underlying geology of any given site and its surrounding area. In the study area, the underlying geology is predominantly Chalk indicating a high potential for infiltration drainage systems. Nevertheless local soil and land use considerations must be taken account of. Water supply is sourced from groundwater and so restrictions in infiltration drainage will apply within the groundwater Source Protection Zones and drainage must be managed carefully.

The Strategic Flood Risk Assessment provides detailed information on flood risk to proposed site allocations, with the greatest risk posed from tidal sources, and from both fluvial and tidal risk in the Stour catchment. Site specific flood risk assessments are required to ensure development in flood risk areas is compatible with the level of risk, and prevents increased flood risk on site and elsewhere in the catchment. Policies that promote the use of Sustainable Drainage Systems and encourage the separation of foul drainage from surface water drains will prevent any increase in flood risk from new development. SuDS systems can also provide opportunities for reducing demand and amenity benefits for example through rainwater harvesting recycling schemes, wetland storage areas and opening up of culverts. The Stage 2 WCS should further investigate the preferred drainage solutions for Dover, including adoption and maintenance procedures.

Contents

1. Introduction

1.1 Aims and Objectives

The objectives of this Phase 1 Water Cycle Study (WCS) are to:

- Present the elements of the water cycle for use by Local Authority Planners;
- Highlight the issues that are relevant to Dover District Council, arising from National and local planning policies;
- Determine the existing capacity of the water supply, wastewater and drainage infrastructure in the study area;
- Identify potential barriers to development, considering the combination of environmental and water infrastructure constraints;
- Prepare guidance for Local Authorities and Developers.

Flood risk in the district has been considered within the Strategic Flood Risk Assessment (SFRA), produced for the Council's Local Development Framework (LDF) by JBA Consulting in September 2007. The WCS study will therefore only be summarising flood risk, using the evidence supplied in the SFRA to avoid repetition of work.

A Water Cycle Study can be undertaken in three stages; an initial scoping study, an outline study and a detailed study leading to a Water Cycle Strategy. This study comprises an outline study, or Phase 1 WCS, and aims to clearly outline the impact of the water cycle on the projected growth in Dover District and highlight any potential problems that may need addressing in order to achieve this growth sustainably. The study has involved consultation with key stakeholders in the Water Companies, the Environment Agency and the Council.

In assessing the capacity of existing water infrastructure (supply, wastewater, and drainage) this Phase 1 WCS will help to inform the development of the Councils' Preferred Options and highlight areas that should be investigated further in Phase 2.

1.2 How to Use this Water Cycle Study

A WCS provides an agreed plan, backed up with evidence, for providing integrated solutions to sustainable management of the water cycle, whilst meeting any additional demands associated with growth. This Phase 1 document brings together environmental and water infrastructure asset information that has been provided by the Environment Agency and the water companies. It sets out the current capacity of existing infrastructure, highlighting where the main pressure points are and identifies the environmental constraints to growth and sets out the areas for further investigation in Phase 2.

The data and analyses presented in this Phase 1 document provide a robust evidence base for making informed planning decisions. It does not provide an instant answer for determining planning applications. This evidence should be used to consider which options will best support the LDF Core Strategy and related policies.

It is important to understand the different scales at which the elements of the water cycle (water supply, sewerage and drainage) are managed, and the impacts this has on assessing constraints to growth. The different legislative and regulatory frameworks used to manage water resources, wastewater, and floods and drainage also needs to be considered.

Water supply is managed strategically, as there is a high level of connectivity in the water supply network. Water can be moved great distances from the raw water sources (rivers, reservoirs, or groundwater) to the point of delivery. New developments can generally be connected to the main system relatively easily. In contrast, WwTWs have much smaller defined catchment areas and so the location of development relative to the capacity of the nearest treatment works and receiving water can be critical. Although drainage issues are specific to individual developments, the integration of drainage across sites offers significant potential for green space / habitat creation and can also increase the amenity value of a site, in addition to reducing flood risk and potentially water demand.

This report contains three technical sections presenting the water resource, receiving water quality/wastewater infrastructure and potential drainage and flooding issues across the study area. The evidence in these sections is examined in the context of the whole water cycle and integrated conclusions drawn with recommendations for the Local Authorities and Developers to ensure sustainable delivery of the proposed development in the study area.

Detailed information on the methods used to assess the environmental constraints, and on sustainable development features, such as demand management measures and sustainable drainage techniques, are included within a series of appendices.

2. Development and Growth

2.1 Planning Policy Context

National, regional, sub regional and local planning policy sets out guidance and requirements for delivering sustainable development and therefore addresses, amongst other things, housing and employment growth and its distribution; water management and protection; infrastructure provision; and flood risk management. The following sections outline the relevant planning policy in which the issues of housing and employment growth, water management, infrastructure and flood risk are framed, and the current and emerging development plan for Dover District. The full review of relevant planning policy can be found in Appendix B.

2.1.1 National Policy

Government guidance is provided through a series of Planning Policy Statements (PPSs), the most relevant of which are summarised below.

PPS 1 – Delivering Sustainable Development and the Supplement to PPS1: Planning and Climate Change

An important theme in government planning policy is the need to achieve sustainable development which includes dealing with Climate Change. PPS1 'Delivering Sustainable Development' (2005) and the December 2006 supplements to it on: 'Climate Change', 'Zero Carbon Development' and the 'Code for Sustainable Homes' have now been incorporated in a Planning and Climate Change Bill. PPS1 requires regional planning bodies (RPBs) and local planning authorities (LPAs) to prepare development plans which ensure that development is pursued in line with the principles for sustainable development and promote outcomes in which environmental, economic and social objectives are achieved together over time. This should be achieved using a spatial planning approach.

Specifically, planning authorities should identify land suitable for meeting housing and other types of development taking into account the need to provide essential infrastructure and avoid flood risk. In addition they should address the issue of climate change; the management of pollution; and the minimisation of impacts from the management and use of resources based upon sound science. PPS1 advises that regional planning authorities and local authorities should promote amongst other things the sustainable use of water resources and the use of sustainable drainage systems in the management of runoff.

The PPS1 supplement advises local planning authorities that when deciding suitable locations for development, and for what type and intensity, they should take into account the capacity of existing and potential infrastructure including water supply, sewage and sewerage, to service the site or area in ways consistent with successfully adapting to likely changes in the local climate. In addition, they could consider physical and environmental

constraints such as sea level rises, flood risk and stability, and take a precautionary approach to increases in risk which may arise as a result of potential changes to the climate.

PPS 3 – Housing

PPS3 underpins the delivery of the Government's strategic housing policy objectives where the goal is to ensure that everyone has the opportunity to live in a decent home, which they can afford in a community where they want to live. Most future development in the District will be for housing. PPS3 requires that 'new housing should be built on previously developed land (PDL) before greenfield land'. PPS25 reiterates this requirement in its Exception Test.

PPS 12 – Creating Strong, Safe and Prosperous Communities through Local Spatial Planning

PPS 12 was published in June 2008. It outlines the nature of local spatial planning and the key components of local spatial plans and how they should be prepared. It should be taken into account by local planning authorities in preparing Local Development Frameworks (LDFs) which include development plan documents (DPDs) and other local development documents (LDDs).

With regard to infrastructure PPS12 states core strategies *should be supported* by *evidence of what physical, social and green infrastructure is needed to enable the amount of development proposed for the area, taking account of its type and distribution. This evidence should cover who will provide the infrastructure and when it will be provided. The core strategy should draw on and in parallel influence any strategies and investment plans of the local authority and other organisations.*

The water cycle study will form part of the robust and credible evidence base which will underpin policies within the Dover District's Core Strategy and other relevant LDDs.

PPS 25 – Development and Flood Risk

PPS25 sets out Government policy on development and flood risk. It aims to ensure that flood risk is taken into account at all stages in the planning process to avoid inappropriate development in areas at risk of flooding, and to direct development away from areas of highest risk. It also aims to ensure that new development does not increase the risk of flooding elsewhere. Where, in exceptional circumstances, new development is necessary in such areas then the aim is to make it safe without increasing flood risk elsewhere and, where possible, to reduce flood risk overall.

PPS25 stipulates that all planning applications for developments greater than 1 hectare must be accompanied by a Flood Risk Assessment detailing surface water management plans to demonstrate that runoff does not increase from the proposed development once it has been built and that runoff is not simply moved elsewhere.

This echoes comments from the Pitt review which reiterates comments in PPS25. It makes it clear that developments within flood zone 2 and 3 should not be allowed to proceed unless there is clear proof that they are compatible developments for these zones, as this report is being used to inform this process it will act as an aid to the decision making process when advising on the suitability of developments in line with guidance within the Pitt review.

2.2 The Development Plan for Dover District

2.2.1 Regional Planning Policy

Since the Planning and Compulsory Purchase Act 2004, regional planning policy is outlined in Regional Spatial Strategies. The objective of the Regional Spatial Strategy (RSS) is to contribute to the achievement of sustainable development by providing a broad development strategy for the region over a fifteen to twenty year period. The RSS informs the preparation of Local Development Documents (LDDs), Local Transport Plans (LTPs) and regional and sub-regional strategies and programmes.

Regional Spatial Strategy for the South East (Regional Planning Guidance 9)

The current adopted regional planning policy for the South East region is Regional Planning Guidance 9 (RPG9) - the current Regional Spatial Strategy for the South East. This was published in March 2001 and covers the period up to 2015. However this policy is to be replaced shortly by the South East Plan - which is a full revision of RPG9 - to cover the period to 2026.

The current RSS encourages greater consideration when planning new developments to avoid areas at risk from flooding and take into account of the availability of water resources. The RSS sets out policies specifically referring to managing flood risk and considering the water cycle when planning for development. Policy INF1 states that *development should be guided away from areas at risk or likely to be at risk in future from flooding, or where it would increase the risk of flood damage elsewhere*. Policy INF2 requires *new development to be located and its implementation planned in a way which allows for sustainable provision of water services and enables timely investment in sewage treatment and discharge systems to maintain the appropriate standard of water quality.* Water efficiency measures and the minimisation of adverse impacts upon water resources, quality, regime, ecology and ground water should be encouraged too and redevelopment should identify and make provision for contamination and drainage problems.

The Emerging Regional Spatial Strategy for the South East (The South East Plan)

The South East Plan (SEP) was submitted to Government in March 2006 and the Examination-in-Public ran was completed in March 2007. The proposed changes to the SEP are due to finish at the end of October 2008. After the Government finalises changes, the plan will be adopted and then form a statutory document covering the period to 2026. It is therefore pertinent to refer to the policies set out in the South East Plan and therefore Dover District's

Local Development Framework will need to be in accordance with this emerging regional planning policy. Full policy wording is contained within Appendix B. Policies set out in the Secretary of State's Proposed Changes to the draft Regional Spatial Strategy (RSS) for the South East document have been referred to as this is the latest version of the SEP.

The SEP outlines Dover as a regional hub and gateway which will deliver considerable housing and employment growth over the plan period. Dover has been identified as a coastal town forming part of the East Kent and Ashford sub region which will benefit from new economic development. Priority should be given in Local Development Documents for major employment sites at Dover and the former coalfield, and proposals for expanding technology, knowledge and scientific sectors will be encouraged.

The SEP places considerable emphasis on increasing the efficiency of resource use, especially natural resources such as water. Policies CC1 and CC3 outline the need to address resource use in the South East and making this a sustainable development priority. Policy CC2 details climate change adaptation measures which include guiding strategic development to locations not at risk from flooding and water shortages; including sustainable drainage measures and high standards of water efficiency in new and existing buildings; and increasing flood storage and developing sustainable new water resources..

Section 9 of the SEP provides detailed policy guidance for the sustainable management of natural resources. This section includes policies requiring water supply and quality to be protected, maintained and enhanced and demand to be managed (NRM1 and NRM2); water resource development to be pursued (NRM3); and to ensure sustainable flood risk management is achieved (NRM4). In particular, policy NRM1 states that LPAs should *direct new development to areas where adequate water supply can be guaranteed from existing and potential water supply infrastructure. Where this is not possible phasing development so that sustainable new capacity can be provided ahead of new development.*

2.2.2 Local Planning Policy

Dover District Local Plan

Dover District Local Plan was adopted in 2002 and covers the period up to 2006. Under the transitional arrangements outlined in PPS12, the Local Plan expired on the 27th September 2007 and only policies saved by the Secretary of State under a direction will continue to be part of the Development Plan. These policies will remain saved until they are replaced by the District's Local Development Framework.

Emerging Local Development Framework

As required by Planning and Compulsory Purchase Act 2004, Dover District Council is reviewing its local plan and currently preparing a LDF which is a suite of LDDs outlining the development strategy for the District.

The Core Strategy is the key document of the LDF. Its main purpose is to set out the Council's vision and spatial strategy for the future development of the District covering the period to 2026. The Council is currently at the preferred options stage and has undertaken consultation on the preferred option for development in the District. All other LDDs of the LDF need to conform to the Core Strategy. The water cycle study will inform the Core Strategy and other LDDs providing them with an evidence base to assist in delivering national, regional and local objectives relating to water in a timely and structured manner.

The Council has tested four broad options for delivering the objectives of the Core Strategy and these are based upon differing levels of growth. They have undergone Sustainability Appraisal which has determined their likely social, economic and environmental effects and the Council has considered their deliverability. They are as follows:

Table 2.1 Proposed Growth Options

Option	Targets
Option 1 - Low Growth – 6,100 homes	Population decline of 1,800 people and there would be a decline of those of working age; Employment land needs could be readily met from existing supply; Labour shortage of between 9,400 and 12,400 people; Land would be needed to provide 6,100 homes – this would be met through current housing commitments and new allocations of brownfield land within existing towns and village boundaries; 40,000 sq m of additional shopping floorspace would be required.
Option 2 – Medium Low Growth – 8,100 homes	Population would increase by 2,600 the majority of which would be in Dover and people of working age would decline; Labour shortage of between 6,400 and 9,500 people; Employment land needs could be readily met from existing supply; Land would be needed for 8,100 homes – the majority would be located in Dover requiring the allocation of any suitable brownfield land beyond the urban boundaries and greenfield land for 1,500 homes, 900 would be located at Whitfield; 43,000 sq m of additional shopping floorspace would be required.
Option 3 – Medium High Growth – 10,000 homes	Population would increase by around 6,700 the majority of which would be in Dover and people of working age would decline; Employment land needs could be readily met from existing supply; Labour shortage of between 3,700 and 6,700 people; Land would be needed for 10,000 homes – the majority would be located in Dover with an additional 500 at Deal and 500 at Sandwich and the villages. Additional 1,900 homes over Option 2 would require greenfield land, 900 of these homes would be located at Whitfield; 46,000 sq m of additional shopping floorspace would be required.
Option 4 – High Growth – 14,000 homes	Population would increase by around 15,600 the majority of which would be in Dover and people of working age would increase by 4,300; Employment land needs could be readily met from existing supply however would need to be carefully monitored; Labour supply would increase sufficiently in broad terms to support the forecast range of jobs growth; Land would be needed for 14,000 homes – the majority would be located in Dover, 900 would be located at Whitfield, with an additional 500 at Deal and 500 at Sandwich and the villages. Around 7,400 homes would need to be located on greenfield land. Additional homes above option 3 would be located at Dover on the west side of Whitfield. 51,000 sq m of additional shopping floorspace would be required.

The Council has determined that Option 4 is the strongest in terms of meeting the objectives of the Core Strategy; however the scale of development and infrastructure makes it uncertain to be delivered by 2026. This option is therefore proposed to form the longer term growth strategy for the District and Option 3 has been put forward as the Core Strategy's preferred option at this stage. The Council has consulted on this decision and the revised Strategy will soon be published for examination. The water cycle study has been reviewed all 4 growth options, focussing on Options 3 and 4 for the more detailed assessments.

The support for large scale development in the District has been supported by Dover District Council being awarded growth point status by Communities and Local Government. The Council will deliver a regeneration programme to achieve significant change and help deliver the preferred option for the Core Strategy, working with a range of partners including the South East England Development Agency (SEEDA), English Partnerships, Kent County Council, Dover Harbour Board and Dover Pride. The Council is currently preparing a Programme of Delivery to ensure it can receive the funding it needs from the Government to help with planning and delivering new developments in the District.

The Water Cycle Study

The Water Cycle Study is intended to inform the planning process and provide an evidence base for the production of the final Core Strategy and other LDDs and, thereby, assist in delivering objectives relating to water in a timely and structured manner when bringing forward development. In effect it provides the detail on how the Local Authority, and ultimately developers, will meet the strategic water requirements of the South East Plan. Dover District Council will need to address the policies of the South East Plan in its LDD and, where necessary, include appropriate policies within its documents. It is fundamental that the Core Strategy includes an appropriate policy base but there are options as to how this is best achieved.

Other environmental studies commissioned to date to inform the planning process include:

- A Strategic Flood Risk Assessment – This provides detailed guidance on areas at risk from flooding in the District;
- A Strategic Environmental Assessment (SEA) and Sustainability Appraisal Baseline Report – the SEA/sustainability appraisal is a continuous process to ensure that the policies and proposals of the Plan have regard to sustainability objectives;
- Strategic Housing Land Availability - This assessment seeks to identify potential housing land across the District and therefore could identify more sites suitable for residential development above those already identified and considered as part of the water cycle study;
- Planning Contributions Supplementary Planning Document which provides guidance on how appropriate contributions are to be sought from new development**;**
- Sustainable Development and Renewable Energy.

This Water Cycle Study examines the capacity of the existing water structure against the four growth options identified by the Council, focussing on Options 3 and 4.

This study sets out the constraints of the water environment and the measures that would be needed to accommodate development within those constraints. It examines the capacity of the water infrastructure and the environment to meet the pressures generated by a maximum of 14,000 new homes by 2026, assuming that no previous allocations have been built or have received planning permission. This therefore represents a conservative approach, as some of the proposed housing targets fall into this category. Where appropriate the WCS examines the spatial context of the environmental constraints, to identify if certain locations or concentrations of development would affect the pressure on the water infrastructure and its ability to cope with the demand.

2.3 Legislation and Regulations

Legislation, guidance and supporting evidence for water related issues, such as water quality, flood risk management and urban drainage, have a significant impact on the water cycle and are often the cause of changes in water infrastructure, as much as development pressures. Any adaptations to the water cycle must be compliant with such legislation and some are undertaken within the regulatory framework.

There is currently an unprecedented level of change in the legislation and guidance for water related issues. Some of these changes are driven by European directives; others are in response to national pressures, from the 2007 summer floods for instance. These changes are either currently being implemented, soon to be applied or likely to change in next five to ten years. Given that the timetable for the Water Framework Directive spans the next 18 years in three six-year cycles, the water companies expect to use the first period to carry out the majority of investigations to establish the necessary investment. This will provide an opportunity to assess the improvements delivered through other quality investments.

The primary pieces of legislation which set the context relating to the water cycle are summarised in Table 2.1 below.

Table 2.2 Primary Water Related Legislation

Legislation	Description
Water Framework Directive	The Water Framework Directive sets out a requirement to achieve good ecological status in rivers, estuaries and coastal waters, together with good status of groundwater by at least 2027. It presents a unique opportunity for holistic environmental management for all users of the water environment. THIS COULD BE EXPANDED TO MENTION NO DETERIORATION POLICY WHICH IS CERTAIN AND COST EFFECTIVENESS DISPROPORTIONATE COST ANALYSIS WE SHOULD HAVE SOME READY TEXT ON THIS STUFF. Standards for coastal and transitional (estuaries) waters brought in to meet the requirements of the Water Framework Directive require that thermal conditions, oxygen conditions, transparency and nutrients are considered. A cross body Technical Advisory Group (UKTAG) has recently published a set of environmental standards. Whilst there is no certainty that these standards will become statutory in the current form, they form the best current knowledge of how the standards may change. It is considered likely they will be finalised later this year. The environmental quality standards of key concern in transitional waters are temperature, suspended solids and nitrogen.
Habitats Directive	As people make increasing demands on the environment our wildlife habitats are coming under more and more pressure. The Habitats Directive recognises this and aims to protect the wild plants, animals and habitats that make up our diverse natural environment. The European Directives created a network of protected areas of national and international importance. These are called 'Natura 2000' sites and include Habitats Directive Special Areas of Conservation (SACs). The Habitats Directive has been transposed into English law as the Conservation (Natural Habitats &c) Regulations 1994, now known as the Habitats Regulations. Existing and future water management has the potential to affect a number of these designations and the Environment Agency Review of Consents process has identified a series of amendments that will be required to existing abstraction licences and discharge consents if adverse effects on the European Sites are to be avoided.
Shellfish Water Directive	The Shellfish Waters Directive aims to protect shellfish populations and contributes to the high quality of shellfish products. It sets water quality standards in areas, mainly in estuaries, where shellfish grow and reproduce. The directive requires that certain substances are monitored in the shellfish waters. These substances can threaten the survival of shellfish, inhibit their growth or make them too expensive to treat before they can be used as a food source. In the UK, the directive is implemented by the Surface Waters (Shellfish) (Classification) Regulations 1997 and the Surface Waters (Shellfish) Directions 1997. The directive will be repealed in 2013 by the EC Water Framework Directive, which must provide at least the same level of protection to shellfish waters (which the WFD classifies as protected areas) as the Shellfish Waters Directive does.
Bathing Waters Directive	The Bathing Waters Directive sets out water quality standards to protect the environment at bathing waters throughout the bathing season. It requires popular bathing waters to be 'designated' and monitored for water quality, particularly for human waste from sewage treatment works. In England and Wales the bathing water season runs from mid-May to September. The directive is implemented through the Bathing Waters (Classifications) Regulations 2003. A revised Bathing Water Directive became law in the UK in March 2008. As well as stricter water quality standards, it contains a requirement to provide more detailed and standardised information about bathing waters across Europe.
Urban Wastewater Treatment Directive	The Urban Wastewater Treatment Directive (UWWTD) regulates the collection and treatment of wastewater from residential properties and industry. Under this Directive receiving waters can be designated as 'Sensitive' where additional levels of treatment are required at significant contributing discharges. These can either be direct discharges or those upstream of the designated reach / water body that serve a population equivalent in excess of 10,000. One type of sensitive area is the "Sensitive Area [Eutrophic]", where elevated nutrient concentrations, mainly nitrogen or phosphorus, present a risk to the ecological status of the receiving water. In these areas, larger sewage discharges must be treated to reduce nutrient loads.

3. The Water Cycle

3.1 Introduction

The water cycle describes the pathways and processes through which the water we use moves through the natural and built environment, as well as through the above and below ground infrastructure on which the domestic population and industry depend. Figure 3.1 illustrates the traditional image of the water cycle showing how water enters a river catchment, how it runs through and over the land, before returning to the river system and ultimately returning to the sea.

Figure 3.1 Traditional View of the Hydrological Water Cycle – Without Artificial Influences

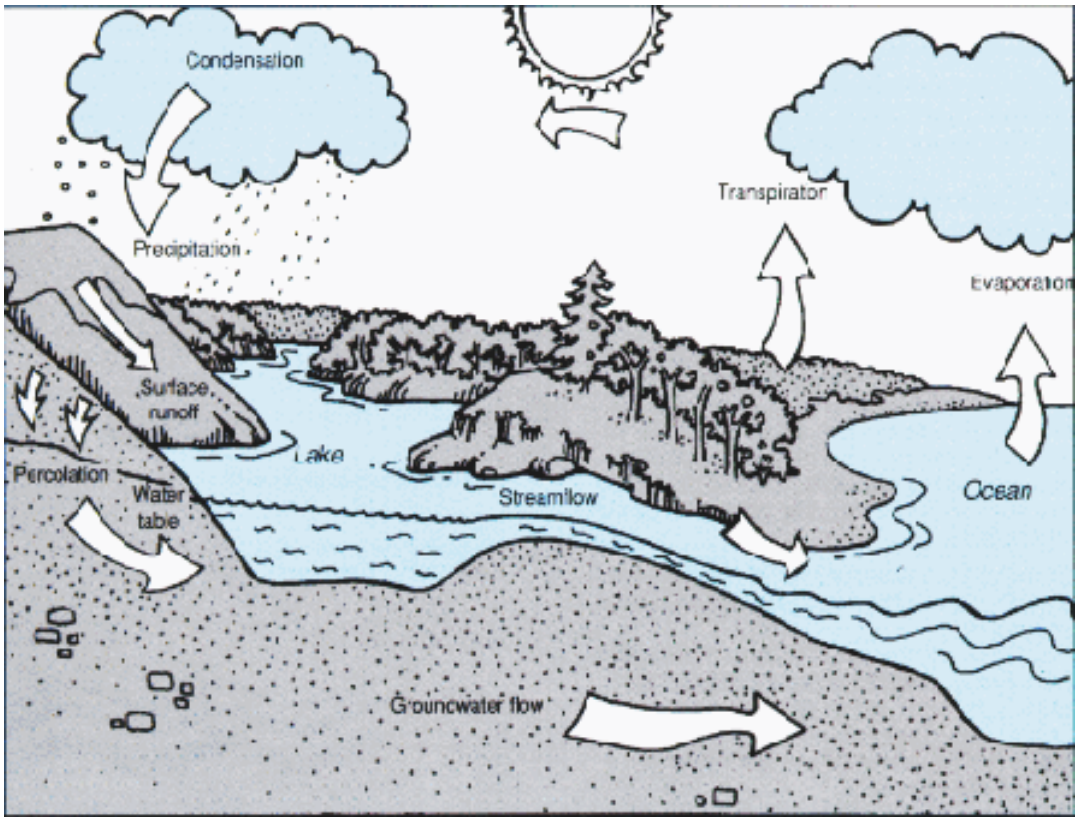
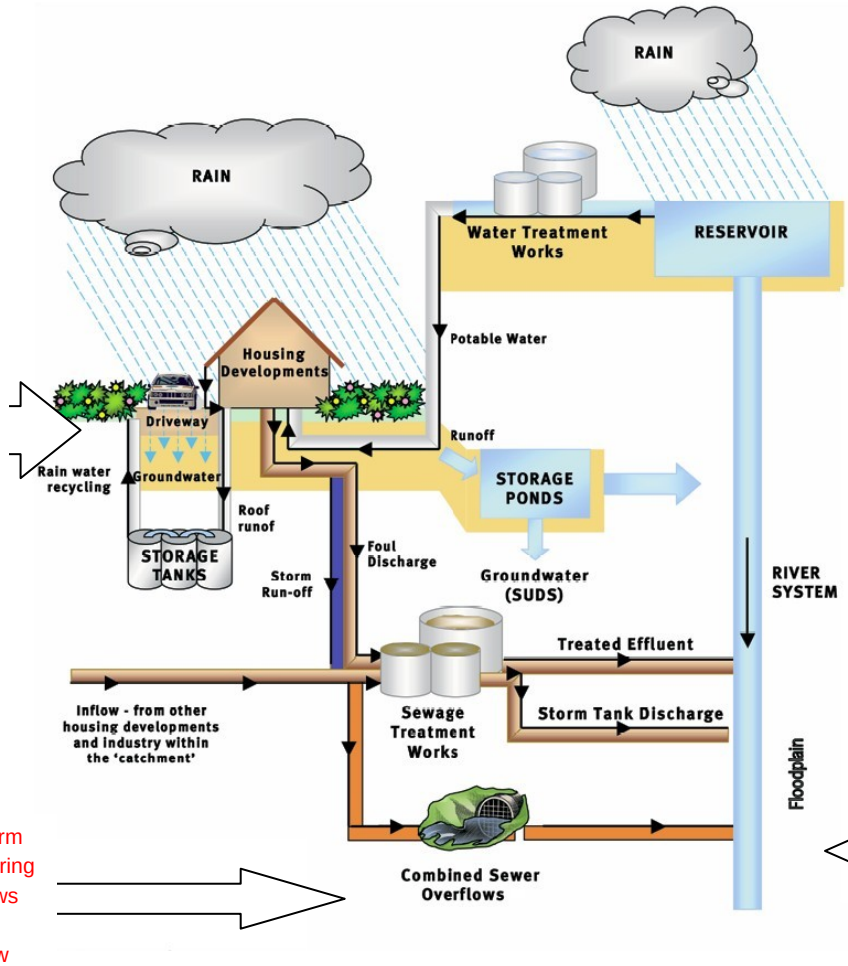


Figure 3.2 illustrates the added complexities within the urban water cycle (in schematic form) as a result of housing development and the infrastructure required to support it. The main differences between the natural and the urbanized water cycle relate to the rate of surface runoff (and percolation in to the ground), and the streamflow. In the urbanized cycle water is captured and stored for use, and this water only re-enters the river network once it has been used and then treated at wastewater treatment works. Hence, the timing and quality of water entering the river network can be significantly different in the urban version of the cycle.

Figure 3.2 Schematic of the Urban Water Cycle



Rainfall is collected and treated to potable standard and pumped to homes and other non-domestic properties.

Surface runoff from roads and other hard surfaces can exacerbate localised flooding and introduce pollutants in to streams and rivers.

Waste water and foul effluent is collected, treated and removed from settlements. Treated effluent is usually discharged into the river system or to long sea outfalls

The floodplain absorbs excess water spilling from rivers during flood events.

Combined sewers carry storm water and sewer water. During heavy rainfall increased flows can exceed capacity and sewage is forced to overflow into streams and rivers through outfalls.

The capacity of the water infrastructure needs to be sized appropriately to ensure the sufficient supply of clean water to homes and industry and to receive foul drainage, whilst preventing the discharge of polluted runoff and untreated foul drainage to protect the quality of the receiving water and any dependant habitats, whilst also reducing the risk of flooding.

3.2 Integrated Catchment Management

The capacity of the receiving water environment and thus development in the study area is constrained by environmental quality objectives enforced by UK and European legislation. The Water Framework Directive (WFD) is European legislation that aims to consolidate existing legislation. It came into force in December 2000, and was transposed into UK law in 2003. It introduces some new environmental standards that will help to improve the ecological health of inland waters to achieve 'good status'. This will be achieved by:

- Driving wiser, sustainable use of water as a natural resource;
- Creating better habitats for wildlife that lives in and around water, for example by improving the chemical quality of water;
- Progressively reducing or phasing out discharges, emissions and losses of priority substances and priority hazardous substances;
- Progressively reducing the pollution of groundwater;
- Contributing to mitigating the effects of floods and droughts.
- The WFD is designed to ensure that water bodies maintain or achieve 'good status' through the holistic management of all the contributing factors, such as:
- Pollution from specific discharge points;
- Diffuse pollution related to various land use types;
- Abstractions in the catchment that may be reducing the capacity of the water body to dilute pollutants;
- Flooding events that may introduce additional pollutants, or modify the channel morphology and sediment structure in the water.

Sustainable drainage systems that encourage infiltration and slow down the movement of rainfall runoff in the catchment can reduce the amount of urban pollutants entering watercourses, encourage infiltration into groundwater sources and mitigate the impact of intense rainfall events on surface water flooding. Reducing the amount of potable water that is wasted by implementing water efficiency measures will help to reduce the pressure to abstract, reducing the pressure on aquatic ecosystems, increasing the volume of water available for diluting both point source and diffuse loads whilst also reducing flow in the sewer network.

The urban water cycle is complex and highly integrated with many feedback mechanisms. Advanced planning and appropriate management helps to ensure that the water cycle contributes to a safe, clean and healthy environment, rather than being a source of long term problems.

3.3 The Study Area

In order to advise on the most sustainable approach water management, an understanding of the existing natural environment and drainage infrastructure is required. The hydrology, ground conditions and drainage of the study area have been summarised using information from various sources, including the Environment Agency and consultations with the water companies and the Council.

Figure 3.3 shows the main towns within the study area, and the WwTWs serving populations over Dover. It illustrates the locations in the River Wingham, River Stour and the Channel into which the treatment plants discharge treated effluent.

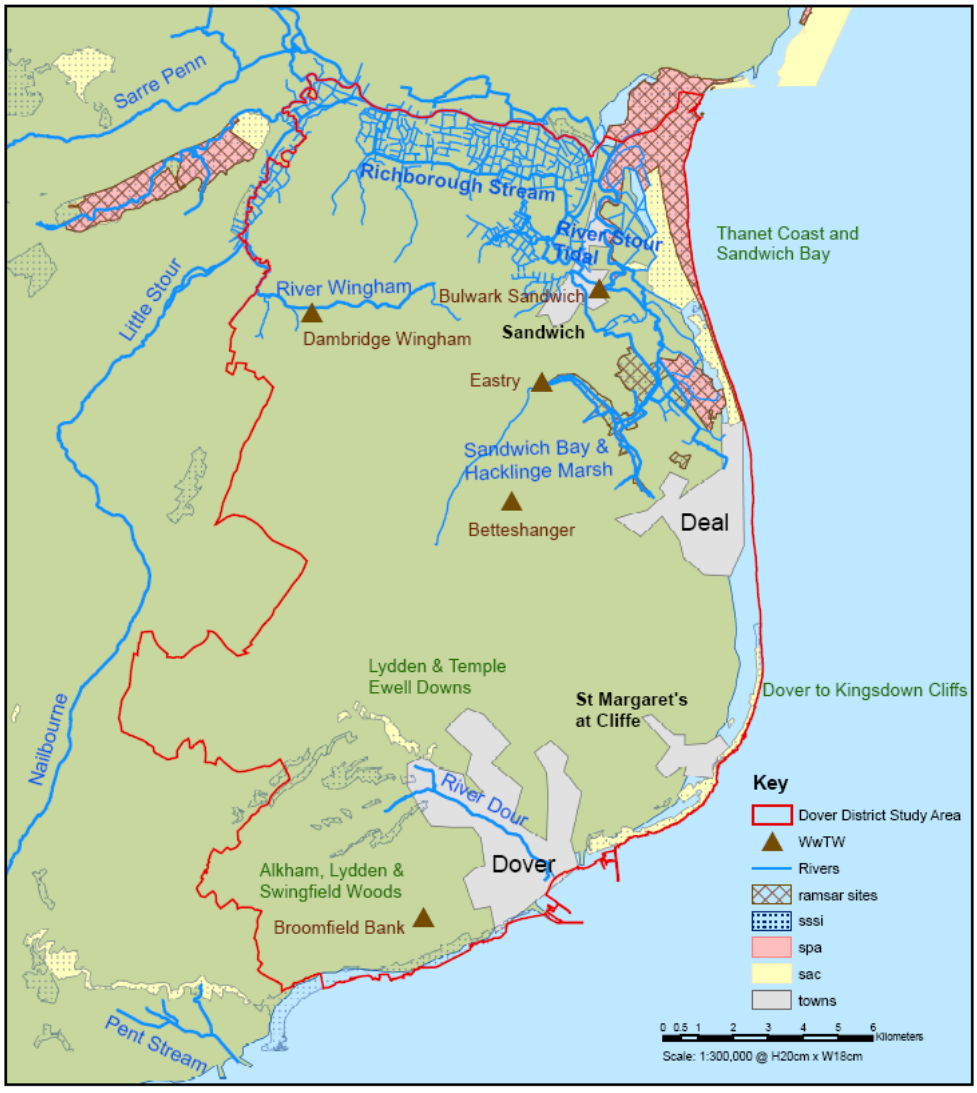
More details on specific elements of the study area are presented in this report:

- Bedrock geology, Figure 3.4;
- Water company resource zone boundaries, Figure 4.2;
- Groundwater protection zones Figure 6.3.

Figure 3.3 Map of the Dover District Study Area

Inset: Dover District study area in the context of South and Eastern England.

Main: Overview of river networks, principal towns in the study area, and location of key waste water treatment works.



3.3.1 Surface Water

The District of Dover is a broadly rural area with urban and suburban settlements. The majority of the district is drained by four main river systems: the River Dour that flows south east into the English Channel at Dover, this is the only surface stream within the Dover chalk block and has been identified by the Environment Agency as a priority habitat (chalk river); the Sandwich and Hacklinge Marsh north of Deal which flows south east into the sea at Deal and also flows north to join the Tidal River Stour; there is a dense network of minor streams at the northern edge of the study area, collectively known as the Richborough Stream; and the River Wingham in the west of the study area. These rivers have an important function in the disposal of wastewater and supporting dependant habitats, particularly the marsh in Sandwich Bay, in addition to the supply of water for consumption, industry and irrigation. Further information on water quality is presented in Chapter 5.

The River Stour is a major watercourse flowing through Kent and flows across the northern edge of the Dover District boundary. Most of the water in the Stour is sourced underground and so changes in groundwater level affect river flow. The Stour has demonstrated its dynamic character in recent years with episodes of both extreme low flows and severe flooding.

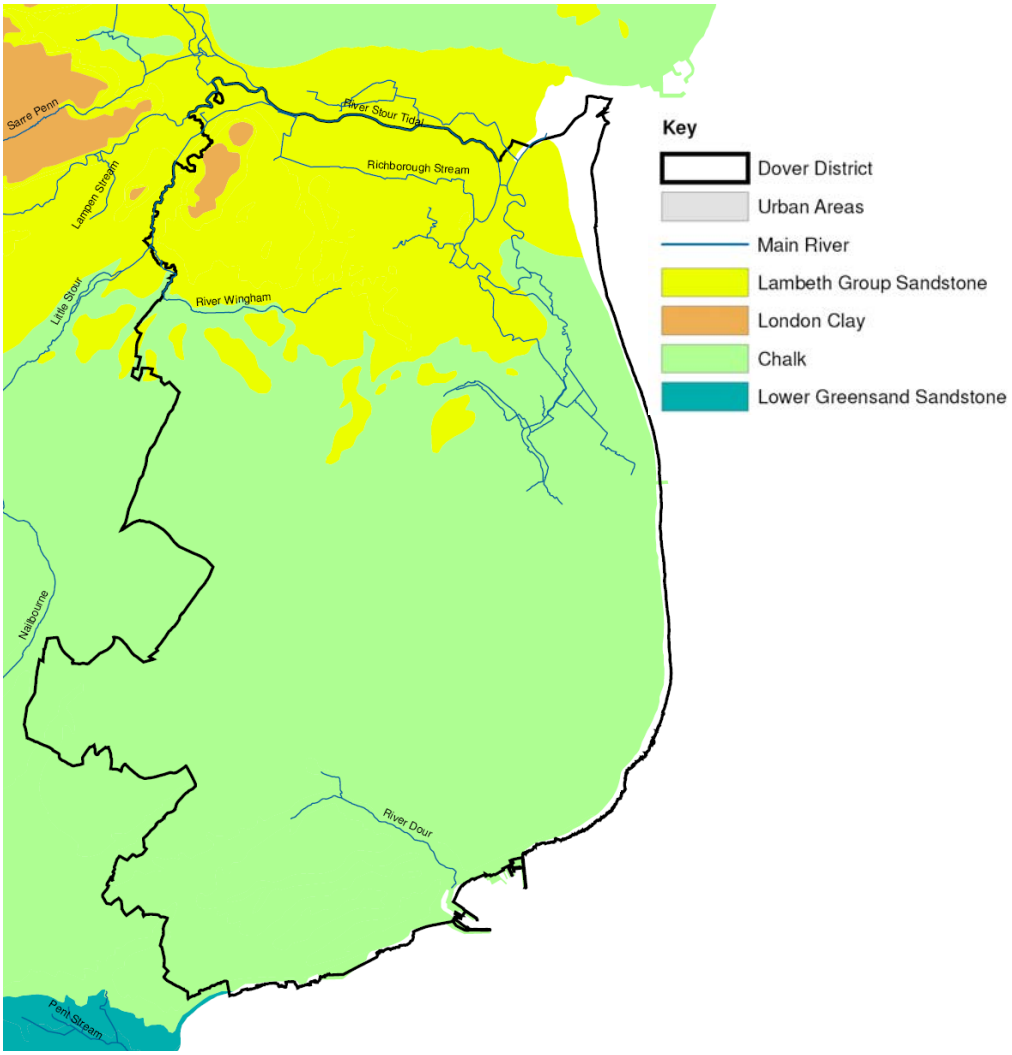
3.3.2 Geology and Hydrogeology

The district is mostly underlain by Cretaceous Chalk, with the Reading and Thanet Beds, a sandstone formation, present in the north. Chalk is a highly permeable calcareous formation, which results in high infiltration and high groundwater yields. The dominance of the permeable Chalk outcrop is reflected by the absence of major rivers in the district.

Across much of the district the Chalk is at outcrop with no drift geology present. Where drift deposits are present, they comprise Brickearth, Clay with Flints, or Alluvium.

Chalk is defined as a Major Aquifer, indicating the high permeability and ability to provide groundwater for public water supply. Indeed, the public water supply for the district is entirely sourced from groundwater. The Reading and Thanet Beds are classified as Minor Aquifer, indicating a low permeability and little groundwater yield for mains public water supply. However these beds can be an important source for local supplies and in supplying baseflow into the rivers.

Figure 3.4 Map of the Dover District Geology



3.4 Climate Change

It is important to take into account the predicted impacts of climate change when considering surface water management, as advocated within PPS25 and PPS1. The changes in global climate patterns are predicted to lead to increased global temperatures, cause sea levels to rise and increase the frequency and intensity of rainfall and extreme weather. At a regional scale the nature of these impacts will vary, and will depend on the levels of greenhouse gas in the atmosphere. Alternative forecasts have been calculated based on varying greenhouse gas emissions scenarios by the U.K. Climate Change Impacts Programme (UKCIP). For Kent, under a Medium-High

emissions scenario in the 2050s, the 2002 UKCIP predictions[1] forecast an increase in rainfall of between 25% and 30% in the winter accompanied by decreases in summer rainfall of between 40% and 50%.

Entec has reviewed the published Water Resources Management Plans (WRMPs) to confirm that both Folkestone and Dover Water and Southern Water have incorporated the most likely impacts of climate change into their resource and demand forecasts. Both companies have also used good practice to take account of the uncertainties associated with climate change. Atkins were commissioned by FDWS to develop a climate change model following the UKCIP methodology for FDWS, Southern Water and South East Water, however, the results were not available in time for inclusion in the draft WRMP. Atkins have now completed the work and the modelling results are available for inclusion in the final WRMP. These are based on individual water level changes at each source, based on the modelled output. Many of these are less than the 2 metres allowed for in the draft plan. The Atkins model outputs have been produced for low, medium and high impacts and FDWS will use the medium impact figures in its final WRMP. The water supply component of this Water Cycle Study is based on the data provided by the water companies, and so too is the impact of climate change.

PPS25 uses data extracted from UKCIP[2] to detail the allowances that should be made to accommodate climate change. Allowances will be needed to manage increased rainfall and the subsequent increase in runoff that will be generated. PPS25 expects new development to be designed to accommodate the impacts of increase runoff from climate change. Revisions to the UKCIP predictions are due to be released in 2008 and these should be taken into consideration in future developments once they are released. Sustainable drainage systems (SuDS) will become more important to manage increased rainfall during the future winters and during unexpected extreme storm events. Drainage recommendations are inherently site specific and so the impacts that climate change may have on the need for, and design of, sustainable drainage should be considered further in the more detailed Phase 2 WCS.

[1] Climate Change Scenarios for the United Kingdom, The UKCIP Scientific Report, UKCIP, April 2002

[2] www.ukcip.co.uk

4. Water Resources and Public Water Supply

4.1 Water Resources Management

In developing a Water Cycle Strategy it is important to consider the regulatory system in which the water companies in England and Wales operate. Water resources are managed by the Environment Agency in England and Wales, in the form of granting (or refusing) abstraction licences to abstract water for various purposes. Once water has been abstracted from the environment the responsibility for public water supplies is transferred to the water undertakers who have a statutory duty to provide water supplies[3]. There are two water undertakers who supply customers in the study area: Folkestone and Dover Water and Southern Water

4.2 Water Resource Availability

4.2.1 Catchment Abstraction Management Strategies (CAMS)

The Environment Agency uses a consistent national approach of Catchment Abstraction Management Strategies (CAMS) as a tool to inform licensing policy. The CAMS assessment process determines how much water is available for abstraction and how much water is required by the environment in each catchment. When completed, the Environment Agency will have produced a CAMS for each river catchment within England and Wales which sets out a strategy of how the balance between the needs of people and the environment will be managed over time. Where the CAMS process identifies that the current volume of water licensed for abstraction (or the actual volume that is abstracted) exceeds the environmental requirements, the CAMS sets out how the Environment Agency will seek to redress this balance.

The CAMS documents are reviewed on a six yearly cycle to tie in with the requirements of the Water Framework Directive, which requires that a River Basin Management Plan be produced and reviewed at the same six yearly frequency.

Local CAMS documents need to be considered within a Water Cycle Strategy. The documents detail the availability of water resources within the strategy area, identifying where there may be more water available to meet the needs of new development, or where there is no water available and the demands of new developments may need to be met from elsewhere. CAMS are also important to wastewater service provision, since the availability of water within rivers is important for maintaining sufficient dilution of wastewater discharges.

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[3]Water Industry Act 1991, Section 37 “duty to develop and maintain an efficient and economical system of water supply within [its] area and to ensure that all such arrangements have been made (a) for providing supplies of water to premises in that area and for making such supplies available to persons who demand them; and (b) for maintaining, improving and extending the water undertaker’s water mains and other pipes”.

4.2.2 Restoring Sustainable Abstraction Programme

In 1999 the Environment Agency established the Restoring Sustainable Abstraction (RSA) Programme to identify sites that are designated (such as EU Habitats Directive and Sites of Special Scientific Interest) and locally important sites that may be at risk from unsustainable water abstraction. If investigations show detrimental affects on these sites from water abstraction the Environment Agency will attempt to reduce the impact. This may be through actions such as helping to develop alternative sources away from the affected sites. The RSA Programme may be important to a water cycle study where locally important water supply sources are subject to investigations and possible reductions in licensed volumes.

4.2.3 Water Stress

The Department of Environment, Food and Rural Affairs (Defra) has established a Water Savings Group (WSG), set up to establish how best to target water efficiency activities to achieve a balance between water supply, demand and the environment. The WSG developed a methodology based on current and forecast per capita demand for water, forecast population growth and current and forecast resource availability to classify the "water stress" of water company supply areas. The assessment has three levels of water stress classification, Low, Medium and Serious. Much of the South East, including the supply areas of Folkestone and Dover Water, and Southern Water (encompassing the Dover district) are classified as areas of "serious" water stress (Environment Agency, 2007b). This means that the WSG has classified the area as requiring the highest level of water efficiency activity, which could include allowing compulsory metering of properties across the area (Environment Agency, 2007c).

4.3 Water Resource Availability and CAMS in the Study Area

The Dover District lies wholly within the Stour CAMS (Figure 4.1). The Environment Agency has completed its assessment of water availability and the impacts of existing abstraction on the aquatic environment in this area.

In the Stour CAMS 84% of the water licensed for abstraction is allocated to public water supply. Land use is predominantly agricultural, and demand for general agriculture and spray irrigation accounts for approximately 10% of licensed abstraction volume. The remaining 6% of abstracted water is shared between industry, the service sector, and environmental purposes (e.g. augmenting river flows elsewhere).

The CAMS process defines resource availability using four categories:

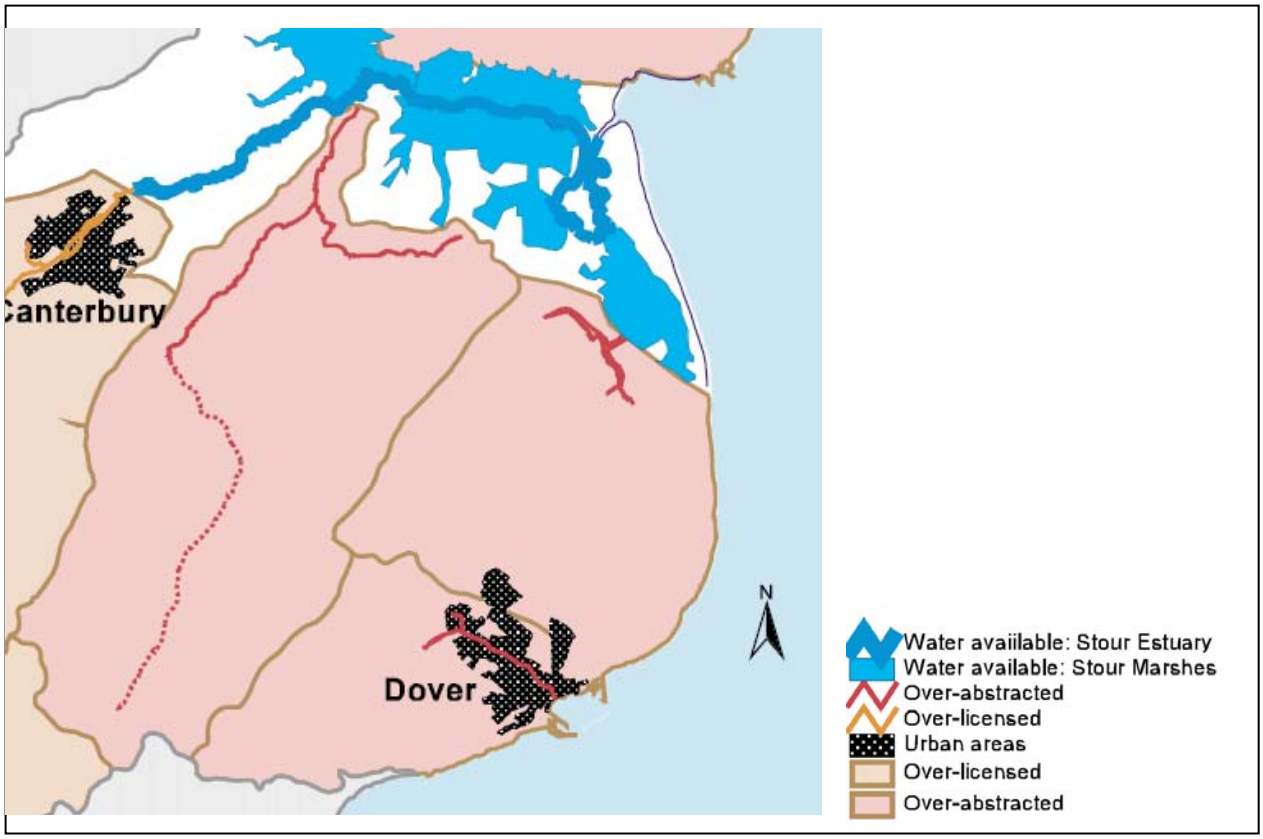
Resource Availability Status	Definition
Water available	Water likely to be available at all flows including low flows, although some restrictions may apply.
No water available	No water available for further licensing at low flows although water may be available at higher flows with appropriate restrictions. This means that all the water is already fully allocated.

Resource Availability Status	Definition
Over licensed	Current actual abstraction is resulting in no water available at low flows. If existing licences were used to their full allocation, they would have the potential to cause unacceptable environmental impact at low flows. Water may be available at high flows with appropriate restrictions.
Over abstracted	Existing abstraction is causing unacceptable environmental impact at low flows. Water may still be available at high flows with appropriate restrictions.

Where the Environment Agency assesses a catchment as being over-abstracted, the Environment Agency's licensing strategy will seek to secure downward variations to abstraction licences under its existing powers when abstraction licences are renewed.

The result of the Stour catchment assessment shows that the majority of the surface and groundwater sub-catchments are over licensed and over abstracted. The CAMS process has identified there is water available for abstraction in the Stour Estuary and Stour Marshes. However, these areas are designated European sites, and water flow is supported by a pumped inflow from the River Stour. Many of the abstraction licences in this area are subject to "Hands off Flow" restrictions (Environment Agency, 2003), meaning that during sustained dry periods water is unlikely to be available for abstraction. Existing abstractions in this area have become more sustainable partly due to the closure of Richborough Power Station.

Figure 4.1 Stour CAMS Water Availability Status



In the wider area, the majority of catchments in Kent are either over abstracted, over licensed, or there is no water available. This means that the Environment Agency is unlikely to grant further licences to abstract water. In fact, the Environment Agency's licensing strategy (under its existing powers) is to secure licence variations when abstraction licences are renewed, to reduce the total volume of water that can be abstracted in areas that are over licensed. This has already happened in this region. The Environment Agency identified that licensed abstractions were negatively impacting the River Dour (Environment Agency, 2003). Consequently, new licences were issued and existing licences have been modified to reduce their impact on the aquatic dependent environment (Environment Agency, 2006).

The CAMS documents demonstrate that there is limited environmental capacity to support further abstraction to meet demand from new development. Increasing resource availability is largely limited to making more efficient use of existing resources. Detail on the catchment resource assessments in and around the Dover District area is reported in the Stour CAMS report (Environment Agency, 2003). Resource assessments in adjacent areas are reported in the Rother CAMS (Environment Agency, 2006), and the North Kent CAMS (Environment Agency, 2004). More detail on the CAMS assessment process is available in Appendix C

4.4 Water Company Water Resource Management Plans

4.4.1 Background and Context

The water companies in England and Wales set out their long term requirements for maintaining and enhancing their water supply and wastewater infrastructure in their Strategic Business Plans on a five yearly basis. The Strategic Business Plans form part of the Periodic Review (PR) process whereby Ofwat, in consultation with other organisations including Defra, the Environment Agency, Natural England and consumer organisations, determines the expenditure that the water companies can make to maintain and enhance their infrastructure. The outcome of this determination is an Asset Management Plan (AMP) for the following five-year period.

The current (fourth) AMP period finishes in March 2010 and the water companies are currently in the process of preparing their Strategic Business Plans covering the next AMP Period (AMP5), setting out their funding requirements for the period from April 2010 to March 2015.

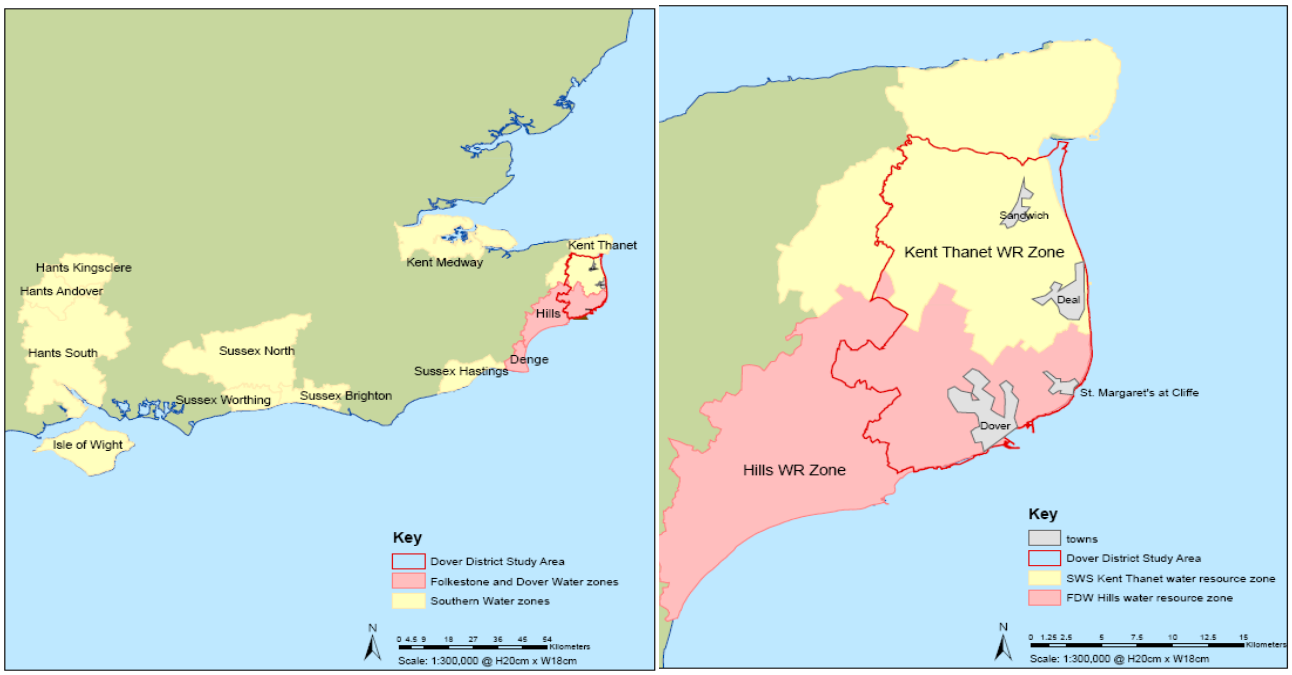
In addition to the Strategic Business Plans, the water companies must also submit a Water Resources Management Plan (WRMP) to Environmental regulator, the Environment Agency. These plans set out in detail how the water companies plan to balance supply and demand for water in their supply area over a 25 year period and take into account the economic, environmental and social implications of these plans. These plans, previously known as Water Resources Plans (WRPs) are reviewed and updated on a five yearly basis and submitted to the Environment Agency and Defra for approval. The last WRP was produced in April 2004. Since that time the plans have become a Statutory requirement under the Water Act 2003. The next WRMP is due to be completed in 2009, although the water companies have prepared and published a draft WRMP for consultation in May 2008.

In the WRMPs, the water companies set out their plans for water resource provision at the sub-company level, in areas called water resource zones (WRZs). A WRZ is 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"* (Environment Agency, 2007a, p24-3).

4.4.2 Water Resource Planning Details

Folkestone and Dover Water and Southern Water are the public water supply undertakers for the Dover District area (Southern Water is wholly responsible for wastewater and sewerage). Dover District is supplied by two water resource zones, Hills (Folkestone and Dover Water) and Kent Thanet (Southern Water). Figure 4.2 illustrates the full extent of both water companies and shows the Dover district in relation to this.

Figure 4.2 Full Extent of Folkestone and Dover and Southern Water Company Areas



Levels of Service and Water Company Planning

When planning future water resources the water companies aim to achieve 'levels of service' for customers that are agreed with the water regulator, Ofwat. Each company has its own levels of service, which state how frequently the companies can impose water use restrictions during periods of water shortage. For example, Southern Water plans to impose hosepipe bans no more frequently than once in ten years (Southern Water, 2008). Levels of service are important as they determine the investment required to maintain secure supplies of water and prevent more frequent restrictions than the companies' stated levels of service.

It is important to be aware that the water company plans are based on theoretical circumstances. For each water resource zone the water companies produce plans under a "dry year" scenario, ensuring that demand for water can be met for the agreed levels of service during a dry or drought period. All water companies produce plans to ensure that the annual average demand for water can be met during a dry year. The water companies use records of actual demand data and carry out a statistical process to 'normalise' this data and then they apply uplift factors to create a theoretical dry year annual average (in which the same demand is planned for every day of the year). Where water companies identify that the ability to meet short-term peaks in demand in a dry year is a driver for additional water supply investment, companies may also submit plans for a WRZ under peak or "critical period" conditions.

The existing per capita consumption for the WRZs that cover the District are presented in Table 4.1 below; these values are taken from Southern Water's WRMPs for both the "dry year" and "normal year" scenarios, and from data provided by and Folkestone and Dover Water's latest WRMP forecast in January 2009.

Table 4.1 Existing per Capita Consumption

Water Resource Zone	Per Capita Consumption (l/h/d)
FDWS Normal year average (Hills and Denge Zone) measured	134.42
FDWS Normal year average (Hills and Denge Zone) unmeasured	168.40
Kent Thanet Zone (Southern Water)	
Dry year average	178.9
Normal year average	165.8

The forecast situation, constrained by existing policies and supply sources, is known as the "baseline". Where a shortfall in supply capability is identified in the baseline, the water company identifies schemes to resolve the situation. These schemes are generally a combination of demand management and resource development, in line with the 'twin-track' approach to water management. It should be noted that, to ensure secure water supply, the water companies take uncertainties into account in their Water Resource Management Plans. These uncertainties include, for example, how climate change may affect demand and resource availability in the future.

4.4.3 Current Water Company Supply-Demand Balances

The baseline forecast for Folkestone and Dover Water's Hills zone (under dry year annual average conditions) is illustrated in Figure 4.2 shows a deficit in supply until 2009-10. The company's existing policies will resolve this until 2014-15 after which the zone is forecast to drop to a deficit greater than 3 Ml/d increasing to 6.9 Ml/d by 2025-26. The situation in Southern Water's Kent Thanet zone is less severe as the zone is not forecast to drop into deficit until 2028-29. This is illustrated in Figure 4.3. However, the current surplus of 10 Ml/d is forecast to decline rapidly, leaving only a small surplus.

Figure 4.3 Baseline Supply-Demand Balance in Hills Water Resource Zone

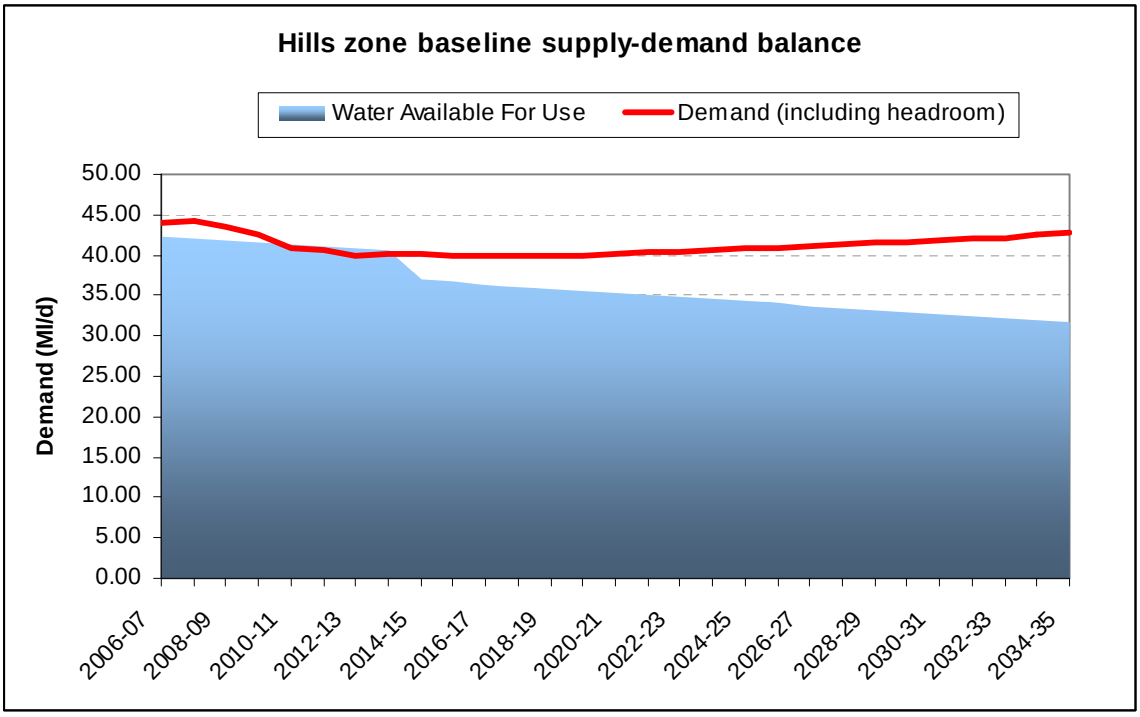
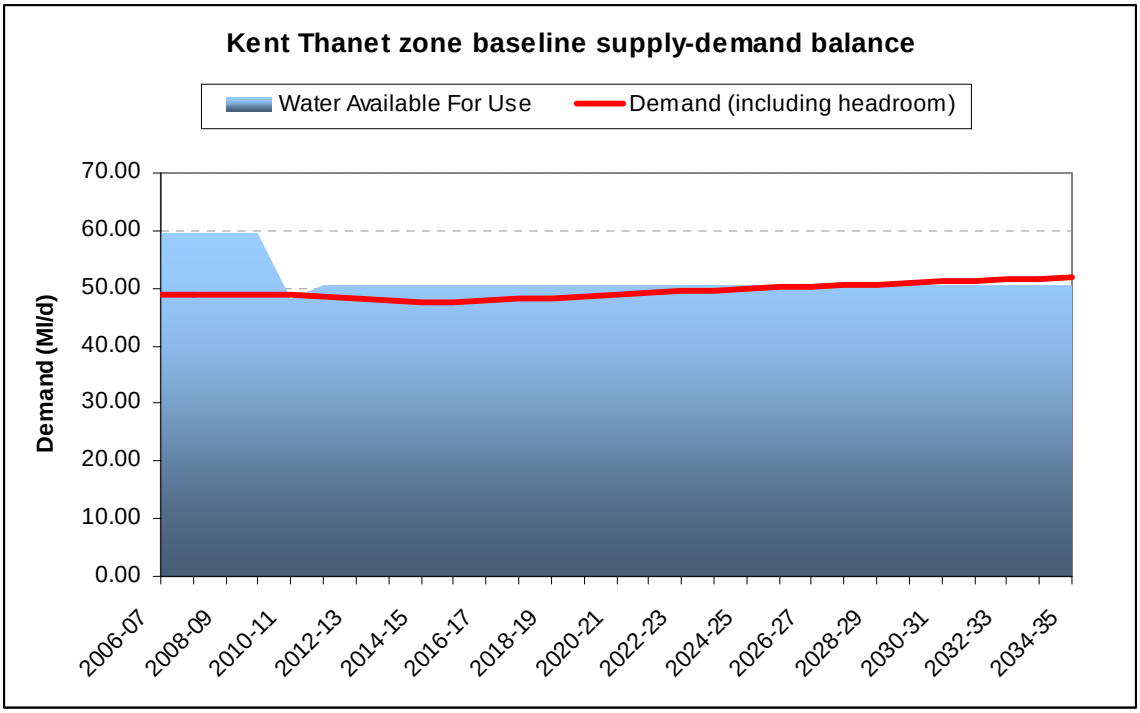


Figure 4.4 Baseline Supply-Demand Balance in Kent Thanet Water Resource Zone



Details on the water companies' preferred schemes to resolve these situations are presented below.

Water Company Options to Resolve the Baseline Supply-Demand Balance

As Southern Water does not forecast the Kent Thanet zone to fall into deficit until 2028-29 it has not considered any investment options to increase its water supply. The Company states that its plan is "demand-led and assumes the completion of universal compulsory metering by 2015, further reductions in leakage, and the continued promotion of water efficiency measures" It is also planning to increase a transfer of potable water from its Kent Medway zone (see Figure 4.2) into Kent Thanet to increase its available headroom. Until 2028-29 the import will remain at 0.01Ml/d but after that the import will increase to at least 3.22Ml/d, increasing annually.

In contrast Folkestone and Dover Water has 17 schemes planned to be implemented in the Hills zone between 2013-14 and 2034-35. These include:

- One demand management option that is expected to reduce demand by 0.5 Ml/d from 2014-15;
- Six distribution network (i.e. leakage) schemes starting from 2014-15 and expected to save a total of 1.44 Ml/d by 2034; and
- Ten resource development schemes, staggered across the planning period from 2013 and expected to generate an extra 10.56 Ml/d by 2034. This includes an option to desalinate sea water (which will also benefit neighbouring Denge zone) as there is very little additional freshwater resource available to abstract (as discussed in section 4.2).

These schemes are strategic which means the results will benefit the Dover district as part of the whole zone. They do not represent solutions to specific issues in the study area.

It will be necessary to work with the water companies to ensure that the final WRMPs take account of the housing growth planned for the Dover district, in addition to growth planned elsewhere in the water resource zones. It is unlikely that the company's supply forecast will increase in the final WRMP but any increases in housing growth provision will affect the demand forecast, essentially pushing up the red line in figure 4.3 and bringing forward the deficit.

4.5 Sustainable Development

4.5.1 Code for Sustainable Homes

The Code for Sustainable Homes is a national voluntary standard for the sustainable design and construction of new homes. This is an important consideration when assessing the water demand from new homes, and thus the demand from new developments, as there is now a commitment to construct a proportion of new homes to minimum performance standards for water use.

There are six performance levels in the Code for Sustainable Homes however, for water performance against the CSH is measured in terms of three per capita consumption (pcc) standards. These are shown in Table 4.2

Table 4.2 Water Performance Standards in the Code for Sustainable Homes

Code Level	Per Capita Consumption (l/h/d)*
Level 1 and Level 2	120 l/h/d
Level 3 and Level 4	105 l/h/d
Level 5 and Level 6	80 l/h/d

Note that the performance standards in the Code for Sustainable Homes exclude water use outside the home (e.g. garden watering)

Although introduced as a voluntary standard, from April 2007 all housing built on English Partnerships' land, and from April 2008 all social housing funded through the Housing Corporation, has to be built to CSH Level 3.

Following the publication of the CSH, the Government has committed to the introduction of a minimum regulatory standard for water consumption in new homes which will be introduced through amendments to the Building Regulations in 2008 (CLG, 2007). The regulatory minimum has been set at 125 l/h/d including water use outside the home and is approximately equal to the least stringent standard of the Code for Sustainable Homes (Levels 1/2).

4.6 Reconciling Water Company and Local Authority Housing Growth Data

The water resource zones do not align with administrative boundaries. Hence the Hills zone also supplies Folkestone and parts of Shepway, and the Kent Thanet Zone supplies all of Thanet District and parts of Canterbury. The water companies' forecasts are at a zonal scale and do not disaggregate growth into specific localities. The water companies have stated that the housing forecasts in their draft WRMPs are based on the housing growth figures in the draft South East Plan (the draft WRMPs were prepared before the revised South East Plan was published). The water companies state that their final WRMPs to be published in 2009 will take account of the updated figures in the Revised South East Plan.

Considering the disparities between the scale of information in the Council's growth data and the water companies' housing forecasts, and accepting that these are based on different versions of the South East Plan, a high level indicative analysis has been completed.

Water company billing data has been used to quantify the proportion of existing households in the Hills zone and Kent Thanet zone that are within the Dover District study area. Approximately 39% of Hills zone existing households, and 26% of Kent Thanet existing households are within the study area.

The housing growth datasets, presented in Chapter 2, Table 2.1, for Dover have been compared to examine what proportion of the 'zonal' new households, 'belong' to the Hills and Kent Thanet zones.

Table 4.3 Proportion of Zonal Housing Forecasts 'Belonging' to Dover District within Five Year Intervals

Growth Option 3	2008 - 2011	2011 - 2016	2016 - 2021	2021 - 2026
Proportion of new Hills zone households that 'belong' to Dover	50.8%	62.5%	55.6%	31.8%
Proportion of new Kent Thanet households that 'belong' to Dover	23.5%	22.9%	14.3%	8.1%
Growth Option 4				
Proportion of new Hills zone households that 'belong' to Dover	50.8%	65.1%	87.3%	94.2%
Proportion of new Kent Thanet households that 'belong' to Dover	23.5%	22.9%	14.3%	8.1%

The results indicate that there is possibly a disproportionate amount of growth planned for Dover District in comparison to the rest of Hills zone. However, as the water company housing forecasts are strategic in nature and cannot be disaggregated to local levels it is not possible to confirm this. This raises two issues:

- The water company draft WRMP (based on draft RSS housing figures) may underestimate total housing growth planned in the zone as per the updated South East Plan. The water companies have committed to update their housing growth forecasts in their final WRMP using the same datasets as used by the Local Authorities, based on a maximum project growth of housing level between Option 3 and Option 4. This is based on work commissioned by both water companies from Experian Business Strategies for PR09 which are based on the Secretary of State's proposed modifications to the South East Plan. The SoS's housing requirement for Dover is 10,100 dwellings and Option 4 is an aspiration of Dover DC that has yet to be tested at EiP as part of their LDF Core Strategy. Experian's latest "Best Estimate" for Dover DC is 12,200 new dwellings which is midway between Options 3 and 4, which is the figure most likely to be used. Once those forecasts have been updated it is expected that their plans will take account of the overall demand forecasts, and the revised WRMP will require a second review to update the Water Cycle Study;

- The second issue is concerned with the location of development. The figures in Table 4.2 indicate that there may be disproportionate growth in Dover District and this has implications for local network infrastructure. The WRMPs are not designed to plan for specific network enhancements needed to move water to specific growth points. Dialogue with the water companies during this Phase 1 study have highlighted that growth in the Whitfield area of Dover will require significant infrastructure enhancements by Folkestone and Dover Water.

The growth figures for Kent Thanet indicate that Dover is less dominant in that zone. This result does not conclusively report that Southern Water's housing forecast for Kent Thanet definitely incorporates all of the

housing in Dover district. If significant housing growth is planned elsewhere then the proportion allocated to Dover district would need to be less than the figures presented in Table 4.3.

It is recommended that the Local Authority works with the water companies to ensure that the final WRMPs take into account the preferred growth rates. It is advisable to work with the water companies whilst they prepare their final plans, prior to Phase 2 of the water cycle study, to encourage the development of disaggregated housing forecasts, at least distinguishing the housing forecasts between Dover and the rest of the zone.

4.6.1 Forecast Demand

The forecast demand from households (existing and new) and non households is calculated using data from the water company WRMP demand forecasts. The water companies' forecasts are considered reasonably robust as they are based on well established methodologies for forecasting supply and demand. The water company demand forecasts incorporate; forecasts of per capita consumption, which are a product of research into future policies on water consumption, water using technologies, and customer behaviour; household forecasts, which use the available Regional Spatial Strategy housing growth forecasts; forecast occupancy rates, which in turn generate a forecast population; and an additional amount of headroom, which is included to take account of the uncertainties in the forecasts.

To estimate existing non-household water demand data has been taken from the draft WRMP 2008 tables and apportioned to the Dover District. The draft WRMP tables contain details of the numbers of non-household properties served within each zone and the demand associated with these properties. A demand per existing property figure is derived from this data. Southern Water provided address point data for both zones (based on sewerage billing data) and this was used to extract the number of non-household properties. The zonal demand per property was then multiplied by the number of properties in the study area to derive the demand for existing non-households in each zone element of the study area. The demand from forecast non-household developments was calculated using forecast annual non-household development areas (in hectares) supplied by the Dover District Council. Further detail on the methodology for forecasting non household demand in the study area is provided in Appendix D.

In Phase 2 the Water Cycle Study will use the demand forecasts provided in the final WRMPs. At that point these data sets will have undergone at least one series of peer review and scrutiny from the Environment Agency and other consulteees, who will have examined, queried and requested improvements where necessary.

Sensitivity Testing Forecast Demand

Dover District Council (DDC) provided four growth options and these have been considered in the study, in particular Options 3 and 4 which represent the higher end of the growth levels and which are supported by the updated South East Plan. The impact that growth will have on demand for public water supply depends on several factors; the number of new houses built and their forecast occupancy rate (population); the expected per capita consumption of water of the population in the new properties, which is influenced by the sustainable design of the

buildings (Code for Sustainable Homes); the size of the existing population; and the per capita consumption of people living in existing homes, influenced by the uptake of domestic water meters, water efficiency education, and incentives to save water.

The future is uncertain and so a range of scenarios have been tested to examine the possible range of impacts on demand that could arise from development within the District. The scenarios highlight the uncertainty surrounding the uptake of future water efficiency measures in new and existing homes. The scenarios are based on daily household consumption rates provided in the Code for Sustainable Homes, the Building Regulations, and use data provided in the water companies' draft Water Resource Management Plans.

Nine scenarios have been selected to represent a range of per capita consumption scenarios from highly efficient new homes (meeting high levels of the Code for Sustainable Homes) combined with significantly reduced per capita consumption in existing homes, to much lower levels of water efficiency in both new and existing homes. There is no equivalent to the Code for Sustainable Homes for non households and there is no data on which to base assumptions of alternative future demands. Therefore, the sensitivity tests focus on the impact on total demand of households only.

The water companies' forecasts of per capita consumption in existing homes are provided in Appendix D. Both water companies are pursuing compulsory metering programmes. This is reflected in Folkestone and Dover Water's forecast as zero unmeasured pcc from 2012-13. Southern Water has retained an unmeasured estimate but its forecast of unmeasured properties declines to approximately 6000 from 2014.

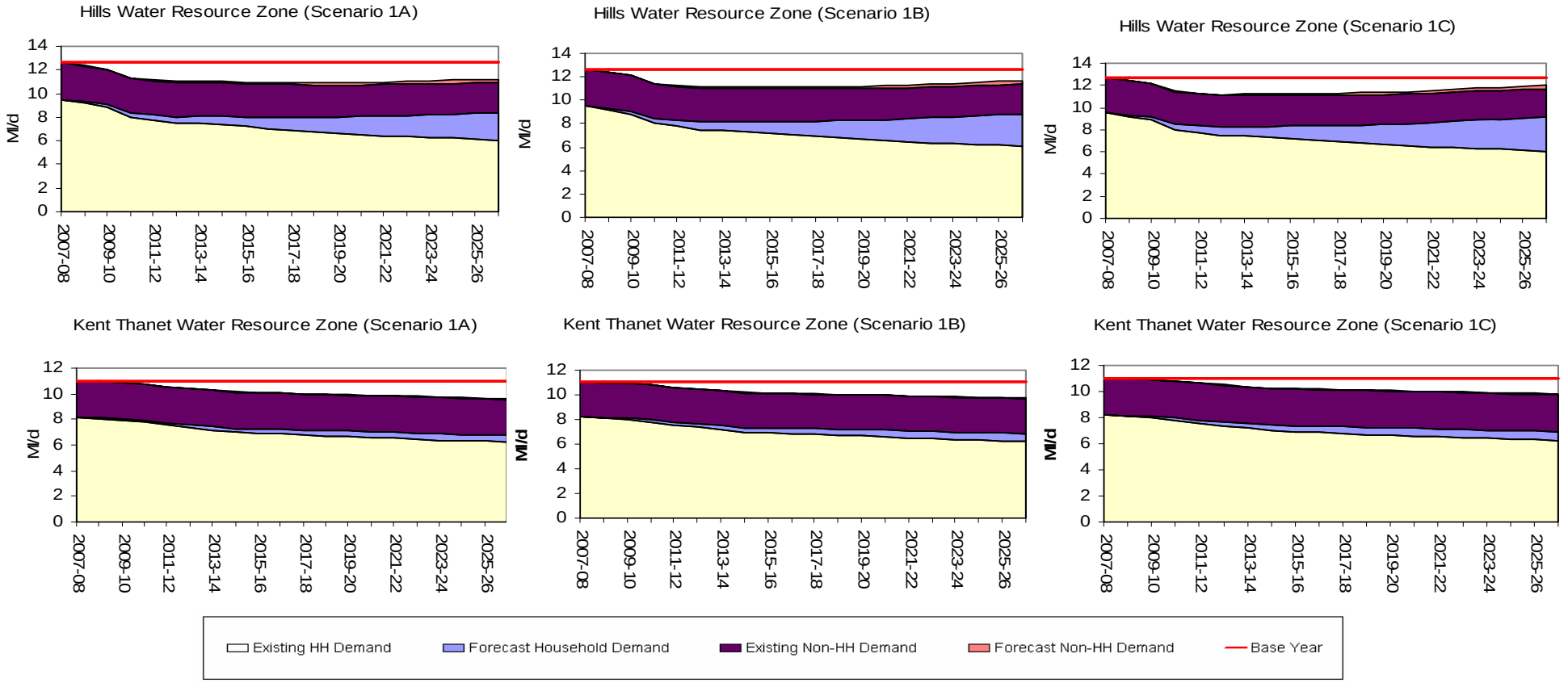
Table 4.4 Summary of Water Efficiency Scenarios Used in Sensitivity Analysis

HIGHLY WATER EFFICIENT Existing household pcc is 10% below water company forecast* Forecast households:	
1a. 35% at 80 l/h/d	65% at 105 l/h/d
1b. 35% at 105 l/h/d	65% at 120 l/h/d
1c. 35% at 125 l/h/d	65% at 130 l/h/d
MODERATELY WATER EFFICIENT Existing households use water company pcc forecast* Forecast households:	
2a. 25% at 80 l/h/d	75% at 105 l/h/d
2b. 25% at 105 l/h/d	75% at 120 l/h/d
2c. 25% at 125 l/h/d	75% at 130 l/h/d

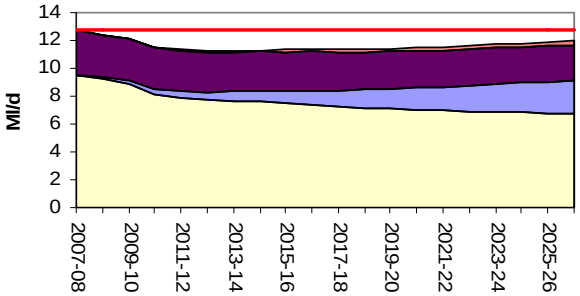
LEAST WATER EFFICIENT Existing household pcc is 10% above water company forecast* Forecast households:	
3a. 45% at 105 l/h/d	55% at 120 l/h/d
3b. 45% at 120 l/h/d	55% at 125 l/h/d
3c. 45% at 130 l/h/d	55% at 150 l/h/d
*See Appendix D	

Detailed results per scenario under Growth option 3 are presented below in Figure 4.4. A summary of the total demand from all scenarios is presented in Figure 4.5.

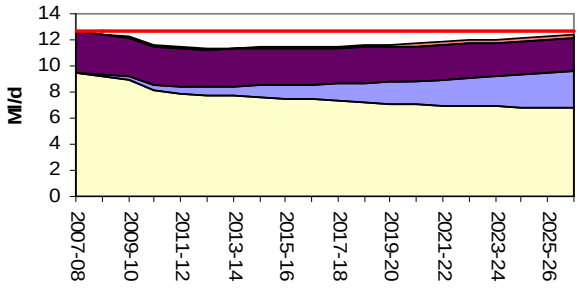
Figure 4.4 Forecast Components of Demand Per Scenario



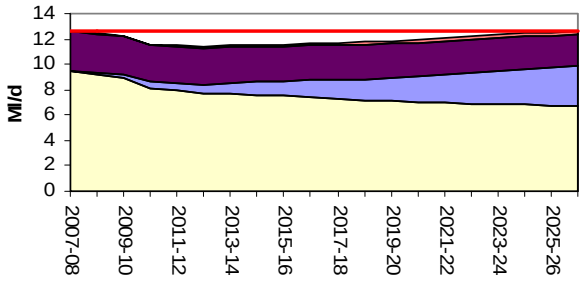
Hills Water Resource Zone (Scenario 2A)



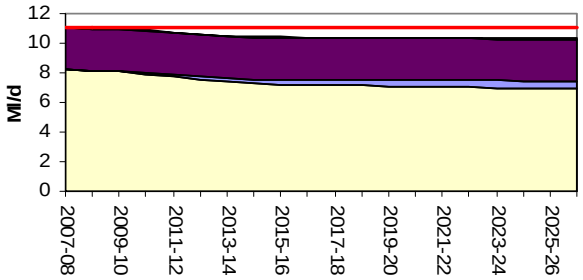
Hills Water Resource Zone (Scenario 2B)



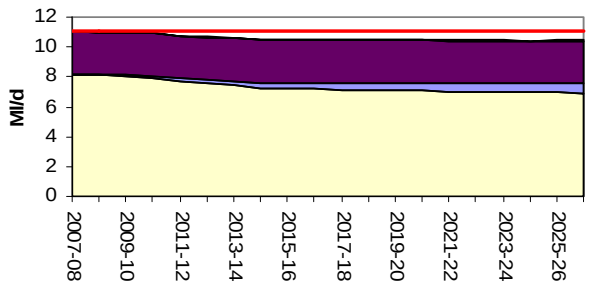
Hills Water Resource Zone (Scenario 2C)



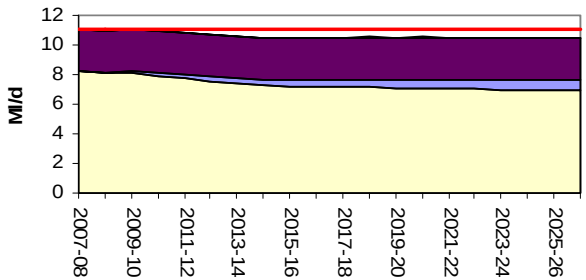
Kent Thanet Water Resource Zone (Scenario 2A)

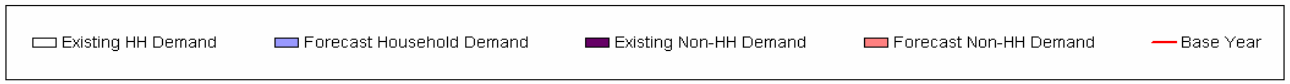


Kent Thanet Water Resource Zone (Scenario 2B)

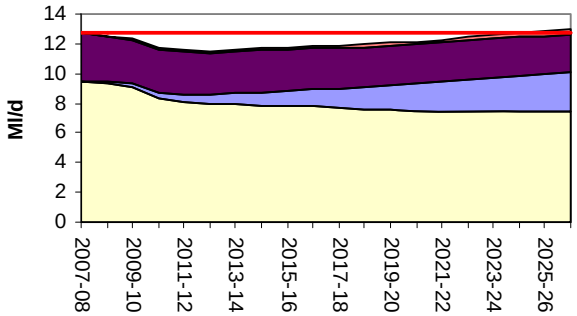


Kent Thanet Water Resource Zone (Scenario 2C)

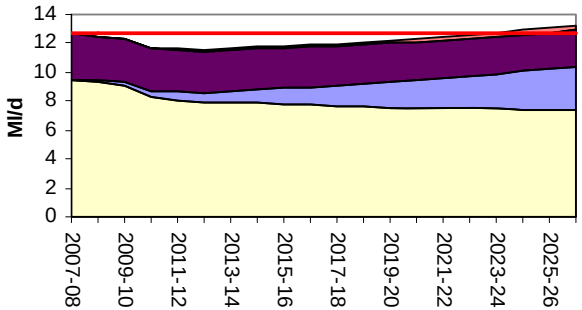




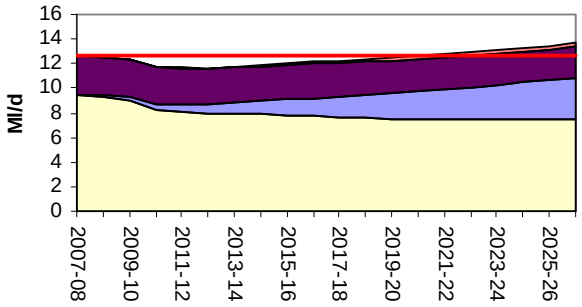
Hills Water Resource Zone (Scenario 3A)



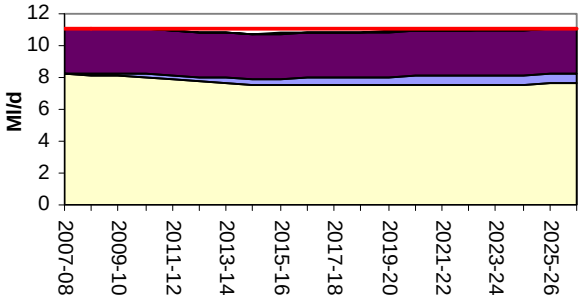
Hills Water Resource Zone (Scenario 3B)



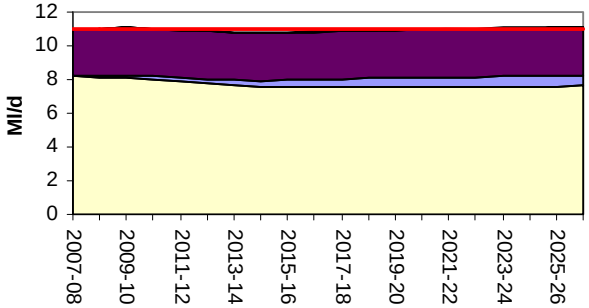
Hills Water Resource Zone (Scenario 3C)



Kent Thanet Water Resource Zone (Scenario 3A)



Kent Thanet Water Resource Zone (Scenario 3B)



Kent Thanet Water Resource Zone (Scenario 3C)

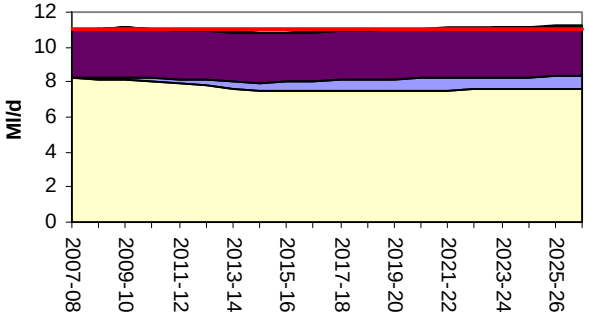


Figure 4.5 Summary of Total Demand Sensitivity Testing (Growth Option 3)

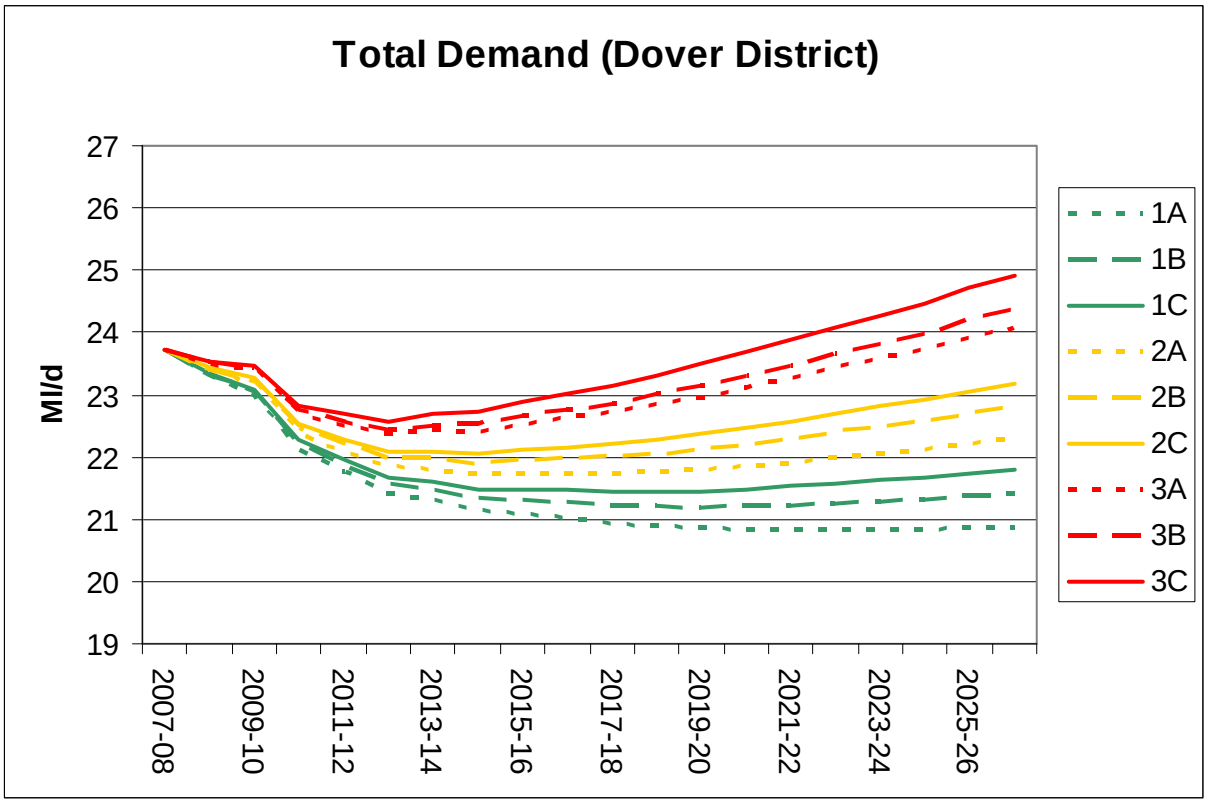


Figure 4.5 clearly shows the range in demand based on the three categories of water efficiency that have been tested. By 2025 the range in demand generated by these scenarios is 4.0Ml/d (20.9Ml/d in scenario 1A and 24.9 Ml/d in scenario 3C). Demand is forecast to decline beyond 2010 due to the impact of metering on the per capita consumption of existing households.

The middle range, scenario 2B using water company forecasts and moderate uptake of CSH in new housing, is the most likely outcome, generating a total household demand of 22.6 Ml/d by 2025. Considering the size of the deficit in Hills zone, the small surplus in Kent Thanet zone, and the options already being considered by Folkestone and Dover Water to meet a lower growth forecast than that planned by Dover District Council, it is clear that water efficiency in new and existing homes will be an important factor to the success of development and water supply in this area.

4.7 Interim Conclusion

Q. Is Water Supply a Constraint to Growth in the Dover District?

Folkestone and Dover Water, and Southern Water have informed the water cycle study that the availability of water resources will not constrain development; however the actual levels of water efficiency achieved will directly affect competing demands for water and the pressure on the water environment.

Recommended Policies

New Households

It is recommended that Dover District Council include policy recommendations for all new developments to meet the Code for Sustainable Homes' level 3 or 4 with regard to water efficiency in order to reduce the pressure as far as possible on the region's water resources. This equates to a daily per capita consumption of 105 litres. National policies are already in place to ensure that all new social housing and housing built on public sector land will meet level 3 of the Code for Sustainable Homes. The Council may choose to take the opportunity to build on this to develop an advisory role to developers, encouraging private developments and maintenance work to follow the recommendations of the Code for Sustainable Homes.

Even with new buildings designed to this standard, future alterations to bathroom and kitchen suites may increase water consumption, for example by installing power showers. Retro fitting water efficiency measures into existing buildings will be equally if not more important, as the majority of demand in 2026 will be generated from houses that have already been built.

Existing Households

The water companies have water efficiency strategies targeting existing households, aimed at reducing per capita consumption. These strategies incorporate metering as a central theme to encourage customers to be more aware of their consumption, and to use water more wisely. It is recommended that Dover District Council develops policies to facilitate the implementation of these water efficiency strategies, with a target level of consumption of 130l/h/d arranged as an optimum level, following the government target set out in the DEFRA publication *Future Water* (February 2008). Options that the Council may wish to consider include;

Hosting or co-sponsoring annual events to promote water conservation. The annual Water Festival co sponsored by Hampshire County Council is a good example. For information and ideas see the Hampshire Water Festival website[4].

[4] http://www.hampshireswater.org.uk/festival.html

A voluntary water efficiency labelling scheme is being operated by the Bathroom Manufacturers Association (BMA) which sets standards of water efficiency against which manufacturers' appliances can be tested. Once approved, the appliances are awarded a water efficiency label and the entered onto a database. The Council may wish to investigate the option to provide rebates to tax payers who purchase appliances that have been approved under this scheme.

Some local governments in other parts of the world that are also experiencing severe water stress, such as Australia, are working with the water undertakers to audit and retrofit selected households with water efficient products such as showerheads, taps and flow controllers. This is an option that Dover District Council may also wish to consider.

A scheme to support householders wishing to retrofit their homes with rainwater harvesting systems, or greywater recycling systems.

- Consideration of the Council's position on the re-use of treated effluent as a source of supply. This is an option that Folkestone and Dover Water is planning for at Hythe: FDWS are currently carrying out a water resources study into the potential use of groundwater at the northern end of the Hythe Ranges. Dependent on the raw water quality, a variety of options will be considered including both de-salination of the natural brackish groundwater and the potential to augment this with fully treated wastewater. Under current water resource plans the development of such a source is proposed only beyond 2020.

Council Establishments

The Council may choose to lead by example by employing policies to minimise the unnecessary use of resources in its own buildings, vehicles and in all its activities. This may include a water audit (survey) of council establishments and implement cost effective water saving measures identified. This could include Council offices, and public facilities such as council operated leisure centres, schools etc. Typical activities include:

- Monitor water consumption on a regular basis and compare against benchmarks;
- Encourage water meter readings to be taken on a regular basis;
- Promote the efficient use of water through regular newsletters and publications;
- Make account holders aware of supplier's policy on water leaks;
- Maximise the claims for rebates due to leaks detected and repaired.

Recommended Actions

Due to the strategic nature of water resource zones, *"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"* the absolute amount of water available for use (supply) is not a constraint to development. However, development may be constrained temporarily by the availability, or lack of, infrastructure to move water to new

areas. Dover District Council's interim preferred options have been discussed with the water companies and one particular area of concern has been highlighted.

Folkestone and Dover Water has indicated that growth in the Whitfield area will need to be supported by significant water infrastructure, including a new trunk main, a service reservoir and a booster station, as there is currently no infrastructure in this area. The approximate timescale of commissioning a reservoir is in the order of 2-3 years. This infrastructure would need to be in place before the development can proceed, indicating the possibility of phasing issues with Dover District Council's Preferred Options 3 and 4. Approximate costing details for the new water assets have been provided by Folkestone and Dover Water (£4.5m, as indicated by email *FDWS response to DCC re DDC LDF Infrastructure* 08/10/08). Folkestone and Dover Water has assumed that developers would contribute 25% of the capital cost; a growth fund contribution would also be sought, with the resulting balance funded through regulatory mechanisms (i.e. through customers' bills).

It is recommended that Dover District Council maintains its communications with Folkestone and Dover Water, and Southern Water to enable all three organisations to develop their Plans in line with one another. It is recommended that Dover District Council takes a proactive approach to ensure that the zonal demands for water take account of the demand that will be generated by development in Dover, and that the housing developments and water infrastructure enhancements are planned together, and phased accordingly.

The Council may find it beneficial to develop its own water efficiency strategy for Dover, working with the water companies, to support the development of its own water efficiency policies.

5. Water Quality and Wastewater Treatment

This section uses all available information to determine the capacity of the environment (in terms of water quality of rivers draining the study area and the sea) to receive effluent discharges without detrimental effects or breach of regulations. The main UK and European legislative drivers are discussed followed by an evaluation of the existing receiving water quality. The capacity of the existing wastewater infrastructure, owned and operated by Southern Water, is then assessed in relation to the influence of the proposed growth on both the sewerage network and wastewater treatment assets. Conclusions are drawn with regard to areas or Wastewater Treatment Works (WwTWs) under pressure and recommendations are made in connection to the options available to Dover District Council.

5.1 Water Quality

5.1.1 Natural Characteristics of Receiving Waters

Rivers

An overview of the study area hydrology is shown in Figure 3.3, with a supportive table of rivers, lengths and catchments in Appendix G. These show that there are two principal catchments in the study area: the River Stour which the majority of waterways feed into; and the River Dour in the southern portion of the study area. Whilst the Dour catchment is contained within the study area, the Stour catchment extends significantly inland beyond the study boundary. The Stour estuary is also fed by watercourses running through the marshes to the south of the estuary, including Minster and Monkton Marshes, and Hacklinge Marsh.

Outside of the study area, the Pent Stream discharges to the coast at Folkestone with potential to impact on water quality in the study area's coastal stretch.

Estuaries and Coastal Waters

Only the Stour has an estuary of significant size within the study area; the Dour is classified as a river up to its discharge point into Dover harbour (WFD classification). The Stour has 35km length of tidal river which runs along the northern boundary to the study area and further inland to Fordwich Bridge. At the estuary mouth, it opens to a funnel shape before joining coastal waters in the bay between Ramsgate and Sandwich Bay[5].

[5] From hereon, the term tidal river Stour refers to elongated inshore river stretch; and Stour estuary refers to the bay area.

There is approximately 31km of coastline stretching from the Stour Estuary to the south western edge of the study area, Dover District. The predominant surface currents in the area run eastwards and north-eastwards around the coast. Sediment transport within the area has resulted in a number of depositional coastal features along low lying coastal areas, including the cuspate shingle foreland at Dungeness outside the District (considered to be one of the best examples in the world), and a number of sand bars and shingle spits. There are some areas of intertidal mudflat and saltmarsh at Sandwich Bay and around the Thanet coast, and a number of sandy beaches (including areas of sand dune). The study area also contains some outstanding examples of chalk sea cliffs (especially between Dover and Kingsdown), chalk wave-cut platforms (forming chalk reefs in the lower intertidal/subtidal) and sea caves.

5.1.2 Designations

The legislative drivers for the water resources are presented in Table 2.2. Additional protection is afforded to receiving waters and their dependant habitats which are considered particularly sensitive and/or designated under European legislation. Such sites within the Dover District area, or potentially influencing/influenced by activities (e.g. discharges, abstractions) within the study area, are listed in Appendix G, along with the legislative driver under which they have been designated. A brief summary is provided below.

The tidal Stour is a designated Sensitive Area [Eutrophic] under the UWWTD. If the population equivalent at a WwTW discharging either directly or upstream of a designated Sensitive Area [Eutrophic] exceeds the 10,000 threshold due to growth, then phosphorus-stripping would be required (as currently provided at Eastry WwTW discharging into the Tidal Stour).

There are a large number of designated areas both onshore and along the coast reflecting the study area's high conservation value and important habitat to a range of wildlife. Whilst only Special Areas of Conservation (SACs) and Special Protection Areas (SPAs) are given statutory protection, when Natural England identifies for example Sites of Special Scientific Interest (SSSI) as being in an unfavourable condition, this can drive more stringent discharge consents with investment sought through the water companies periodic review process.

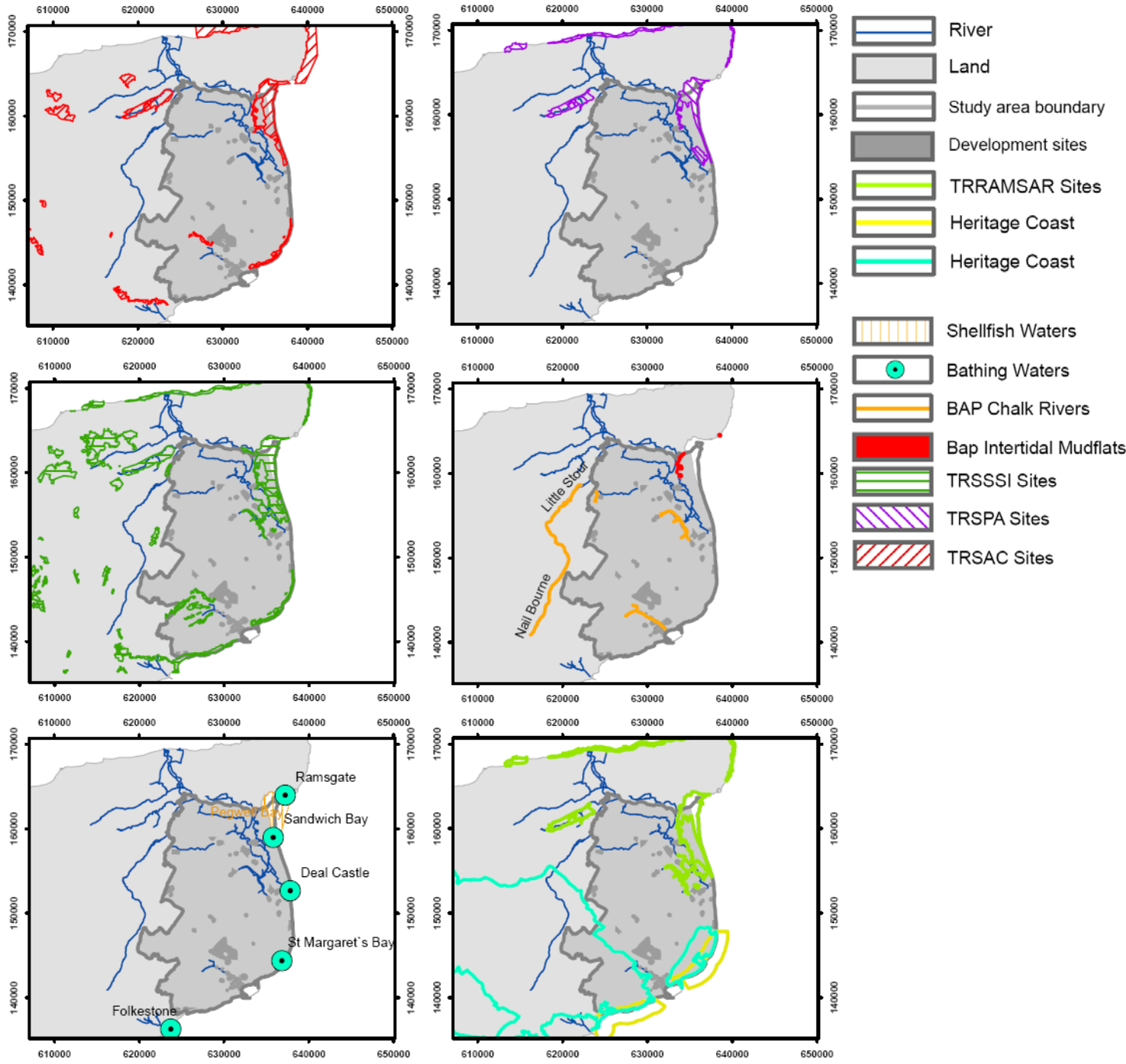
A full list for designations is given in Appendix G. and shown in Figure 5.1. Designated areas effected by receiving waters include the Stour Estuary (SAC, SPA, SSSI, Ramsar); marshes feeding into Stour Estuary (BAP chalk rivers / intertidal mudflats, SPA, SSSI, Ramsar); coastline either side of Dover (Heritage Coast, SAC, SSSI, AONB including extending onshore); and the Dour River and upper catchment (BAP chalk rivers, SAC, SSSI). These aim to protect a large number of species and habitats and those considered to be vulnerable to abstractions and discharges in the upstream catchment are given in Appendix G, Table G3 and Table G4, as compiled from Natural England's Regulation 33 Advice Package for the North East Kent marine sites.

As noted above the SACs and SPAs within the region are Sandwich Bay and the Thanet Coast SAC/SPA, Dover to Kingsdown Cliffs SAC, and Lydden and Temple Ewell Downs SAC. Also in the wider region are Stodmarsh and Dungeness SAC/SPAs, which may also be influenced by increased discharges within or abstractions for the district as they all feed into/fed by water bodies draining the district. In the recent Review of Consents (RoC) under this

Directive none of the abstraction licences and discharge consents within the study area have been identified as requiring a revised consent to protect the designated sites[6] (listed in Appendix G, Table G2). The Environment Agency has also confirmed that the outcome for low priority SAC sites in the wider region (Dover to Kingsdown Cliffs, Folkestone to Etchinghill Escarpment, Lydden and Temple Ewell Downs and Parkgate Down) showed no likely significant effects and no requirement for Stage 3 of the RoC. The outcome for medium priority sites (Sandwich Bay sac, Thanet SPA, Stodmarsh SAC/SPA) was that existing permissions/licences are likely to have no effect on the nature conservation interests; this was confirmed by Stage 4 of RoC. Furthermore, the Water Resources assessment has identified that many of the abstraction licences in this area are subject to "Hands Off Flow" restrictions (Environment Agency, 2003), meaning that during sustained dry periods water is unlikely to be available for abstraction to protect designated sites such as Stodmarsh SPA. The Environment Agency is unlikely to grant further licences to abstract water due to the CAMS status. In fact, the Environment Agency's licensing strategy (under its existing powers) is to secure licence variations when abstraction licences are renewed, to reduce the total volume of water that can be abstracted in areas that are over licensed.

[6] Work is under way on the Dour Alleviation of Low Flows (ALF) scheme. In order to protect flows in the headwaters of the Dour, modifications to the abstraction regime throughout the catchment have been determined and are undergoing implementation.

Figure 5.1 Designated Sites within Dover District



5.2 Environmental Capacity

5.2.1 Rivers (Surface Waters)

The Environment Agency monitors the health of all receiving waters through the General Quality Assessment (GQA) scheme. The scheme provides a snapshot of receiving water quality based on the following aspects:

- Chemistry – water chemistry based on the following key determinands: Biological Oxygen Demand (BOD), Dissolved Oxygen (DO) and Ammonia;
- Biology – based on the biodiversity of organisms living in the river and on the river bed;
- Nitrate – Nitrate concentrations in the water column;
- Phosphate – Phosphate concentrations in the water column.

Appendix G, Table G.5 shows a summary of the GQA grades of river lengths within the study area with a key showing categories.

The Environment Agency's routine water quality monitoring programme changed at the beginning of 2007 to meet WFD requirements, with more risk-based sampling focused at fewer sites. Unfortunately the GQA scheme is not directly comparable with the regime being set for WFD. However it is the WFD standards that will drive future improvements to water quality and ecology of the receiving water and against which the existing and future capacity of the receiving water should be assessed.

Although it is not possible to make a direct comparison between the proposed WFD standards and those used under the GQA scheme, for the purpose of this assessment we have assumed that the UKTAG standard of 0.12mg/l of phosphate approximately equates to the boundary between 'fairly good' and 'good' grades under the GQA scheme.

Based on this assumption and data available for the five sampling sites the GQA data illustrates that 40% of the river reaches are at risk of exceeding the WFD standard for phosphorus. For many rivers a combination of measures that tackle both diffuse and point sources will be required to meet these standards[7].

The water quality of the River Dour in the Dover District has, over the period 2000-2007, been relatively consistently high based on both chemistry and biology. However, the River Stour has an overall poor water quality and biology over the past 9 years, with the most recent measurements of 2006 being the worst. This includes the River Stour at its confluence with the River Wingham; the Little Stour confluence at the Durlock gauging station; and lastly the tidal River Stour confluence at Eastry.

[7] Due to insufficient knowledge / understanding of the link between concentration and ecological status, together with the uncertainty surrounding the interdependencies with other pollutants, particularly phosphorus, UKTAG have not yet derived a WFD standard for nitrogen.

The River Dour at both Wellington Dock (downstream of Buckland Paper Mill) and at the Paper Mill at Chilton has on both accounts good water quality with higher standards than these observed on the Little Stour and Wingham. Whilst the 2006 data show the overall best quality over the last 9 years, nitrate levels appear to be the highest in the record examined with Level 4 assigned (fair); however this is still better than the whole record of the Little Stour and Wingham.

Nutrients are essential for aquatic life, however elevated concentrations (mainly phosphorus and nitrogen) can have a significant impact on the aquatic ecology through stimulating the growth of benthic and microscopic plants. This is known as eutrophication and can result in oxygen depletion, a reduction in water clarity[8] and even fish kills.

Summary Baseline

The WFD initial assessment of water body compliance showed that phosphate, ammonia and dissolved oxygen have all failed standards set in the Stour catchment, supporting the GQA results discussed earlier.

The baseline assessment of GQA data for rivers in the district has demonstrated that whilst the River Dour catchment is in good status, the lower reaches of the River Stour have shown poor water quality both in recent years and historically. The poor water quality mainly relates to nitrates and phosphates and, where data is available, this has also been shown to often relate to poor biology status.

Due to the sparse data examined, it is not clear whether there is deterioration in water quality downstream of the District's WwTWs. The already high levels of phosphates and nitrates in the Stour catchment illustrate the potentially limited environmental capacity of the receiving water to assimilate any additional pollution load. The main failures in chemistry along the Little Stour and the Wingham could partly be attributed to wastewater and private discharges, but again it is important to note that diffuse sources, and particularly runoff from agricultural land, as well as urban areas, as well as climate variability can contribute (to a greater or lesser extent) to these failures.

Phosphorus removal at WwTWs is thought to be an appropriate measure to combat high nutrient levels; an AMP5 scheme is indeed planned for Dambridge WwTW discharging to the River Wingham. However, there is still considerable uncertainty surrounding the ecological benefits of phosphorus removal, since there is little evidence that clearly demonstrates a positive ecological response to a significant reduction in SRP concentrations in the water column in many UK rivers.[9]. It is therefore likely that are range of measures aimed at both point and diffuse sources will be required to meet WFD objectives.

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[8] Eutrophication can also have an indirect effect through changes in biodiversity / community structure and affect food of birds, fish and mammals and also a wider variety of water uses such as water supply, livestock watering, irrigation, navigation, angling, and water sports. Slow flowing lowland rivers in southern and eastern England, such as those draining the study area, are particularly susceptible to elevated nutrient concentrations.

[9] The absence or slow response of the ecology may be due to phosphorus bound in the river sediments. This raises the question of other forms of phosphorus, including sediment bound P, delivered to the watercourse from other diffuse and point sources.

5.2.2 Estuaries and Coastal Waters

WFD Risk Assessment

Whilst current compliance of the Stour Estuary has relied on GQA assessment to date, a more encompassing assessment of estuaries will be provided in WFD following monitoring initiated in December 2007. However an initial risk assessment has been completed for this estuary. Regarding point source pollution, the Stour Estuary has been categorised as 'probably at risk' from Dangerous Substances Directive (EQS failures) and metals, and sanitary determinands; and 'sanitary determinands not at risk' from organic enrichment. Regarding diffuse pollution, it is 'probably not at risk' from nutrients / nitrogen and pesticides (Tributyltin).

Similarly, the coastal waters of the Dover district have been categorised under the WFD initial risk assessment. Regarding point source pollution, the coastal stretch is categorised as 'probably not at risk' from Dangerous Substances Directive (EQS failures) and metals, and sanitary determinands; and 'not at risk' nutrient nitrogen. Regarding diffuse pollution, it is 'probably not at risk' from nutrients / nitrogen; and 'probably at risk' from pesticides (Tributyltin).

Designated Bathing Waters

From 2000-2007, all designated Bathing Waters in the study area, i.e. Sandwich Bay, Deal Castle and St Margaret's Bay, as well as those nearby, i.e. Folkestone and Ramsgate, have passed standards, predominantly meeting the stricter 'guideline' standards. Full compliance results are given in the Appendix G, Table G.6, with summary information shown in Table 5.1.

Table 5.1 Bathing Water Results – Summary Information

Summary Baseline

The baseline assessment of water quality in estuaries and coastal waters in the district has demonstrated a similar outlook to that of rivers. The River Dour appears not to be affecting water quality at nearby St Margaret's Bay

which has consistently attained a 'guideline' (i.e. optimum) standard for the last seven years. Whilst those bathing waters influenced by the Stour runoff do have poorer water quality, recent years have been compliant with 2007 achieving guideline standards in all cases except for Deal Castle bathing waters.

The predicted results under the revised Bathing Water Directive show a similar outcome though with Ramsgate bathing waters slightly improving relative to Sandwich Bay. Also of concern, Folkestone recedes to the 'sufficient' standard. Only 11% of bathing waters in England are predicted to have this classification, and 9% 'poor', the worst case[10]. However these results do not account for wet weather waivers, which allow certain samples to be excluded from the compliance assessment, as per the rBWD Regulations 2008.

5.3 Water Quality Interim Conclusion

Q. Is Water Quality a Constraint to Growth in the Study Area?

The Environment Agency has indicated that it has a presumption against any new discharges into surface waters in the District. It is also expected that the quality of the discharged effluents should not deteriorate due to growth in the region, and indeed should improve over coming years. The WFD's no deterioration policy is expected to apply to all future discharges in the area. As a minimum requirement where proposed growth will cause a breach in the current consent conditions the Environment Agency will require an overall standstill in the load to prevent deterioration in the receiving water quality. The implications are that where flow, through growth, is allowed to exceed the consented flow (through renegotiation of revised flow consents), a pro-rata reduction in the effluent quality will be expected. It is reasonable to expect that the BAT and BATNEEC principles[11] will also apply.

Where there is scope to improve treated effluent quality and achieve load standstill it is unlikely to present a barrier to development. This is certainly the case at Broomfield Bank WwTW (which has a relaxed quality consent as it discharges to the sea) and Weatherlees Hill WwTW where further process optimisation could be carried out. Existing consent conditions are tighter at Dambridge and Eastry WwTWs; however, Southern Water has indicated that effluent water quality could indeed be improved at these two remaining works serving the area. If consents were to be tightened in the River Stour and the Wingham, to meet the requirements of WFD or another driver, far beyond existing levels, then the limited capacity and high sensitivity of these receiving waters might result in the consent being technically infeasible or disproportionately costly to meet. Wider sustainability issues from WwTW expansion or process optimisation (such as increased energy use and carbon costs in relation to use of raw materials) should also be considered when assessing barriers to development, together with the physical footprint of the WwTW and any potential planning issues

[10] http://www.defra.gov.uk/ENVIRONMENT/water/quality/bathing/revision.htm#revised

[11] The tightening of effluent quality standards should not exceed those considered achievable using the Best Available Techniques (BAT). and/or the Best Available Technique Not Entailing Excessive Costs (BATNEEC).

Nutrients in the Freshwater and Tidal River Water

Based on the historic GQA data from the Environment Agency only the smaller Dour catchment consistently achieves or exceeds good quality. Reaches in the lower Stour catchment often fail to achieve river quality objectives. Based on this data the key issue across the Stour catchment in terms of water quality is that of nutrients. The GQA data illustrates that elevated nutrient concentrations (nitrates and phosphates) are widespread across the catchment, as is the case for many rivers in the South East. Phosphorus is a limiting nutrient for plant growth in freshwaters and thus elevated concentrations are likely to adversely affect the trophic (nutrient) status and thus present a potential limit the environmental capacity of the receiving water.

The GQA data also imply that elevated nutrient concentrations may be having a deleterious impact on the biology of the receiving water in the Stour catchment. This is not supported however by the recent Review of Consents under the Habitats Directive, which did not identify any consent conditions to be reviewed in order to protect / restore the integrity of any of the most sensitive environmental receptors, or protected sites downstream of the study area. It should be noted that that the Review of Consents assessed impacts of pollutants on Natura2000 site designated features only. Although nutrients were not critical in this regard, this does not prevent high nutrients from adversely affecting aspects (including biology) that are not designated Natura2000 features. The Natura2000 features may not be the most sensitive to excess nutrients.

Uncertainty surrounding future standards and the programme of measures required to achieve WFD objectives makes it difficult to identify whether the receiving water environment will present an absolute barrier to development. The Environment Agency will set out the programme of measures required to meet the 0.12mg/l standard for phosphorous in the South East River Basin Management Plan. That document will be published in draft in December 2008 and finalised in December 2009 and will seek to tackle both point and diffuse sources and therefore investigations may be required to ascertain the relative contribution in order to target the measures. As part of these investigations the link between the elevated nutrient concentrations and the ecological status should also be assessed to determine the likely environmental benefits of potential measures, which could include the tightening of discharge consents and thus potentially constrain future development. Compliance with discharge consents and WFD's no deterioration policy will ensure the current quality of the receiving water is maintained.

Capacity of the River Wingham

The River Wingham drains a predominantly Chalk groundwater dominated catchment in East Kent. Both the effects of abstraction and discharge have impacted on the ecology of the Wingham. The impacts relating to the discharge from Dambridge WwTW have been exacerbated by the 'in-combination' effect of reduced dilution, due to reduced flow. Although the neighbouring river systems, which have similar morphology and land use, have BAP species, the main River Wingham does not. The Environment Agency's intention is to make the necessary modifications so as to improve the flows and water quality of the river, which will allow the ecology of the river to recover. An indicator of achievement therefore would be the re-population of BAP species. In previous years flow rates on certain reaches of the Wingham have been effectively negligible. Low flows in the Wingham do not

necessarily denote a dry river due to impoundment structures which 'pond' the river water. However, low or no flow is detrimental to the ecology that a Chalk lowland river should support.

Faecal Assessment in the Coastal Waters

The introduction of the revised Bathing Water Directive (rBWD) in 2008 may have some impact on the perceived quality of bathing waters along the coastal stretch of the Dover district. Recent compliance results show that there is little additional capacity for loading at bathing waters Deal Castle, Sandwich Bay and Folkestone. Also the rBWD may introduce greater concern for Folkestone with this still achieving compliance but at a lower grade to Deal Castle and Sandwich Bay.

Water companies have improved sewerage infrastructure in recent years, resulting in improved bathing water quality since 1995. Therefore increased sewerage capacity and loading to the environment will be challenged to help maintain this steady recovery. However diffuse water pollution continues to affect some bathing waters, predominantly faecal pollution arising from agricultural and/or urban runoff. Therefore careful management of the upstream catchment which is mainly characterised by grazing farmland could also help reduce loading to these sensitive areas.

5.4 Wastewater Treatment

This section assesses the likely change in hydraulic capacity associated with the proposed growth options and outlines the current and future planned capacity of the wastewater treatment works (WwTW) that are likely to be affected by this growth. The Environment Agency regulates the quality of effluent discharges to help protect water quality, the environment and human health. This is done through issuing discharge consents which outline the flow rates and water quality standards that must be achieved at the point of effluent discharge.

There are four WwTWs with numeric discharge consents serving the Dover District, one of which is located outside the district boundaries (Weatherlees Hill WwTW). Two WwTW also serve areas outside the district: Broomfield Bank WwTW serving Dover and Folkestone, and Weatherlees Hill WwTW serving Ramsgate, Sandwich and Deal. Figure G.1, Appendix G, presents the WwTW locations and catchment areas. It can be seen that much of the central rural areas of the district are outside the sewered catchments and will be served by cesspits and septic tanks.

Table 5.2 presents the current consent conditions and populations served by WwTWs in Dover District. All WwTWs are owned and operated by Southern Water, the sewerage undertaker for the region. There are also private wastewater facilities serving the Pfizer pharmaceuticals plant near Sandwich; these are not likely to be affected by the proposed growth in the area and have, therefore, not been considered further in this study.

Table 5.2 Current Population and Consent Conditions for WwTWs Serving the Study Area

Site Name		Consent (mg/l) –as 95th percentile				DWF (Ml/d)	
	Total PE	TSS	BOD	Amm. N	Other	Measured	Consented
Weatherlees Hill A WWTW	91,528	35	25	5 (10)*	Upper tier: Cd, Hg, CN, Ag	16.5 (20th percentile)	21.435
Broomfield Bank WWTW	107,650	250	250		Upper tier: TSS: 150; Hg, Cr, Ni, Cu, Zn, Pb	37.668	42.512 (max. vol. 92.448)
Dambridge WWTW**	23,371	30	15		Upper Tier: TSS, BOD	2.609	3.510
Eastry WWTW	2,174	30	15	6	P=1 Upper Tier: Amm.N = 23, P=5, Fe-4	0.246	0.497

*** Winter (November-March) consent value in brackets**

**** Dambridge has a proposed AMP5 P removal scheme. This will have a 2 mg/L mean P standard and 2 mg/L max iron standard. There is also a proposed AMP5 WFD driver ammonia scheme with a 3 mg/L ammonia standard**

PE – Population Equivalent. TSS – Total Suspended Solids. BOD – Biological Oxygen Demand. AmmN – Ammonia (Ammoniacal Nitrogen). P – Phosphorus. Cd – Cadmium, Hg – Mercury. CN – Cyanide. Ag – Silver. Cr – Chromium. Ni – Nickel. Cu – Copper. Zn – Zinc. Pb – Lead. Fe – Iron. DWF – Dry Weather Flow.

5.4.1 Hydraulic Capacity Assessment

The hydraulic capacity[12] of wastewater infrastructure is a function of the physical / hydraulic capacity of assets, both the sewer network and wastewater treatment processes, to receive additional flows. A fundamental factor describing capacity is a treatment works' 'Dry Weather Flow' (DWF), which is a measure of the flow influx to a WwTW derived from human activity (both domestic and trade), but excluding any storm-induced flows.. A similar method, 'Formula A' [13], is commonly used to describe the flow passed forward for full treatment (i.e. not spilling from the sewer network via Combined Sewer Overflows (CSOs) following heavy rainfall): The method for determining DWF and Formula A is presented in Appendix G.

Growth scenarios have been provided as preferred site options 1-4 for Dover District, which can all be mapped to an individual WwTW, therefore future capacity can be assessed on a WwTW catchment basis based on the

[12] There is also a treatment capacity for each works, which is a measure of the capacity of the treatment process to treat additional wastewater. This has not been examined in this study.

[13] The design capacity of a WwTW is commonly defined by 3 x DWF. This is considered a robust representation of the peak demand and should ensure spills are avoided during dry weather conditions. Storage (i.e. storm tanks) should accommodate the remaining flow (i.e. the difference between Formula A and 3 x DWF). Formula A approximately equates to 6-7 times DWF.

calculated DWF. Where significant growth has been identified in a specific location (e.g. Whitfield), the associated drainage area could be examined in a Phase 2 WCS to fully review of the capacity of key assets in the sewerage network (i.e. pumping stations and CSOs) using Formula A. Where insufficient capacity leads to an increase in the spill frequency of CSOs, a parallel assessment on the impact on the receiving water should also be undertaken.

Future growth estimates, as derived based on the following data and assumptions, were used to calculate the additional wastewater DWFs predicted to arrive at each WwTW between 2008-2026:

- The dwelling completions for Options 1-4 as provided by Dover DC;
- The household occupancy rates used by Southern Water (as provided in their draft Water Resource Management Plan);
- A wastewater consumption rate of 170 l/day per person has been assumed to be representative of the whole Dover District (as used internally by Southern Water). This figure provides a basis against which the benefit of metering and water efficiency measures can be quantified;
- A fixed infiltration rate of 40% of consumption (i.e. PG) has been assumed to remain constant and representative in all WwTW catchments;
- 100% of the water supply is returned to sewer (worst case scenario);
- Three main water efficiency scenarios: 120 l/day/head (Levels 1/2), 105 l/d/h (Levels 3/4) and 80 l/d/h (Levels 5/6) based on the CSH publication;
- Future non household contributions have been accounted for by converting the areas occupied by proposed business sites[14] to floorspace, and assuming appropriate water use rates for each business type;
- No allowance has been made for changes in trade effluent contributions (i.e. no trade effluent growth);
- Proposed housing growth in Folkestone (draining to Broomfield Bank WwTW) and Ramsgate (draining to Weatherlees Hill WwTW)[15] was included as total housing numbers to 2026 spread evenly between 2008-2026 to provide phasing.

The combination of 4 preferred options and wastewater demand figures for the 4 WwTW would generate 16 potential scenarios to be explored. However, it is understood that Options 1 and 2 are below the South East Plan targets and, therefore, these scenarios are not presented here. In addition, housing numbers within Options 3 and 4

[14] Dover District Council has provided the proposed locations of employment sites which indicate that any significant commercial development will be located in the northern outskirts of the towns of Deal and Sandwich, in Dover Port and the south and east of Whitfield, with a further employment site at Tilmastone Colliery (north of Eythorne).

[15] It was assumed that 2,550 properties and 4,000 properties would be built within the Folkestone and Ramsgate urban areas respectively. These forecasts were obtained from Thanet and Shepway District Council's websites and personal contacts and should be considered as approximate only and subject to change, as their LDFs are at an early stage.

are only different for the Broomfield Bank catchment; therefore, for clarity the analysis of Options 3 and 4 for Broomfield Bank only, and Option 4 scenarios for each of the other works are presented here. Figure 5.2 presents the calculated additional wastewater DWF arriving at the WwTWs due to growth strictly within the Dover district under scenario 4. Figures 5.3 and 5.4 show the additional wastewater DWF calculations for the Broomfield Bank and Weatherlees Hill WwTW catchments taking into account growth in Folkestone and Ramsgate.

These WwTW specific growth estimates can be used as an indication of the scale of potential increase in incoming flow at a specific works. As expected, due to increasing population, the assessment forecasts a net increase in wastewater flows at all four works; the greatest increases linked to Option 4. It is also obvious that the wastewater flow contributions from growth in Folkestone and Ramsgate result in greater incoming DWFs to Broomfield Bank and Weatherlees Hill WwTWs. Under Option 4 the additional DWF at Broomfield Bank is made up approximately of 80% flow contribution from growth within Dover and 20% from growth in Folkestone. By contrast, the additional DWF at Weatherlees Hill is made up approximately of 35% flow contribution from growth within Dover and 65% from growth in Ramsgate.

Under the worst case scenario (Option 4 including growth outside the district), the additional DWF arriving at Broomfield Bank by 2026 will be in the order of 6 Ml/d, which represents 14% of the current DWF consent allowance (42.5 Ml/d). Considering that the WwTW currently operates at approximately 5Ml/d below its consent limit (see Table 6.2), this would mean that the limit of the consent at Broomfield Bank would be breached. However, Southern Water indicates that there is some spare capacity in the design of the works; therefore, if an existing DWF consent were to be revised coupled with improved effluent quality (e.g. through process optimisation), then the 'no deterioration' principle would be adhered to and no overall increase in load would be achievable.

The forecast additional DFW arriving at Weatherlees Hill A[16] by 2026 is in the order of 3 Ml/d, which represents 14% of the current DWF consent allowance (21.4 Ml/d). As the WwTW currently appears to operate at approximately 5Ml/d below its consent limit, this increase in DWF would be acceptable. Southern Water confirms that there is spare capacity at Weatherlees Hill WwTW.

The forecast DWF increases at Eastry and Dambridge WwTWs are in the order of 0.06 and 0.75Ml/d respectively, representing 12% and 20% of their current DWF consents. As there is some capacity available at the works, these figures are considered acceptable for future works operations. However, as the water quality consent limits are fairly tight for these two works and involve nutrient removal[17], it may be necessary in the future to fine tune or upgrade some of the treatment processes provided in these two WwTWs.

[16] Weatherlees WwTW is divided into two parts, A and B. Weatherlees A is the section that receives flows from Dover District and Ramsgate

[17] Currently only at Eastry, but nutrient stripping will also be introduced at Dambridge under an AMP5 scheme; to be confirmed by the Environment Agency.

It is important to note that any reductions in water consumption through metering, water efficiency measures or any other demand management measures in both new and existing households is not reflected in these calculations, as a constant figure of 170 l/h/d has been used[18]. In reality, the overall hydraulic demand on wastewater services should decrease if demand for public water supply were to decrease due to water efficiency measures and increased household metering (and also due to reducing occupancy rates) [19]. This is explored by the other scenarios developed for this study, which (instead of using the figure of 170 l/h/d) use wastewater consumption figures that match the CSH water efficiency rates of 120 and 105. Figure 5.5 presents the effect of implementing the water efficiency rates under Option 4 and including growth outside the district. It is evident from these figures that significant savings can be achieved; for example, the CSH Level 3/4 water efficiency measures would achieve a decrease of between 35-50% of the predicted additional DWF arriving at WwTWs. The benefits of implementing CSH Level 5 or 6 in water efficiency measures cannot be passed forward to water savings at WwTWs, as to reach such measures rainwater harvesting and greywater re-use, and thus not all the water is accounted for.

[18] Southern Water has indicated that they will not be changing their estimates of wastewater consumption according to FDWS water demand estimates.

[19] However, the lower flow rates are likely to lead to higher strength wastewater (higher BOD, ammonia and solids concentrations) as the per capita biological polluton load will be largely unchanged. This may in turn cause issues with the treatment processes at WwTWs which will have to cope with more biosolids; more sludge will also be generated and need treatment and disposal.

Figure 5.2 Additional Wastewater DWF to WwTWs Due to Growth in Dover District under Option 4

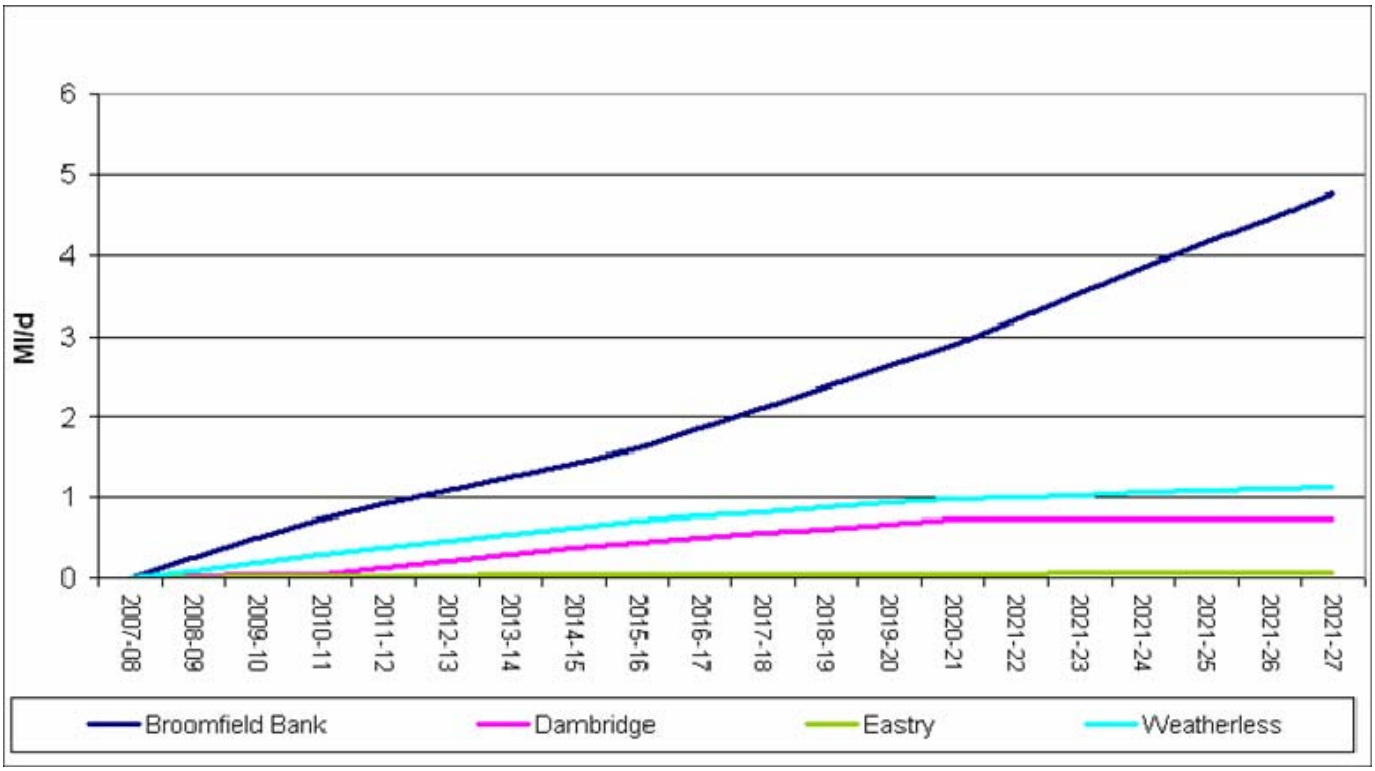
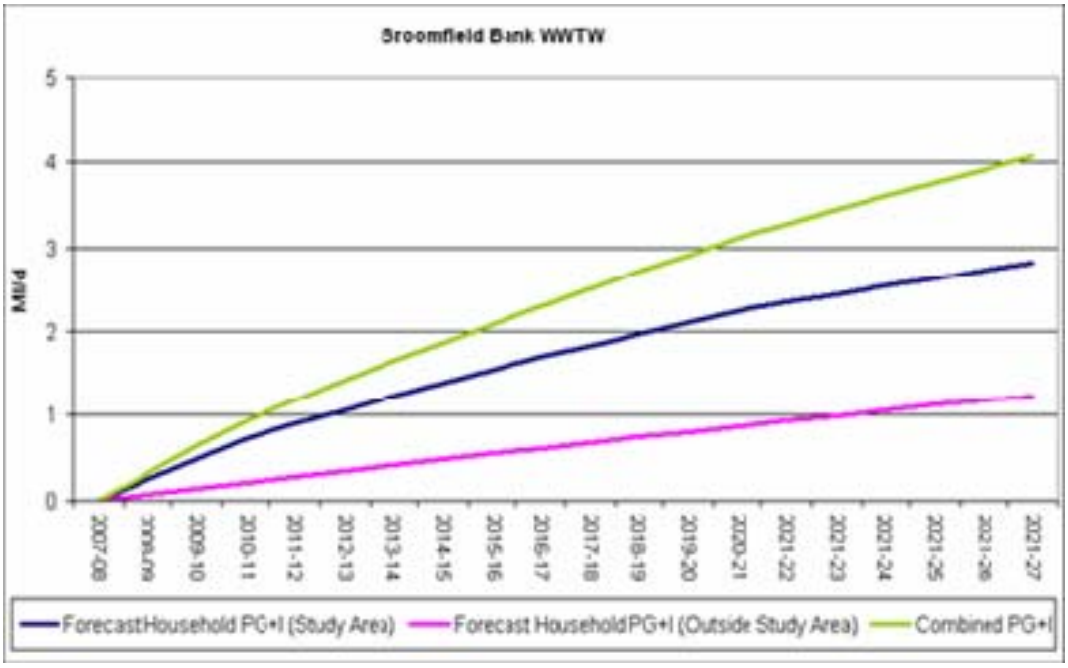
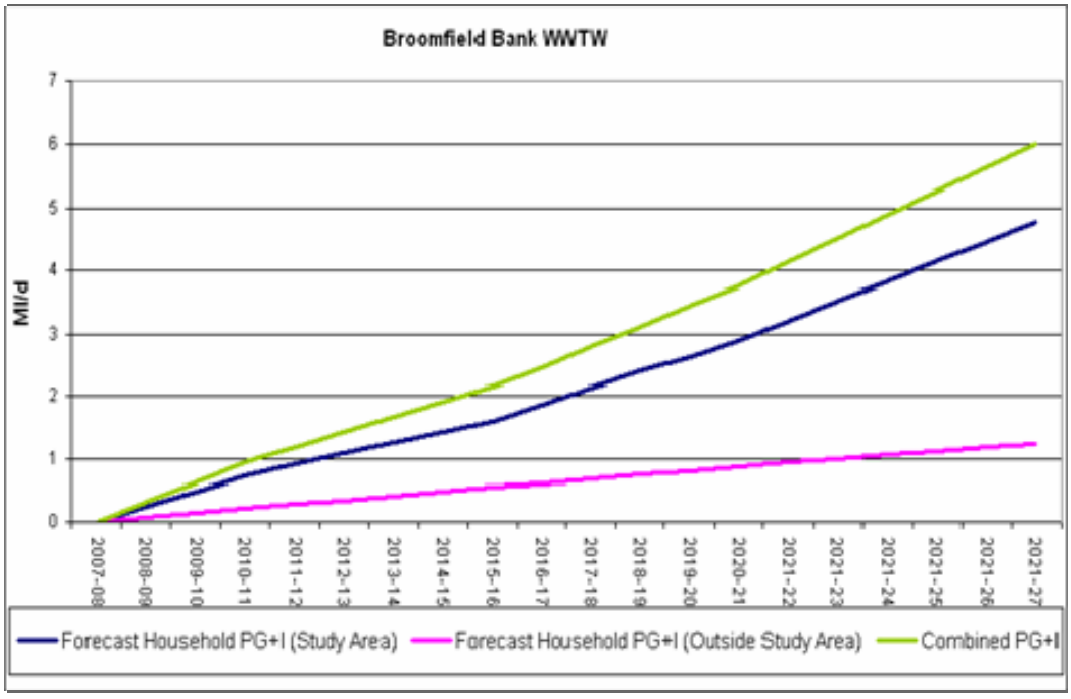


Figure 5.3 Additional Wastewater DWF to Broomfield Bank WwTW (Including Growth Outside District)

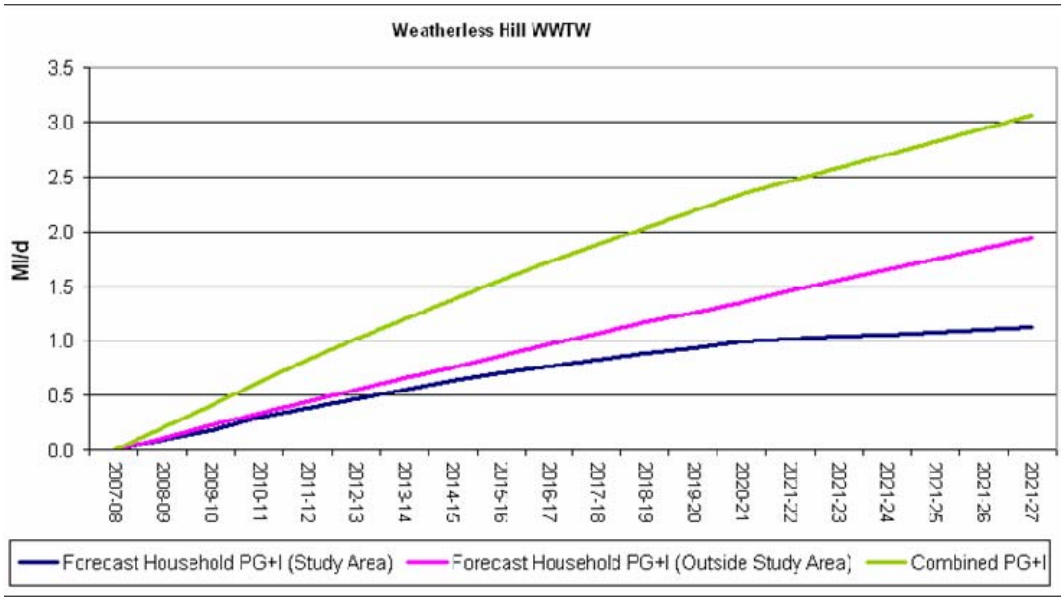


Option 3



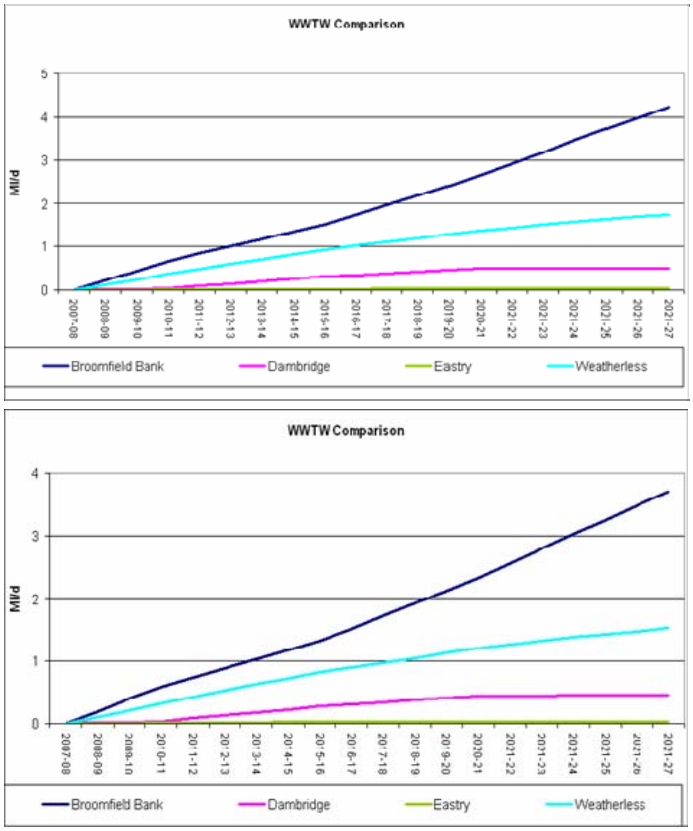
Option 4

Figure 5.4 Additional Wastewater DWF to Weatherlees Hill WwTW (Including Growth Outside District)



Options 3 and 4

Figure 5.5 Additional Wastewater DWF to WwTWs Under Water Efficiency Measures (Option 4, Including Growth Outside District)



CSH Level 1/2: 120 l/h/d/

CSH Level 3/4: 105 l/h/d/

5.4.2 Sludge Management

Wastewater sludge is produced in the treatment of wastewater and also requires treatment and disposal in a sustainable manner. The planned growth in the South East is expected to lead to increased sludge production and potentially affect future sludge management practices in the region. Future expansion plans, as part of the sludge management strategy, concentrate on Ashford WwTW which is becoming a major regional centre for sludge treatment. Investment has been allocated to increase its capacity and enable sludge conversion to other end products (e.g. pellets).

Within Dover District both Weatherlees Hill and Broomfield Bank WwTWs are designated sludge handling centres that are capable of producing a digested sludge cake; however, neither works is a sludge treatment centre (i.e. producing a disposable end product). The nearest sludge treatment centres are located in Ashford and Tenterden. The digested cakes from Weatherlees and Broomfield Bank are currently transported to Ashford WwTW for

further treatment and disposal to agricultural land applications[20]. Although unconfirmed, it is speculated that the sludge from Dambridge is transported to nearby Canterbury WwTW, where it is subjected to a digestion process.

Southern Water has issued a statement[21] that the predicted growth in Dover will lead to additional quantities of sludge being produced. Due to the difficulties and cost of building small scale sludge treatment facilities Southern water will review the future County requirements and if required, build (or extend) an appropriate strategically located facility. In terms of the Dover area there is an existing sludge treatment centre at Ashford that has the capability for being extended, however, it is yet to be determined if additional capacity will be required on this site before 2015. It is intended that the treated sludge in Kent will continue to be utilised in agriculture due to its fertilising and soil enhancing properties.

5.4.3 Sewerage Assessment

Headroom

Headroom in the sewerage network can be defined as the capacity to accommodate additional wastewater flow without breaching the CSO consent conditions or those at the WwTWs or leading to sewer flooding. As the connected population increases, there is generally a proportional increase in the amount of raw wastewater. Discharge consents are set to a certain design horizon and as a result there is commonly a population and flow headroom allowance available in the effluent consent. As the population increases this headroom is eroded and the risk of non-compliance, and thus risk of failing to meet the water quality objectives in the receiving water, increases[22].

Sewerage Network

In 2007 Southern Water carried out assessments of the impact of population growth on some of their sewerage network assets to determine the improvements required to accommodate growth to 2026; this forms part of the PR09 Business Plan submission to OFWAT. Two of these sewerage system assessments were made available to this WCS: one for the Dambridge catchment and one for Broomfield Bank (split into Dover and Folkestone portions) as they are the focus of investment under AMP5. Growth was accounted for as both ‘defined’ growth (known development schemes to 2026, with differing degrees of certainty) and ‘undefined’ growth (long term household and population forecasts). The growth information, together with occupancy rates and allowances for

[20] It should be noted that part of the cakes is mixed with activated sludge liquors and returned to activated sludge treatment plants in the region.

[21] Personal Communication, Paul Kent, September 2008.

[22] As a result headroom is not an absolute value but is defined as the difference between the assessed probability of failure (of a particular asset or level of service) and the maximum acceptable probability or risk of failure.

infiltration and urban creep/illicit connections[23], was used to update and run the sewerage model for each catchment. Any increases in sewer flooding and CSO spills were noted and measures were proposed to improve performance where necessary. The total length of sewers requiring upgrading, as well as the required sewer diameters to convey the additional flows to 2026, were detailed in the assessment reports.

Table 5.3 shows the phasing of 'defined' growth considered in the Southern Water sewerage assessments, as well as the total number of households to 2026. It is evident that the total number of households (5,252) considered in the Dover sub-catchment draining to Broomfield Bank WwTW is lower than preferred Option 4 (in fact slightly lower than Option 3 figures), whereas the household numbers considered in the Dambridge catchment exactly match the Option 4 figures.

Table 5.3 Housing Growth Related to Southern Water's Sewerage Network Assessment in Dover, Folkestone and Dambridge (to nearest hundred)

Sewerage Network	Defined Growth Current - 2009	Defined Growth 2010-2015	Defined Growth 2016-2020	Defined Growth 2021-2026	Total Defined Growth	Total Undefined Growth	Total Number of Households ('defined' and 'undefined' growth)
Broomfield Bank*	2,500 (600)	2,300 (1,400)	1,200 (1,200)	1,400 (1,400)	7,500 (4,600)	2,500 (600)	10,000 (5,300)
Dambridge	100	400	400	500	1,000	200	1,500

* Dover and Folkestone combined (Dover sub-catchment only in brackets)

The details of schemes proposed to accommodate the new development in each sewerage catchment are presented in Table 5.4. It is indicated that a total of 19.5 km of upgraded sewers and upgrading of 8 pumping stations is required within the Dover district. It is highly likely that the increased housing numbers proposed in the Dover and Whitfield area under Option 4 will necessitate further improvements (than those detailed in Table 5.4) in the existing Broomfield Bank network, as well as potentially provision of new assets (e.g. pipework and pumping station) in Whitfield.

Where Southern Water has identified a need for significant capital investment in the wastewater infrastructure, asset plans have been developed which outline the specific upgrade requirements during AMP5. For instance, significant sewerage improvement works are due to take place in AMP5 to accommodate growth in the Dambridge catchment.

[23] Additional storm runoff area of 4m^2 per household was applied to allow for urban creep and future illicit connections.

It should be stressed that the levels of growth proposed in Dover and Whitfield under Option 4 have not been considered in Southern Water's internal assessment of asset capacity in the region (which was based on confirmed developments in October 2007 and approximately corresponds to housing level Option 3). However, assurances were given by Southern Water that subsequent updates of their assessments will consider the level of growth proposed in the revised South East Plan, and management plans will be updated according to the assessment findings. Some increase in sewerage capacity can be met through minor improvement works. Where this is insufficient, an interim application for further funding to meet this demand could be made to OFWAT outside the AMP process. If there is currently sufficient capacity, or significant growth is unlikely to be delivered during this AMP period, Southern Water may seek approval for additional investment to upgrade sewerage assets during AMP6 (i.e. 2016-2020).

For the Whitfield development, local infrastructure is likely to require funding from the developer. This could be either through a requisition process, under the Water Industry Act 1991, or due to the size of the development, there is potential for infrastructure funding from the Growth Point funding, coordinated by Dover DC. The Council would later be repaid by developers when individual developments connect to the network. This option would secure the designing and installing of the infrastructure in sufficient time ahead of development. The wastewater assets could then be adopted by Southern Water at a later date or an inset appointment[24] could be considered to encourage the developer to embrace sustainable water management principles

Table 5.4 Proposed Schemes Related to Southern Water's Sewerage Network Assessment

Sewerage Network	Model nodes that showed increased flooding	Total length (m) of sewers to be upsized (to 2026)	Total pumping stations to be upgraded	Other modelled impacts
Broomfield Bank*	168 (40)	25,241 (11,002)	11 (4)	Increase of 25% in peak flow at Elizabeth Street during 3DWF (Dover subcatchment only) Increase of 45% in peak flow at WWTW during 3DWF (Folkestone subcatchment only)
Dambridge		8,543	4	Increase of 124% in peak flow at WWTW during 3DWF

* Dover and Folkestone combined (Dover sub-catchment only in brackets)

[24] An inset agreement (or arrangement) could be made, without direct involvement of the water companies. This could be set up, for example, for part (or all) of the Whitfield developments, whereby private wastewater treatment facilities are commissioned by the developers to treat wastewater from Whitfield and obtain a discharge consent from the Environment Agency. Another alternative would be for the developer to be responsible for the foul drainage with a commercial arrangement with Southern Water to receive wastewater flows to an existing WwTW catchment (Broomfield Bank)

Combined Sewer Overflows

There are 11 active CSOs within Dover District, which intermittently discharge diluted wastewater into surface and coastal waters and are regulated by Environment Agency discharge consents[25]. The location of all CSOs is shown in Figure G.2 Appendix G. Southern Water has stated that no CSOs in the region were facing compliance or other operational problems. Where expansion of the sewerage network is planned due to future growth, Southern Water should assess overflows and plan improvements to avoid deterioration in their performance. CSO performance should be monitored to ensure planning is successful. Southern Water undertake regular wastewater asset assessments and modelling exercises which include CSO operation and are able to highlight any need for improvements. The Environment Agency also investigates sewer flooding problems; sewer overflows are the subject of an ongoing study in the Dover District.

5.5 Wastewater Infrastructure Assessment: Discussion

The current consent conditions at both Broomfield Bank and Weatherlees Hill WwTWs were agreed within the last 10 years (as these works have had new treatment processes installed in recent years). Design of the works was based on meeting the requirements of the UWWTD; however, Southern Water stated that considerable headroom was built in the design of the works to allow for growth in the areas served. If the spare capacity at Broomfield Bank were to be significantly exceeded, expansion of the works would be difficult and expensive to implement as most of the treatment processes are built underground. Environment Agency compliance monitoring data for the last two years has shown no compliance exceedances for any of the WwTWs in the district. Southern Water has stated that there are no known compliance or performance issues with any of the four WwTWs; therefore, there are no plans to invest in wastewater treatment improvements during AMP5.

The capacity assessment (section 5.4.1) indicates that growth within Dover under Option 4 by 2026 would lead to increased wastewater DWFs of up to 4.9Ml/d at Broomfield Bank (or 6Ml/d including growth in Folkestone), up to 1.1Ml/d at Weatherlees Hill (or 3Ml/d including growth in Ramsgate), up to 0.75Ml/d at Dambridge and 0.06Ml/d at Eastry. These potential requirements for gradual increase in WwTW capacity over the next 20 years (and assuming no benefits from water efficiency measures) are considered acceptable and should be able to accommodate within the existing design of the works and through the AMP funding process in the next 3-4 AMP cycles.

The Water Quality Assessment advises of the WFD no deterioration policy that is designed to ensure that there is no impact on the receiving water quality. The Agency's national permitting centre has stated (*Personal Communication.*, October 2008) that any exceedance of flow consents is likely to lead to pro-rata reduction in the water quality standards to ensure no overall increase in the consented effluent load. As flows approach or exceed the current consented flows, Southern Water will be required to renegotiate consent flow conditions with the

[25] CSO consents are often set as a maximum number of spillages/events in a given year (rather than volumetric consents).

Environment Agency, whilst maintaining or improving the quality consent conditions. A cost benefit analysis should also be conducted to ensure any change in consent conditions is sustainable in terms of both cost and wider environmental impacts, such as increased use of raw materials, energy and carbon costs.

The new water quality targets could be met through optimisation or upgrading/expanding existing treatment processes. There is considerable scope to optimise existing processes, particularly at Broomfield Bank and Weatherlees Hill WwTWs which currently comply with relatively relaxed quality standards. Nutrient stripping at Eastry and Dambridge WwTWs could also be further optimised. More detailed assessments of the WwTW operation and performance would be required to determine the exact level of improvements needed at each works; assessments should include not only the treatment processes but also the storm tanks design and capacity, the inlet and screen capacity, and the operation and storage facilities at pumping stations.

The proposed development in the Dover Town and Whitfield area will necessitate upgrades to the capacity of the sewerage network. This has been confirmed by Southern Water's internal assessment. Similarly, sewerage network improvements have been proposed and will be implemented (under AMP5) in the Aylesham/Wingham area. Although no details were obtained, it would be reasonable to expect some sewerage works in the vicinity of proposed housing in the Deal and Sandwich areas as well. Most of the necessary works will be to provide local sewers, upgrade trunk sewers and increase pumping station capacity; the proposed development areas that fall outside the existing sewer network are shown in Figure G.1 Appendix G.

The above improvements to increase the capacity of sewers and treatment works at a strategic level can be funded through the normal regulatory mechanism and with contributions from developers requesting to connect to Southern Water's mains sewer. Local infrastructure is the responsibility of the developer who will be expected to fund a connection to the trunk sewerage system at a point of adequate capacity via a requisitioning process, as outlined in the Water Industry Act 1991. Trunk sewer improvements will be funded by Southern Water via the Ofwat periodic review process. Developer contributions will be sought where local infrastructure is required to connect to the trunk mains, so that existing customers should not the fund costs associated with new development through an increase in sewerage charges. A potential option for the Whitfield area, which –as a 'whole site' development– would benefit from designing and installing wastewater infrastructure well ahead of development construction, could be to obtain funding from the Government's Growth Point fund, which can be managed by Dover DC and repaid by developers as and when individual properties connect to the network[26]..

[26] The wastewater assets could then be adopted by Southern Water at a later date or an inset appointment could be considered to encourage the developer to embrace sustainable water management principles.

5.6 Wastewater Assessment: Interim Conclusion

Q. Is Wastewater a Constraint to Growth in the Study Area?

Despite the high level of proposed development under Options 3 and 4, relatively small increases in wastewater flows are forecast across much of the study area. The capacity of the existing wastewater infrastructure at the treatment works is sufficient to meet much of the proposed increase in residential properties. However, Broomfield Bank and Weatherlees Hill WwTWs are expected to see small increase in incoming flows due to growth not only in the urban areas of Dover District but also in neighbouring Folkestone and Ramsgate. The increase in flow projected from the non-household/employment site demand should also be considered when choosing the location of some of the larger scale development as it has the potential to further increase future capacity requirements on individual WwTWs and particularly the sewerage network. The analysis undertaken in this assessment also indicates that the reduced occupancy rates and per capita consumption, e.g. through implementation of water efficiency measures, may offset much of the increase in wastewater DWF associated with growth.

Sewerage assessment has highlighted the need for investment in the early stages of development to provide the required upgrades to the sewer network and pumping stations serving the Dover and Whitfield areas. Southern Water, the sole sewerage undertaker in the study area, has adopted a proactive approach to growth planning and will be updating their asset management planning to achieve consistency with the population growth projections that form the basis of this assessment. This will allow specific investment requirements to be identified to meet capacity targets in the sewer network and key WwTWs. Developer contributions are likely to be sought for the required local infrastructure serving individual developments between the development and the trunk sewerage system, so that existing customers do not end up paying for the new infrastructure. For Whitfield, one option suggested is for the Council to coordinate the necessary infrastructure ahead of development using Growth Point funding, and to reclaim the costs from developers as individual sites connect to the network. The feasibility of conveying flows to the treatment works should be considered in identifying preferred sites.

Recommended Policies

New and improved strategic sewerage infrastructure (trunk mains and pumping stations) will be required to meet the demand from the proposed growth and will be required to be in place before development begins. It is recommended that the Council provides a policy to ensure that mechanisms are in place so that the infrastructure can be designed and permitted in time with the proposed development.

For improvements to local sewer networks, developer contributions are likely to be sought. This message should be highlighted in the Council's Core Strategy.

All new infrastructure provided should be designed to be efficient and sustainable, including provision of separate foul and surface water sewers.

Recommended Action

To ensure the timely development of some of the larger proposed development sites, for example Whitfield, it is recommended that the Council outlines a mechanism for funding and delivery of the required local sewerage infrastructure in advance of the development, through ongoing stakeholder engagement between Southern Water and developers.

6. Flood Risk and Sustainable Drainage

Flood risk and drainage of surface water are intrinsically linked, with many cases of flooding caused by heavy rainfall events leading to local drainage systems reaching their capacity. It is therefore an important consideration of future development to control surface runoff to prevent increased flood risk, both at new development sites, and at locations downstream in the river catchment and drainage catchment. This section outlines the national policies in place for controlling flood risk from surface drainage and highlights opportunities for maximising the drainage systems across the District.

Flooding from rivers and tidal sources are dealt with in detail in a Strategic Flood Risk Assessment (SFRA), which has been produced by JBA Consulting (September, 2007) on the behalf of the Council. The study looks in detail at the proposed site allocations with regard to flood risk, and therefore to avoid repetition of this work, a brief summary of fluvial and tidal flood risks is presented within this section prior to discussion of surface drainage and flood risk. The reader is referred to the SFRA report for more detailed information on fluvial and tidal flood risk and future development allocations. Along with the Water Cycle Study, the SFRA report will form one of the Local Development Documents to be used as an evidence base for the Local Development Framework.

6.1 Summary of Fluvial and Tidal Flood Risk

6.1.1 Tidal Flood Risk

The main source of flooding to the district is from tidal sources from the English Channel coastline bordering half of the district. Historically development has been on the coast at Dover, Deal and Sandwich, with mainly rural land uses inland. Tidal flooding can be caused by a range or combination of the following: high tide levels; storm surge; exceptional wave heights; combined fluvial and tidal events. In general much of the District is protected from sea level flooding by the steep Chalk cliffs.

Flood defences are located at various sections of the coast where there are shallow or an absence of cliffs. However, failure of defences can cause the most hazardous flood events due to a sudden flow of seawater. Flood risk behind defences is generally considered to be a residual risk as in defended areas the land behind the defences is protected so long as the sea level remains below the level of the tide. Parts of north Deal lie at residual risk from flooding of the coastal sea defences.

The Stour Catchment Flood Management Plan covers the entire district and advises that sea level rise as a result of climate change, and the associated tidal risk present major issues for future flood risk management, highlighting Sandwich and Deal as being at potential flood risk. Sandwich is at risk from tidal flooding of Pegwell Bay and also a combination of fluvial and tidal flooding from the River Stour and the associated marshes of the Richborough Streams.

6.1.2 Fluvial Flood Risk

Although less extensive than the tidal flood risk, there is a risk of fluvial flooding in the District from the River Dour through Dover, the River Stour through Sandwich and its tributary the River Wingham through Wingham and toward West Stourmouth. The River Dour is a relatively small flowing river and as a result the associated flood risk zones are closely contained to the river channel. Nevertheless, the river has been culverted as it flows through the centre of Dover, and the urban development within the river floodplain is at potential risk from storm events and flooding.

Much of the land around Sandwich is low-lying and comprises marshy areas of the Stour estuary. These areas are potentially at risk from both or a combination of fluvial and tidal sources. Figure 6.1 indicates that most of the flood risk area corresponds with the low lying drainage area of Ash Level and Richborough Stream in the Stour Marshes. Developments that lie partly within Flood Zone 3 and will require a site specific Flood Risk Assessment have been highlighted and are listed in Table 6.1. More detailed information on the flood risk to each specific allocation is provided in the Dover SFRA (JBA Consulting, 2008).

Figure 6.1 Environment Agency Flood Zones in District

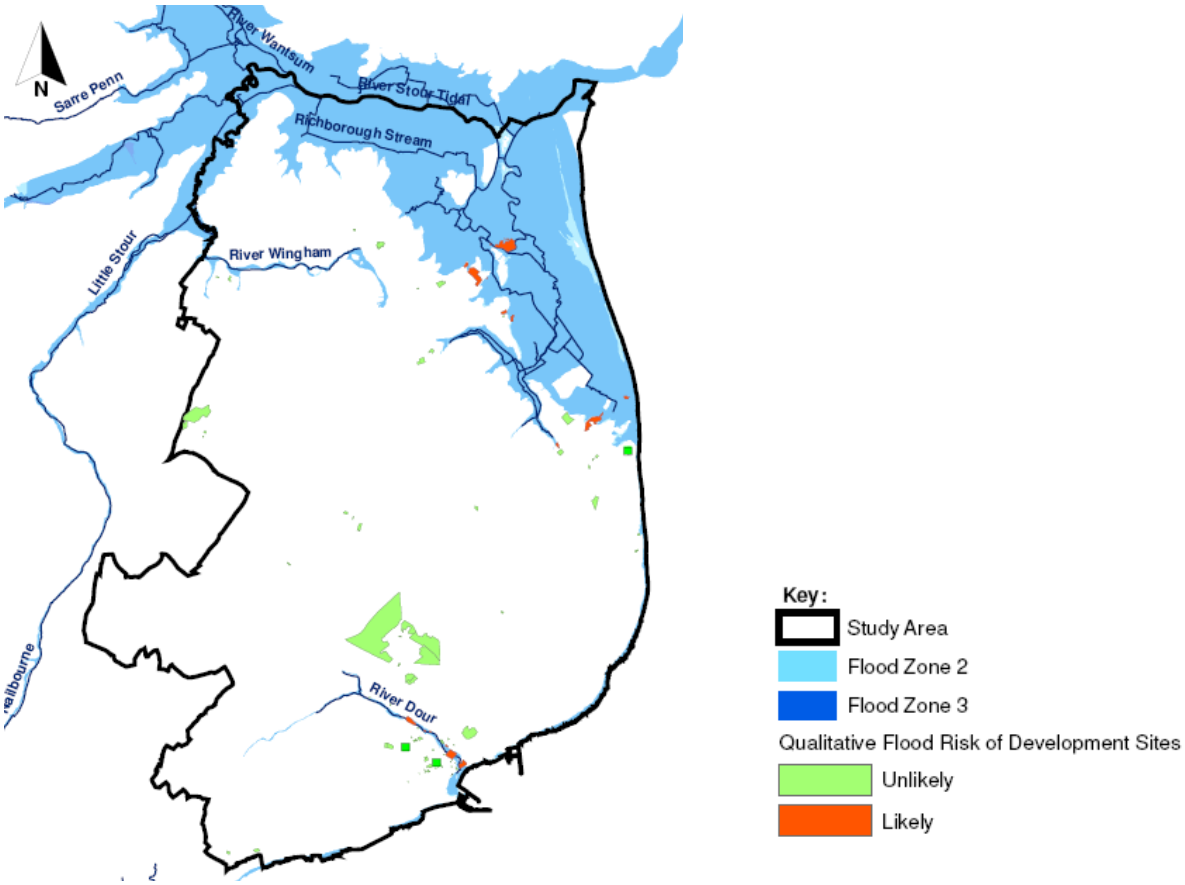


Table 6.1 Proposed Allocation in FZ3

Proposed Development Allocation	Proposed Housing Numbers
Reliance Garage, Beaconsfield Road	9
Land adj to & rear of 21 Cherry Tree Avenue	10
Art School, The Paddock	22
38 Castle Street	5
West of Pillory Gate Wharf, Strand Street	9
The Bargain Shop, 68 Dover Road	5
Land n of River Stour, Ramsgate Road and part of Sandwich Ind Estate	247
St James's Area	53
Eclipse Recovery Services and Sorting Office, Maison Dieu Road	24
Factory Building, Lorne Road	17
Mid Town Area	200
Buckland Paper Mill, London Road	300
Cannon Street	20
Stalco Engineering, 126 Mongeham Road	36
Land to the East of Jubilee Road, Worth	15
Land to the west of St Bart's Road	100
Sunnyside Nurseries, Woodnesborough Road	37
Land between Deal and Sholden	290
Land to the east of Jubilee Road	15
Bisley Nurseries, The Street	50

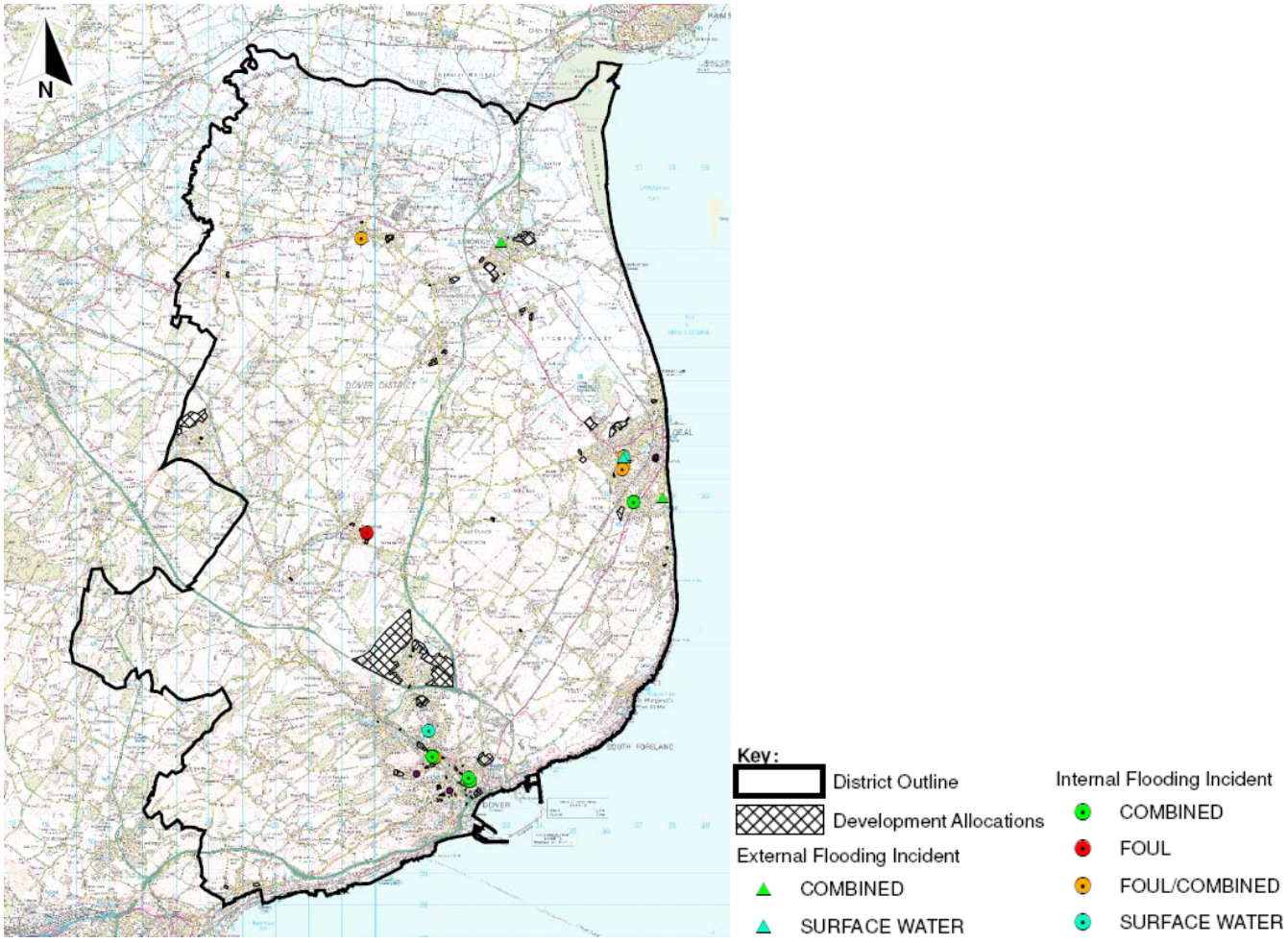
6.2 Surface Water Runoff

In urban areas, impermeable surfaces replace the natural ground surface resulting in increased conveyance of rainfall runoff into drains, rather than naturally infiltrating into the ground. The rate and volume of rainfall runoff from these areas can increase and exacerbate flooding by reaching river systems quicker than in a natural environment, and through exceeding the capacity of conventional piped drainage systems. In many areas, drains are designed for both surface water and foul water, and should these reach capacity ahead of heavy rainstorms, the risk of sewage flooding can be high.

Most of the District is generally rural and underlain by permeable Chalk, such that runoff rates will naturally be low and infiltration of rainfall will be high. Within urban areas, however, and where drift and soils are made of clay material, runoff rates will potentially be higher.

Within Dover District, records of urban flooding have been recorded in Aylesham, however a growth scheme for the drainage network is underway. Southern Water has provided records of drainage flooding from both surface water drains and sewers, which are presented on Figure 6.2. The figure shows that in the past there have been incidents of drainage flooding in Dover, Deal, Sandwich and isolated incidents in Ash and Eythorne.

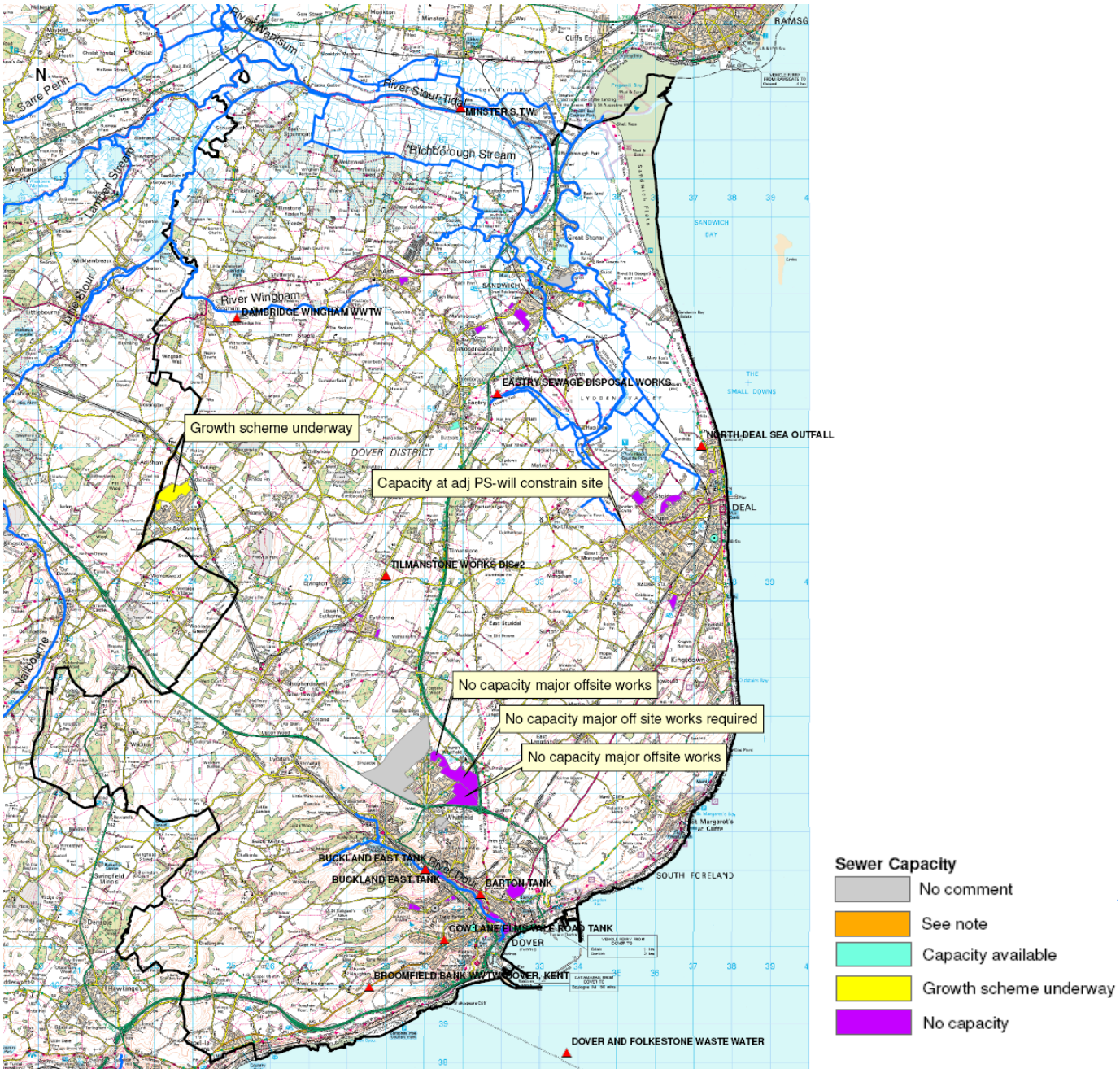
Figure 6.2 Records of Sewer Flooding from Southern Water



Furthermore, Southern Water provided feedback to the Council on the proposed site allocations regarding infrastructure and capacity issues for new development. A summary of the comments supplied is displayed in Figure 6.3 below. It should be noted that while there are capacity and infrastructure issues associated with some

parts of the development, the regulatory mechanisms for providing sewerage will address these issues for the Dover site allocations. More information on sewerage and infrastructure implementation is discussed in Chapter 5.

Figure 6.3 Southern Water comments on Site Allocations



6.3 Sustainable Drainage

In order to minimise flooding resulting from heavy rainfall and drainage constraints, development plans must consider the potential runoff and discharge rates from potential development sites, as well as consulting with the sewerage undertaker to determine existing capacity of the drainage network. PPS25 states that all developments greater than one hectare must provide a Flood Risk Assessment which considered surface water management for the development to prevent increased flood risk from surface drainage.

The Government's Water Strategies *Making Space for Water* (2005) and *Future Water* (2008) and the requirements of the Water Framework Directive require a more sustainable approach to drainage. In these documents Defra highlights the benefits of sustainable drainage systems as an alternative approach to traditional piped systems. Defra is promoting SuDS as a natural drainage process with the characteristics of storage, slow conveyance and some volume reduction.

In Dover, most developments drain into conventional piped networks, either combined (foul and surface water) or surface water only (i.e. rainfall). As discussed above, conventional drainage has the potential to cause flooding in urban areas when rainfall runoff exceeds the drainage capacity. This section examines sustainable drainage in the study area with respect to surface water management and drainage.

Regional planning statements and the Environment Agency promote the use of Sustainable Drainage Systems (SuDS). The aim of SuDS is to mimic the natural drainage as far as possible by:

- Controlling runoff at source;
- Improving water quality by treating runoff and removing pollutants prior to discharge off site;
- Enhancing the amenity value of a development;
- Encouraging groundwater recharge; and
- Integrating with the environmental surroundings.

This section provides an overview of the benefit of using SuDS , the planning context for sustainable drainage and high level guidance on the suitable techniques in relation to the Dover District and hydrological characteristics. Whilst the primary purpose of SuDS is to reduce flood risk and alleviate pressures on drainage systems, where surface drainage is conveyed to via combined drainage systems the use of SuDS and separate surface water systems further reduces pressures on wastewater treatment works.

This assessment does not include an analysis of the hydraulic capacity of the existing surface water management. It is not feasible to develop detailed knowledge of the existing systems or complete specialist hydraulic assessments in the timescale and constraints of this study. However a more detailed assessment focused on the key areas identified for development should form part of the detailed Phase 2 study.

6.3.1 The Benefit of Sustainable Drainage Systems

SuDS are designed to reduce the potential impact of new and existing developments with respect to surface water drainage discharges by using more natural processes to convey surface water away from development. They do this by:

- Dealing with runoff close to where the rain falls;
- Managing potential pollution at its source now and in the future; and
- Protecting water resources from point pollution (such as accidental spills) and diffuse sources[27].

SuDS are often described in a "management train", a series of progressively larger scale practices to manage runoff and control water quality. The management train is:

- Prevention, Application at individual sites, e.g. use of rainwater harvesting, management to prevent accumulation of pollutants;
- Source Control, Control of runoff at or very near to its source e.g. through permeable pavements, green roofs etc;
- Site Control, Management of water in a local area or site e.g. by routing water from building roofs and car parks to large soakaways or infiltration/detention basins;
- Regional Control, Management of runoff from a site or number of sites, typically in a balancing pond or wetland.

6.3.2 Infiltration and Potential for SuDS

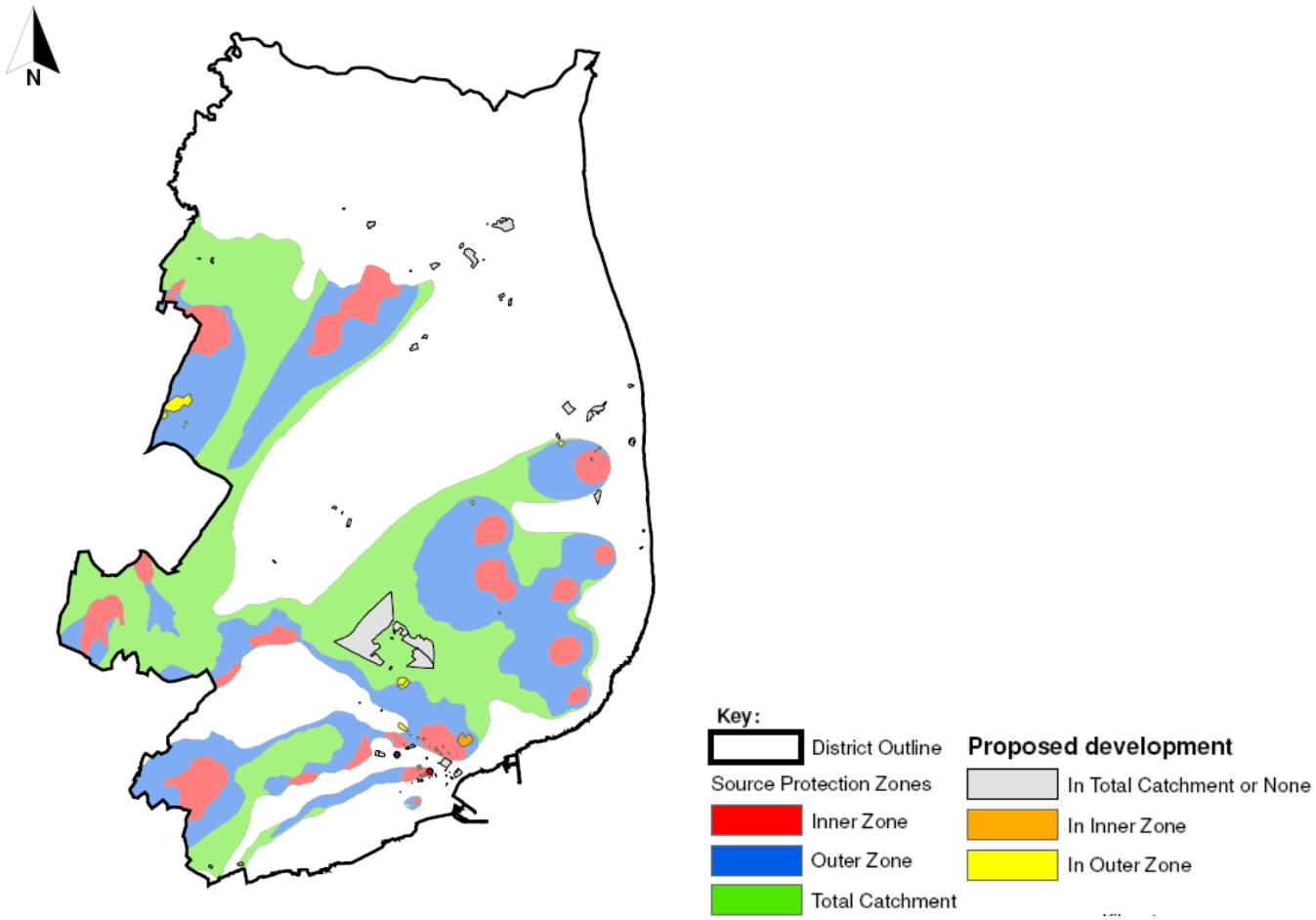
Many SuDS techniques are based on infiltration of surface water into the ground. In most cases any pollutant particles are absorbed and dissipated by vegetation. Infiltration SuDS are best suited to areas overlain by permeable soils, drift and geology. Examples of these drainage techniques are permeable paving, soakaways, infiltration trenches, infiltration basins and swales. Areas of drift free Chalk and sandy soils and drift will generally be suitable for these techniques. Due to the variability of soils and geology however, site specific infiltration tests must be carried out to confirm the feasibility of infiltration drainage. In many cases, infiltration techniques provide capacity for holding back water whilst allowing infiltration to occur, and in this manner also offer storage or attenuation of rainfall runoff.

Furthermore, where infiltration is into an aquifer the risk of contamination must be minimised, particularly where the groundwater is a source of public water supply, as is the case across the District. Additional measures, such as

[27] CIRIA C69; *The SUDS Manual*; CIRIA 2007

oil interceptors, may be required. Source Protection Zones (SPZs) are used to protect groundwater resources from pollutants. In areas designated as SPZs, the location and type of discharges into the water environment are closely controlled. The level of control is most stringent close to the point of abstraction. Figure 6.3 shows the location and definition of the SPZs relevant to Dover.

Figure 6.3 Environment Agency Source Protection Zones



Each SPZ has different requirements for the quality of water that can be discharged into it and consequently the types of development from which runoff may infiltrate. The description of each SPZ, and guidance for the suitability of runoff for each zone (from the CIRIA Report 156: Infiltration Techniques) is presented in Appendix H.

The use of SuDS will be of particular importance in Dover, where the surface water drainage discharges in the River Dour flowing through the centre of the town. Infiltration SuDS will reduce the volume and rate of surface runoff reaching the watercourse during heavy rainfall, therefore minimising the risk of urban flooding.

6.3.3 Attenuation SuDS

Where infiltration SuDS are not feasible, either due to SPZs or limited land availability, non-infiltration (or attenuation) techniques may be more appropriate. Green roofs, rainwater harvesting, wetlands and detention basins are examples of attenuation techniques, although the scope and impact of these are far more limited without infiltration. These examples reduce the rate of surface water runoff by holding back peak flows, following the management train hierarchy of Prevention, Source Control and Site Control drainage techniques.

Examples of a range of SuDS techniques are provided in Table 6.2.

Table 6.2 Examples of Suitable SuDS techniques

SuDS techniques	Description	Attenuation / Infiltration
Soakaways	Grassed trenches that store and dispose of water through infiltration	Infiltration
Permeable Paving	Paving that will permit rainwater to infiltrate into the soil or constructed layers beneath the surface	Both
Infiltration Basins	Depressions that store and dispose of water through infiltration when required during heavy rainfall events. During dry periods the basins remain dry.	Both
Infiltration Trench	Vegetated strips of gently sloping ground that allow infiltration through the base and sides, as well as filtering out silt and pollutants	Both
Filter Strips	Vegetated strips of gently sloping ground to drain water from impermeable surfaces and filter out pollutants, silt and suspended sediments	Both
Swales	Shallow vegetated channels that conduct and/or retain water, and allow filtering of particulates through the vegetation. If unlined these features allow infiltration into the underlying ground	Attenuation
Ponds	Permanently wet basins designed to store water and attenuate peak flows, with permanent bankside and emergent vegetation	Attenuation
Detention Basin	Dry basins designed to attenuate peak flows and store water for specific retention times	Attenuation
Wetlands	Shallow pond systems with aquatic vegetation that allow water to be stored and passed through vegetation for filtration of pollutants	Attenuation
Green Roofs	Vegetated roofs that reduce runoff volumes and rates	Attenuation

6.3.4 Drainage Assessments

As discussed in Section 6.3 above, and as required in PPS25, all developments greater than 1 ha require a FRA (or Drainage Impact Assessment) that takes account of proposed drainage of surface runoff. A list of the proposed site allocations that are greater than 1 ha, and will therefore require a FRA, is presented in Appendix I. Of the proposed

site allocations provided to date, 36 out of 97 allocations fall into this category. Large sites that will potentially have a group of small housing developments should also consider using integrated drainage systems, for example, diverting all of the developments drainage to one attenuation or infiltration system.

A preliminary drainage strategy has already been prepared for the Whitfield development. The report has reviewed a number of drainage options, including traditional piped drainage, a central infiltration basin, cascading infiltration basins and property specific soakaways or boreholes. It is recommended that the preferred option would be to use soakaways at each property, thereby passing ownership and maintenance to each resident. Site specific infiltration tests are essential for this option to determine the variability of infiltration across the site. Although individual drainage systems disperse the maintenance responsibility, a disadvantage of this system can be when properties are unoccupied or if maintenance is not a regular procedure. It may be more beneficial to consider a central infiltration basin, so that management of the drainage system is undertaken by a management company and will be regularly inspected and maintained. More information on management of SuDS is provided in Section 7.3.

An assessment of infrastructure requirements has also been undertaken for the Connaught Barracks development by Scott Wilson (October, 2008). The assessment summarises the condition of the drainage network based on CCTV footage of the foul network, and concludes that the drains may require upgrading and restoration. New drainage of the site is advised to include SuDS, such as green roofs, filter strips, swales, stormwater infiltration, permeable paving, rainwater harvesting tanks, ponds and basins. A cost estimate per household for implementing SuDS suggests that green roofs would comprise the most expensive item, with other SuDS techniques comprising a small proportion of the total potential cost. The assessment is very high level and no calculations of runoff rates or infiltration potential has been undertaken. The WCS recommends that consideration of the underlying SPZ is also taken into account in the final drainage strategy.

6.4 Drainage Interim Conclusions

Q. Is Drainage a Constraint to Growth in the Study Area?

Drainage plans must be integrated to specific developments. Infiltration techniques are likely to be the most suitable where land take is available and with suitable controls in the relevant SPZs. Attenuation techniques should also be incorporated into development plans to slow the movement of surface water through the urban water cycle.

Water efficiency savings from existing and new housing would ease the pressure on the drainage network. Reduced flows within the foul water sewerage network increases the capacity of the existing infrastructure to cope with additional runoff from newly developed land and/or from increased rainfall that may occur as a symptom of climate change.

Unlike water resources which is a regional issue, and wastewater treatment which is managed on a sewage treatment catchment scale, drainage is much more localised and site specific. This Phase 1 Water Cycle Study has examined the general feasibility of infiltration and attenuation drainage techniques relative to the underlying geology of the area. It is not appropriate at this stage to examine drainage in more detail as this requires detailed

information and analysis of site specific surface permeability, rainfall runoff, and hydraulic capacity. It is recommended that such analyses are applied to specific potential development sites in a Phase 2 study. Site specific conclusions and developer recommendations would be of more use at that stage.

Planning Context and Recommended Policies

Information on the Planning Policy Statement 25 (PPS25), relevant to flooding and drainage, and PPS1, delivering sustainable development, is within Section 2.1.1 on National Policy. This section examines how the national policies are relevant to Dover and presents the potential constraints and solutions to development in the area.

The type of land on which development is to be located dictates the amount of runoff that is permitted from development, and how it must be managed. Developments on brownfield, or developed sites, that have conventional drainage infrastructure, are permitted to discharge to the existing drainage system provided flows do not increase. It is likely that development will increase runoff and therefore the additional runoff would need to be managed on site before being discharged into existing drains. However, the surface water runoff rate after development on Greenfield, or undeveloped sites, must not be greater than the runoff rate from the undeveloped site.

The use of SUDS are promoted in all new developments in national, regional and local planning policies and it is recommended to continue this approach in the Core Strategy. The importance of using infiltration SUDS where possible will benefit water resources and recharge to the Chalk aquifer, as well as providing flood mitigation. Furthermore, surface water drainage from all new developments should be provided in separate systems from the foul sewerage in order to reduce flow in the sewerage network and through treatment works.

Adoption of SUDS can be a difficult process, as the sewerage undertakers can’t adopt them under current legislation. Failure to maintain SUDS to the required level could potentially lead to flooding issues. For local authorities to adopt, a funding mechanism is required usually through commuted sums from developers. A Maintenance Plan is usually required under section 106 of the Town and Country Planning Act 1990. It is recommended in the Stage 2 Water Cycle Study that further investigation is undertaken into procedures for SuDS adoption.

7. Integrated Recommendations and Guidance

The analysis in this Water Cycle Study has concluded that the water companies have plans to revise their Water Resource Management Plans to allow for the revised growth targets in the District, which will include plans to secure water supplies over the next 25 years. There are limitations on the water supply in the District, with no water available for increased abstraction licences. Water resources and supply are managed at a much larger scale than the study area and it has therefore been difficult to match the water companies' targets with the District's development targets. However, where possible a comparison of population within Dover compared to WRZs has been undertaken. Even though the EA's CAMS assessment indicates no further water is available, the Water Companies have indicated that future demand can be met through their twin track approaches in their WRMPs for supplying water, which include demand management techniques, reduced leakage and increased efficiency of water treatment works. Water companies will require 6 to 18 months lead time to plan and implement supply pipelines to new developments (time scale depending on their size and location). Environmental impact assessments, potentially including protected species surveys, are required if pipelines are to be laid in currently undeveloped areas. These are likely to result in further delays.

Investment in wastewater treatment is managed in 5 year cycles and therefore the proposed growth targets can be managed more easily.

A summary of the Phase 1 findings and future recommendations are presented below.

7.1 Water Resources and Demand Management

The southern half of Dover District receives a potable public water supply from Folkestone and Dover Water Services (FDWS) (Hills Water Resource Zone); Southern Water (SWS) supply the northern half (Kent Thanet Water Resource Zone). The water resource zones are a function of the mains network and as such do not match up with administrative boundaries; the water companies do not therefore hold detailed information on their forecast demand and growth scenarios for the Dover fraction of the water resource zones. It has been estimated that household water demand in Dover makes up 26% of the Hills Zone household demand and 35% of the Kent Thanet Zone household demand. Household demand in Dover is estimated to increase to represent 37% of the total household demand currently forecast for the Kent Thanet Zone and, similarly, 80% of the current forecast for Hills Zone in 2026.

Drinking water is supplied wholly by groundwater sources from the underlying Chalk in Kent and the EA has identified that all the groundwater sources are over-abstracted. This means that the Agency is unlikely to permit any increase in licensed abstraction volumes for both FDWS and SWS. FDWS plans to enforce compulsory water metering across the majority if its customers under the umbrella of Water Scarcity Status. Future demand must therefore be met firstly by increasing water efficiency and reducing leakage, followed by making more efficient use of existing resources.

Future demand has been estimated on a range of scenarios based on daily household consumption rates provided in the Code for Sustainable Homes (CSH), the Building Regulations, and using data provided in the water companies' draft Water Resource Management Plans. It is difficult to precisely quantify future demand due to unknown effects of water efficiency measures in new and existing homes. FDWS and SWS have informed us that meeting future demand will not constrain development, however the pressure on the water environment and competing demand for supply will depend on the actual levels of water efficiency achieved.

All social funded households are designed to this standard as of April 2008, and all new buildings will be designed to Buildings Regulations Standards which will equate to CSH Level 1 / 2. It is recommended that DDC include policy recommendations for all new developments to meet the CSH Level 3 / 4 with regard to water efficiency in order to reduce the pressure as far as possible on the region's water resources. This would equate to daily per capita consumption of 105 litres. Even with new buildings designed to this standard, future alteration to water fittings may increase water consumption, for example by installing power showers. Retro-fitting water efficiency measures into existing buildings will be equally, if not more, important as the existing housing stock will still make up the majority of demand by 2026.

FDWS has indicated that growth in the Whitfield area will need to be supported by significant water infrastructure, including a new trunk main, a service reservoir and a booster station. The approximate timescale of commissioning a reservoir is in the order of 2-3 years; this infrastructure would need to be in place before the development can proceed, thereby indicating the possibility of phasing issues with DDC's Preferred Options 3 and 4. Approximate costing details for the new water assets were provided by FDWS (£4.5m; email from FDWS to GVA Grimley; 08/10). FDWS assumed that contributions to 25% of the capital cost would be recovered from developers; a Growth Point fund contribution would also be sought, with the resulting balance funded through the regulatory mechanism.

7.2 Water Quality and Wastewater Treatment

The WwTW capacity assessment has highlighted issues surrounding the treatment of additional wastewater DWFs at WwTWs and subsequent discharges to receiving waters. Most forecast that the projected DWF in 2026 can be accommodated within the existing hydraulic headroom. The worst case scenario of Option 4 development, combined with significant growth in neighbouring districts and no benefits from water efficiency measures, shows the need for a small increase to the current capacity of Broomfield Bank and Weatherlees Hill WwTW.

This analysis can be used to highlight the level of upgrades required to accommodate the proposed growth, whilst meeting statutory objectives in the receiving water the WFD's no-deterioration policy. The Habitats Review of Consents has concluded that existing licences have no significant effects on protected sites. However, water quality/nutrient concerns in the River Wingham and the lower Stour (which are designated Sensitive Eutrophic areas) may necessitate the further tightening of discharge consents in the future, particularly if revisions to flow consents were to be negotiated. This may affect the effluent quality standards at Eastry, Dambridge and Weatherlees Hill A WwTWs. Particularly for Dambridge, there will be a requirement to remove nutrients in the

very near future, as there are AMP5 schemes to introduce nutrient stripping. Although there is sufficient headroom at existing sites, and space is available if treatment plants need to be extended to meet the proposed growth, the capacity of the receiving water to dilute the additional discharge whilst maintaining water quality, presents a finite capacity to accommodate additional growth. However, at this stage no attempt has been made to pre-empt potential changes to achieve future targets in receiving water targets (e.g. specific Water Framework Directive measures beyond the no deterioration policy or future changes in designations). The only confirmed scheme currently being promoted by the Environment Agency in the River Wingham, is the introduction of nutrient removal at Dambridge WwTW through AMP5 schemes under the UWWTD driver. Environment Agency staff in southern region have indicated that a pragmatic approach will be adopted that will consider the wider sustainability (e.g. energy and carbon costs) implications of meeting tighter standards in the receiving water.

Wastewater treatment and water quality will not constrain development in the study area. This assumes that full compliance to existing discharge consents is maintained and no new discharges are introduced. However the feasibility of conveying wastewater flows to a WwTW with sufficient capacity should be considered in selecting preferred sites.

It is also important that the implications of Southern Water updated wastewater management plans with the population reflecting a target between Option 3 and Option 4 is considered in the ongoing Water Cycle Study. The spare hydraulic and treatment capacity at the works, coupled with the gradual increase in population over the next 3-4 AMP cycles should ensure that any improvement works needed are planned sufficiently ahead of time and receive adequate funding. Although no compliance issues have been identified, the possibility of tighter discharge consents due to new designations or implementation of the WFD cannot be discounted; however, there is scope for WwTWs of the region to produce even higher quality effluent by optimising existing processes or carrying out relatively small scale alterations/ improvements.

The provision of sewerage infrastructure for, and often ahead of, the planned development is vital since it can lead to long delays and phasing issues in the absence of appropriate planning. Certain proposed development areas are outside the existing sewer network, while proposals for Whitfield and Dover (Option 4) see the introduction of 9,700 properties draining to the same catchment. It is therefore essential that strategic level sewerage upgrade planning is brought up to date, investment is secured during AMP5 and AMP6 to support the extensive improvement works needed in the Dover area, and that the mechanism for local sewerage infrastructure from developer contributions is assisted through policy in the LDF.

Table 7.5 provides an analysis of the potential constraints to proposed development relating to wastewater and water quality in the Dover District. A traffic light system is used to illustrate the significance of components of the water cycle on development

Table 7.1 Potential Wastewater Constraints at Development Sites within Dover District

	Hydraulic Headroom (Wastewater)*					Wastewater Treatment Capacity	Sewerage Capacity	Receiving Water Capacity	Planned Investment	Overall Score Post Investment and Main Limiting Factor
	WwTW Name	Consented DWF (Ml/d)	Measured DWF (Ml/d)	Additional DWF to 2026 - Option 4 (Properties)	Comments					
Dover	Broomfield Bank	42.5	37.6	6 (3700)	Projected DWF to exceed the current DWF consent condition (Option 4) by 2026 due to growth (in Dover and Folkestone).	Good hydraulic capacity, though more may be needed towards the end of the period to 2026 to accommodate Option 4 growth. Would be difficult and expensive to expand if required (as largely underground). Relatively relaxed consent conditions; treatment optimisation should be possible.	Significant improvements required in the next 2 AMP cycles; sewerage planning needs to be brought up to date with growth Option 4. Significant pumping costs due to topography/size of area served.	Large dilution provided by the sea. No consent changes predicted (though it would be possible to improve effluent quality).	No plan to increase WwTW capacity in AMP5 and AMP6 (2010-2020). Some AMP5 sewer improvements planned; further requirements to be identified. Proposed growth may require future upgrade in AMP 7 and AMP8 (2021-2030).	Good capacity currently available. WwWT expansion/treatment capacity should be addressed in AMP6. Significant sewerage upgrade works required. Unconfirmed growth in Folkestone.
Whitfield	Broomfield Bank	42.5	37.6	6 (6000)	Projected DWF to exceed the current DWF consent condition (Option 4) by 2026 due to growth (in Dover and Folkestone).	Good hydraulic capacity, though more may be needed towards the end of the period to 2026 to accommodate Option 4 growth. Would be difficult and expensive to expand if required (as largely underground). Relatively relaxed consent conditions; treatment optimisation should be possible.	Significant improvements required in the Whitfield area; large parts of which are outside the existing network. Sewerage planning needs to be brought up to date with growth Option 4. Significant pumping costs due to topography/size of area served.	Large dilution provided by the sea. No consent changes predicted (though it would be possible to improve effluent quality).	No plan to increase WwTW capacity in AMP5 and AMP6 (2010-2020). Some AMP5 sewer improvements planned; further improvements will be required. Proposed growth may require future upgrade in AMP 7 and AMP8 (2021-2030).	Good capacity currently available. WwWT expansion/treatment capacity should be addressed in AMP6. Very substantial sewerage improvement works required. Unconfirmed growth in Folkestone.

Table 7.1 (continued) Potential Wastewater Constraints at Development Sites within Dover District

	Hydraulic Headroom (Wastewater)*					Wastewater Treatment Capacity	Sewerage Capacity	Receiving Water Capacity	Planned Investment	Overall Score Post Investment and Main Limiting Factor
	WwTW Name	Consented DWF (Ml/d)	Measured DWF (Ml/d)	Additional DWF to 2026 - Option 4 (Properties)	Comments					
Deal	Weatherlees Hill	21.4	16.5	3.1 (1600)	Projected DWF to approach the current DWF consent condition (Option 3/4) by 2026 due to growth (in Dover and Ramsgate).	Good hydraulic capacity, though more may be needed towards the end of the period to 2026 to accommodate Option 3/4 growth. Good treatment efficiency (which could be enhanced to meet tighter effluent quality, if required).	Some improvements may be required in local sewer system (no data provided for WCS). Proposed development largely within existing network.	Discharges to the River Stour Estuary and Sandwich Bay subject to strict regulation by UK and EC legislation. Currently unknown WFD/RBMP implications. No compliance issues (WwTW able to meet tighter consent if required)	No plan to increase WwTW capacity in AMP5 and AMP6 (2010-2020). Unconfirmed sewerage investment. Proposed growth may require future upgrade in AMP 7 and AMP8 (2021-2030).	Good capacity and treatment currently available. WwTW expansion/treatment capacity should be re-assessed in AMP6. Unconfirmed growth in Ramsgate.
Sandwich	Weatherlees Hill	21.4	16.5	3.1 (500)	Projected DWF to approach the current DWF consent condition (Option 3/4) by 2026 due to growth (in Dover and Ramsgate).	Good hydraulic capacity, though more may be needed towards the end of the period to 2026 to accommodate Option 3/4 growth. Good treatment efficiency (which could be enhanced to meet tighter effluent quality, if required).	Some improvements may be required in local sewer system (no data provided for WCS). Proposed development largely within existing network.	Discharges to the River Stour Estuary and Sandwich Bay subject to strict regulation by UK and EC legislation. Currently unknown WFD/RBMP implications. No compliance issues (WwTW able to meet tighter consent if required).	No plan to increase WwTW capacity in AMP5 and AMP6 (2010-2020). Unconfirmed sewerage investment. Proposed growth may require future upgrade in AMP 7 and AMP8 (2021-2030).	Good capacity and treatment currently available. WwTW expansion/treatment capacity should be re-assessed in AMP6. Unconfirmed growth in Ramsgate.

Table 7.1 (continued) Potential Wastewater Constraints at Development Sites within Dover District

	Hydraulic Headroom (Wastewater)*					Wastewater Treatment Capacity	Sewerage Capacity	Receiving Water Capacity	Planned Investment	Overall Score Post Investment and Main Limiting Factor
	WwTW Name	Consented DWF (Ml/d)	Measured DWF (Ml/d)	Additional DWF to 2026 - Option 4 (Properties)	Comments					
Aylesham/ Wingham	Dambridge	3.5	2.6	0.75 (1500)	Projected DWF to approach the current DWF consent condition (Option 3/4) by 2026 due to growth.	Good hydraulic capacity, though more may be needed towards the end of the period to 2026 to accommodate Option 3/4 growth. Good treatment efficiency, which will be upgraded to include nutrient removal through AMP5 schemes.	Some improvements may be required in local sewer system. AMP5 improvements already planned (e.g. Aylesham).	Discharges to R. Wingham receive little dilution; low flow and biology/nutrient issues. Currently unknown WFD/RBMP implications. No compliance issues. P and N removal to be installed at WwTW.	No plan to increase WwTW capacity in AMP5 and AMP6 (2010-2020). Some AMP5 sewer improvements planned. Provision of WwTW nutrient stripping through AMP5 schemes (under UWWTD driver).	Good capacity and treatment currently available. Nutrient stripping to be introduced. Sensitive/eutrophic receiving waters.
Eastry	Eastry	0.5	0.25	0.07 (150)	Projected DWF to be within current DWF consent condition (Option 3/4) by 2026.	WwTW operating below DWF and within consent conditions. Nutrient stripping available (may need adjustment/upgrading, as population served grows).	Small scale improvements may be required in local sewer system.	Discharges to the River Stour Estuary subject to strict regulation by UK and EC legislation. Currently unknown WFD/RBMP implications. No compliance issues (WwTW able to meet tighter consent if required).	No plan to increase WwTW capacity in AMP5 and AMP6 (2010-2020). Unconfirmed sewerage investment.	Good capacity and treatment currently available. Sensitive/eutrophic receiving waters.

Table 7.1 (continued) Potential Wastewater Constraints at Development Sites within Dover District

	Hydraulic Headroom (Wastewater)*					Wastewater Treatment Capacity	Sewerage Capacity	Receiving Water Capacity	Planned Investment	Overall Score Post Investment and Main Limiting Factor
	WwTW Name	Consented DWF (Ml/d)	Measured DWF (Ml/d)	Additional DWF to 2026 - Option 4 (Properties)	Comments					
Rural Sites	Various (or septic tanks)			700		As above (or N/A if served by septic tanks)	Some improvements may be required in local sewer systems (or N/A if served by septic tanks)	Discharges to various receiving waters with issues as discussed above.	No plan to increase WwTW capacity in AMP5 and AMP6 (2010-2020). Unconfirmed sewerage investment.	WwTW and sewerage capacity should be addressed in Phase 2 WCS and AMP6.

7.3 Drainage Recommendations

Due to the site specific nature of drainage requirements/opportunities this study has made high level recommendations that SuDS should be incorporated into development plans, and the environmental issues that control the type of SuDS that can be implemented. Broadly speaking, the potential for using infiltration SuDS is high due to the permeable geology of the District. Conversely, potential for surface water flooding is low, although within Dover where there is urban development over the Dour valley, combined with sewer capacity issues, there is a higher risk of surface water flooding.

There are a number of techniques that encompass the essential elements of SuDS such as green roofs, porous paving and ponds. A key problem highlighted by Defra is that arrangements for managing surface water drainage are split between the Environment Agency, local authorities, water companies, and other agencies, with no one organisation having overarching responsibility. As a result, decisions about new drainage or development investments are often taken without a complete understanding of surface water risks and the most effective solutions. This Water Cycle Study should be used to develop that understanding, and facilitate informed discussion between the stakeholders involved in developing drainage infrastructure. It is recommended that in a Phase 2 Study, areas at most risk of surface water flooding are highlighted for the potential preparation of a Surface Water Management Plan.

New developments should aim to manage surface water runoff in a sustainable manner by considering SuDS as early as possible in the planning process. Each new development greater than 1 ha surface area must prepare an appropriate scale Flood Risk Assessment that demonstrates that SuDS can control runoff rates and volumes from the site to existing runoff rates. These requirements stem from PPS25.

A site specific assessment of ground conditions is needed to determine the most appropriate SuDS for use at the new development. Reference to the SFRA where appropriate will aid the assessment for SuDS suitability. SuDS must be designed so that no flooding occurs at properties at a 1 in 100 year storm event (1% annual probability). A 30% increase in rainfall must be added to the runoff calculations when designing SuDS at both outline and detailed planning application. Priority should be given to SuDS over more traditional drainage systems, and if SuDS are not considered appropriate then justification should be given.

All new developments should aim to direct surface water runoff into infiltration schemes or nearby watercourses/surface water systems that discharge to rivers directly. By using separate surface water sewers, the risk of urban flooding and exceedance of foul sewers will be avoided. This is particularly relevant to developments within the catchments of the Dambridge and Broomfield treatment works, where compliance for meeting water quality targets may be impacted by additional storm flows and as the Broomfield catchment will experience the most development.

A decision to implement SuDS should consider a number of factors including:

- Permeability of the soils and drift;

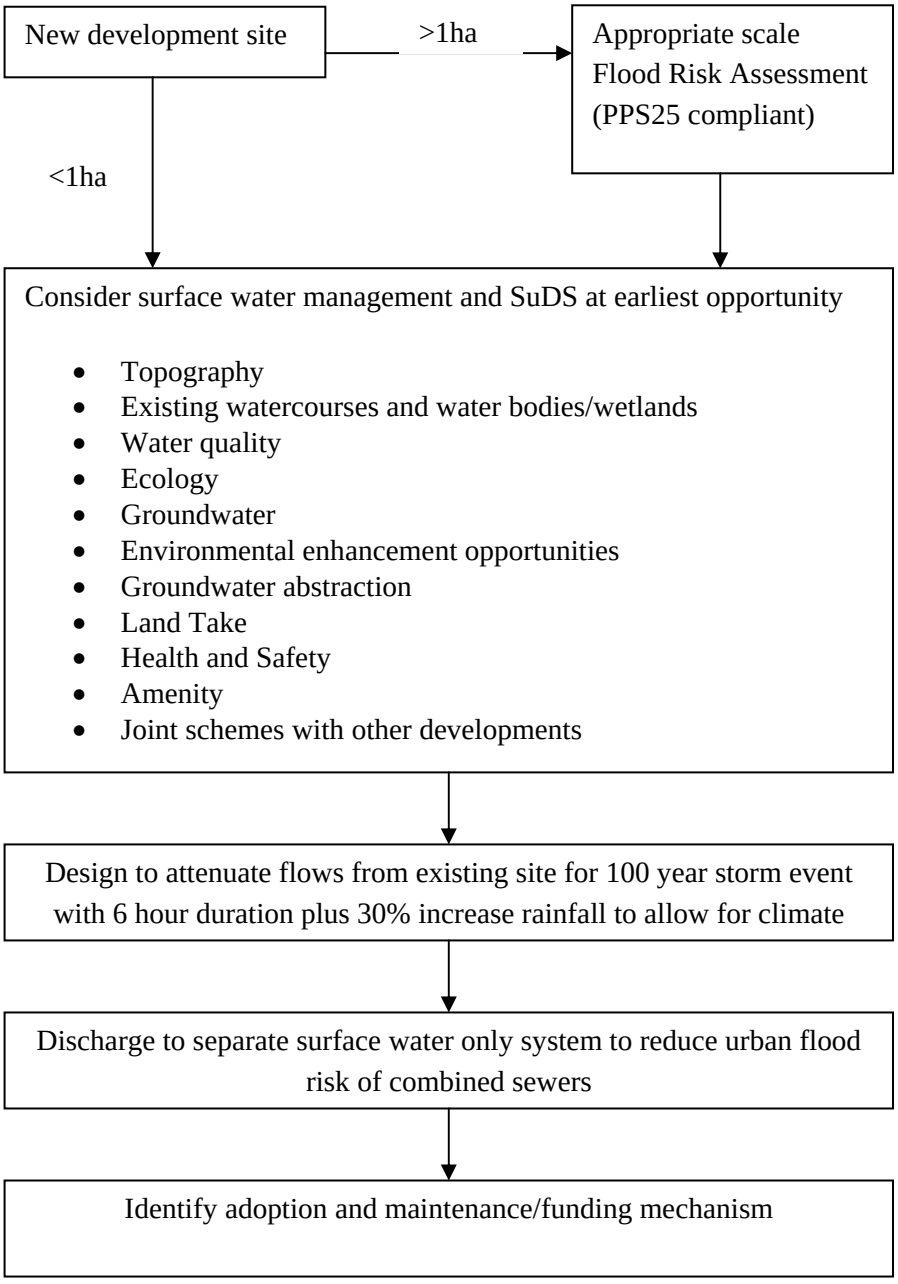
- Proximity of groundwater abstractions to Source Protection Zones;
- Available land take;
- Surrounding land use;
- Site gradients;
- Ecology;
- Economic viability; and
- Safety issues and maintenance.

For developments in close proximity and limited land space, proposals to use offsite attenuation to serve more than one development should be considered. Developers should work together with the Environment Agency, sewerage undertakers and local planning authorities during the design of the surface water drainage for a particular site.

It is important that funding mechanisms are identified at an early stage of the planning process.

A flow diagram of the above recommendations for a drainage strategy for each development is presented in Figure 7.1 below.

Figure 7.1 Drainage Strategy Flow Diagram



7.4 Recommendations for Phase 2 Analysis

The Phase 1 WCS has collated available information at a strategic level to determine potential constraints to development targets in the District. The study has highlighted some discrepancies between the draft WRMPs and the proposed growth targets in the emerging LDF, which will be rectified in the final WRMPS produced by the water companies in 2009. In order to further assist in meeting the development targets and improving the sustainable use and treatment of water in the District, the following recommendations for a Phase 2 WCS are proposed:

- It will be important to reconcile the Water Companies predicted demand and management measures once the WRMP are re-issued and have considered the proposed growth options 3 and 4. The Phase 2 study will review the final WRMP for the Council to identify any new findings. The exact level of investment required in water services to support growth can also be identified by water companies and/or by a Phase 2 Water Cycle Study in 2009;

- With particular reference to Whitfield and also other preferred site allocations, closer consultation with the water companies will identify more detailed issues relating to supply infrastructure, which will be communicated to the Council and developers through the Phase 2 report;

- With policy recommendations in place for water efficiency measures complying with CSH Level 4 as a maximum, water demand in the District will be set to become more sustainable. In the Phase 2 study, more detailed site specific recommendations can be made for implementing and maintaining water efficiency measures, for example through combined site rainwater harvesting and grey water re-use systems;

- Where significant growth has been identified in a specific location (e.g. Whitfield), the associated drainage area could be examined in a Phase 2 WCS to fully review of the capacity of key assets in the sewerage network (i.e. pumping stations and CSOs) using Formula A. Where insufficient capacity leads to an increase in the spill frequency of CSOs, a parallel assessment on the impact on the receiving water should also be undertaken;

- Continued proactive engagement is recommended between Dover DC and Southern Water, once preference for one of the development Options is fully established, to determine the most sustainable options for meeting any potential increase in flows to sewer and WwTWs to 2026. This process can be facilitated in the Phase 2 WCS which can also address any issues from publication of the draft RBMPs in late 2008 and carry out costing of required infrastructure and scheme options;

- The potential for the implementation of SuDS across the District has been identified within the Phase 1 study. In Phase 2, assessments of areas that require integrated surface water management can be achieved, with the aim of producing surface water management plans for the preferred site allocations as recommended in the Pitt Report.

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Appendix A
Glossary of Terms

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Abstraction license	A licence granted under the Water Resources Act 1991, as amended by the Water Act 2003, to abstract untreated water from a source of supply.
Asset Management Period (AMP)	Five year period in which water companies implement planned upgrades and improvements to their asset base. Activities are subject to funding review.
Biochemical Oxygen Demand (BOD)	A widely used measure of polluting potential - a measure of oxygen use, or demand, by bacteria breaking down the biodegradable load in sewage treatment plants or environmental waters.
Biodiversity Action Plan Priority Habitat	Each Local Biodiversity Action Plan works on the basis of partnership to identify local priorities and to determine the contribution they can make to the delivery of the national Species and Habitat Action Plan targets.
Catchment Abstraction Management Strategy (CAMS)	The assessment of how much water can be extracted to meet its many economic uses – agriculture, industry, and drinking water supply – while leaving sufficient water in the environment to meet ecological needs.
Catchment Flood Management Plan (CFMP)	A strategic planning tool through which the Agency will seek to work with other key decision-makers within a river catchment to identify and agree policies for sustainable flood risk management.
Code for Sustainable Homes	Signals a new direction for building standards. Wherever practical DCLG intend to develop and introduce a system of sustainable building standards based on voluntary compliance.
Core Strategy	A Development Plan Document setting out the spatial vision and strategic objectives of the planning framework for an area, having regard to the Community Strategy (see also DPDs).
County Council	The local authority that is responsible for waste and minerals planning functions in non-unitary, and non-national park, local authority areas. A county council may provide advice and proposals on strategic planning issues to the Regional Planning Body.
Department for Environment, Food and Rural Affairs (DEFRA)	Department that brings together the interests of farmers and the countryside; the environment and the rural economy; the food we eat, the air we breathe and the water we drink.
Development Plan Document (DPD)	Details the spatial representation of housing and employment land allocations in response to the regional spatial strategy.
Dry Weather Flow (DWF)	Is a measure of the flow influx to a WwTW derived from human activity (both domestic and trade), but excluding any storm-induced flows
EA flood zone	Flood zones on the maps produced by Environmental Agency providing an indication of the flood risk within all areas of England and Wales, assuming there are no flood defences.
EC Freshwater Fisheries Directive	Protects and improves the quality of rivers and lakes to encourage healthy fish populations.
Environment Agency (EA)	A government body that aims to prevent or minimise the effects of pollution on the environment and issues permits to monitor and control activities that handle or produce waste. It also provides up-to-date information on waste management matters and deals with other matters such as water issues including flood protection advice.
Environmental capacity	The ability of the physical environment to accommodate urban development and population growth without causing a deterioration in environmental quality.
Flood Estimation Handbook (FEH)	Document produced by Centre for Ecology and Hydrology, Wallingford (formerly the Institute of Hydrology).
Flood Risk Assessment (FRA)	An assessment of the likelihood of flooding in a particular area so that development needs and mitigation measures can be carefully considered.
General Quality Assessment (GQA) Programme	The Agency's method for classifying the water quality of rivers and canals is known as the General Quality Assessment scheme (GQA). It is designed to provide an accurate and consistent assessment of the state of water quality and changes in this state over time.
Geographical Information System (GIS)	Is a system for capturing, storing, analyzing and managing data and associated attributes which are spatially referenced to the earth.
Habitats Directive	An EU Directive which seeks to ensure the conservation or restoration of habitats.

Hydro-ecology	The science of water in relation to wetland wildlife habitats and of how plant and animal communities interact with their supporting soil water, surface water and ground water systems.
Interim Code of Practice for SuDS	Document produced by CIRIA, which aims to facilitate the implementation of sustainable drainage in developments in England and Wales by providing model maintenance agreements and advice on their use. It provides a set of agreements between those public organisations with statutory or regulatory responsibilities relating to SuDS.
l/h/d	Litres per head per day
Local Delivery Vehicle (LDV)	Partnership that brings the public and private sectors together to deliver large-scale social, economic and environmental change to deliver the Government's Sustainable Communities Plan.
Local Development Framework (LDF)	A folder of local development documents that outlines how planning will be managed in the area.
Local Planning Authority (LPA)	The local authority or council that is empowered by law to exercise planning functions. Often the local borough or district council. National parks and the Broads authority are also considered to be local planning authorities. County councils are the authority for waste and minerals matters.
Natural England	Is formed by bringing together English Nature, the landscape, access and recreation elements of the Countryside Agency and the environmental land management functions of the Rural Development Service.
OFWAT	The Water Services Regulation Authority. Ofwat regulate how much money a water company can is required to spend over each five year planning period, and regulate the amount of money the water companies can charge from their customers.
OSPAR	The Convention for the Protection of the Marine Environment of the North-East Atlantic.
Per capita	A Latin phrase meaning 'for each head'
Periodic Review or price review (PR)	One of Ofwat's main tasks is to set price limits for the water and sewerage companies in England and Wales. Ofwat do this in order to protect consumers from the monopoly providers of these services. However it is also our duty to enable efficient companies to finance their functions. They make sure that consumers receive reliable services and value for money and that each company is able to meet its environmental obligations now and in the future. We review price limits every five years. Prices were set at the price review in 2004 for the 2005 – 2010. This current price review (PR09) covers the five years from April 2010.
Planning Gain Supplement Obligations	The planning gain supplement is a proposed mechanism by which landowners or land developers will contribute to off site infrastructure.
Planning Policy Statements (PPS) and Planning Policy Guidance (PPG)	Set out the Government's national policies on different aspect of planning. The policies in these statements apply throughout England and focus on procedural policy and the process of preparing local development documents.
Receiving water	Watercourse, river, estuary or coastal water into which the outfall from Combined Sewer Overflow (CSO), surface water or other sewer discharges.
Regional Assembly	Each of the English regions outside of London has a regional chamber that the regions generally call Regional Assemblies (not to be confused with the term Elected Regional Assemblies). They are responsible for developing and coordinating a strategic vision for improving the quality of life in a region. The assembly is responsible for setting priorities and preparing certain regional strategies, including the Regional Spatial Strategy.
Regional Development Agency	The nine Regional Development Agencies (RDAs) set up in the English regions are non-departmental public bodies. Their primary role is as a strategic driver of regional economic development in their region.
Regional Spatial Strategy (RSS)	A broad development strategy for a region for a 15 to 20 year period prepared by the Regional Planning Body.
Restoring Sustainable Abstraction Programme (RSAP)	Identifies abstraction licences causing problems, and reviewed them with the purpose of rectifying the problems by reducing the volume extracted, altering licence conditions, and relocating abstraction points.
Review of Consents Programme (RoC)	As RSA but reviewing impacts of abstractions on designated sites

River Ecosystem class (RE)	Classification which uses a six-fold classification (five RE classes and an unclassified level for the very polluted rivers). This classification reflects the chemical status of the water, as an indication general health of the water.
River Quality Objective (RQO)	Agreed by Government as targets for all rivers in England and Wales when the water industry was privatised in 1989. The targets specify the water quality needed in rivers if we are to be able to rely on them for water supplies, recreation and conservation.
RQP	Environment Agency River Quality Planning Software
S106	A legal agreement under section 106 of the 1990 Town & Country Planning Act. Section 106 agreements are legal agreements between a planning authority and a developer, or undertakings offered unilaterally by a developer, that ensure that certain extra works related to a development are undertaken.
SIMCAT	Catchment based water quality model developed by Environmental Agency.
Site of Special Scientific Interest (SSSI)	A site identified under the Wildlife and Countryside Act 1981 (as amended by the Countryside and Rights of Way Act 2000) as an area of special interest by reason of any of its flora, fauna, geological or physiographical features (basically, plants, animals, and natural features relating to the Earth's structure).
Source Protection Zone (SPZ)	Designated area around public water supply groundwater abstractions to indicate the catchment to the abstraction.
Special Areas of Conservation (SAC)	A site designated under the European Community Habitats Directive, to protect internationally important natural habitats and species.
Special Protection Area (SPA)	Sites classified under the European Community Directive on Wild Birds to protect internationally important bird species.
Strategic Flood Risk Assessment (SFRA)	Document that informs the planning process of flood risk and provides information on future risk over a wide spatial area. It is also used as a planning tool to examine the sustainability of the proposed development allocations.
Strategic Water Resources Plan, or Statutory Water Resources Management Plan (WRMP)	It is now a statutory duty for water companies to prepare, consult, publish and maintain a water resources management plan under new sections of the Water Industry Act 1991, brought in by the Water Act of 2003. This plan is then kept under yearly review.
Super Output Areas (SOA)	A new national geography created by the Office for National Statistics (ONS) for collecting, aggregating and reporting statistics.
Sustainable Drainage Systems (SuDS)	Sustainable drainage systems or sustainable (urban) drainage systems: a sequence of management practices and control structures designed to drain surface water in a more sustainable fashion than some conventional techniques (may also be referred to as SuDS or SDS).
The First Secretary of State	The lead Minister for all policies relating to Town & Country Planning, having powers of intervention on Development Plans and Planning Casework under certain circumstances.
United Kingdom Technical Advisory Group (UKTAG)	Supporting the implementation of the European Community (EC) Water Framework Directive (Directive 2000/60/EC). It is a partnership of the UK environment and conservation agencies. It also includes partners from the Republic of Ireland.
Urban Regeneration Company	A dedicated body through which different people combine to co-ordinate the delivery of urban regeneration projects such as major mixed-use developments.
Wastewater Treatment Works (WwTW)	Separates solids from liquids by physical processes and purifies the liquid by biological processes. Discharge from Wastewater Treatment Works may contain a range of pollutants and need to be carefully monitored.
Water Cycle Study	
Water Framework Directive (WFD)	A European Union directive which commits member states to making all water bodies (surface, estuarine and groundwater) of good qualitative and quantitative status by 2015.
Water Resource Zone (WRZ)	Defined by the water supply/demand balance in the region such that all customers within it receive the same level of service in terms of reliability of water supply.

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Appendix B
Planning Context

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The Planning and Compulsory Purchase Act 2004 came into force from September 2004. This Act amended the Town and Country Planning Act 1990 and, in part, introduced new legislation including a new statutory policy framework for planning. Under Section 38 of The 2004 Act, the determination of planning applications must now be in accordance with the approved development plan unless material considerations indicate otherwise. Other changes to the 1990 Act included the replacement of Regional Planning Guidance with new statutory Regional Spatial Strategies (RSS), the abolition of Structure Plans and the replacement of Local Plans with spatially orientated Local Development Frameworks (LDF). Whilst the Development Plan Documents which make up the LDFs are being prepared interim arrangements exist whereby certain Structure and Local Plan policies will continue to apply provided that upon Direction of the Secretary of State they were saved before 27th September 2007[28]. New statements of government planning policy (PPS) have, and are, being prepared to replace Planning Policy Guidance notes (PPG) and to provide an up to date national planning policy framework.

National Policy

PPS 1 – Delivering Sustainable Development

Planning Policy Statement 1 (PPS1) was published in January 2005 and sets out the Government's overarching planning policies on the delivery of sustainable development through the planning system. The policies set out in the PPS need to be taken into account by regional planning bodies in the preparation of regional spatial strategies and by local planning authorities in the preparation of local development documents. The Government considers Sustainable development is the core principle underpinning planning and in its objectives for the planning system reiterates the four aims set out in its 1999 strategy[29]. These are:

- Social progress which recognises the needs of everyone;
- Effective protection of the environment;
- The prudent use of natural resources; and,
- The maintenance of high and stable levels of economic growth and employment.

National policies and regional and local development plans are seen as providing the framework for planning for sustainable development and ensuring development is effectively managed. The PPS advises that amongst the key principles to ensure development plans and decisions taken on planning applications contribute to the delivery of sustainable development is the adoption of an integrated approach. Regional planning bodies and local planning authorities should ensure that development plans promote outcomes in which environmental, economic and social

[28] Paragraph 1(3) of Schedule 8 to the Planning and Compulsory Purchase Act 2004

[29] A Better Quality of Life - A Strategy for Sustainable Development for the UK 1999

objectives are achieved together over time and contribute to global sustainability by addressing the causes and potential impacts of climate[30].

It advises that in protecting and enhancing the environment planning authorities should seek to enhance the environment as part of development proposals; avoid significant adverse impacts and pursue alternative options. Where adverse impacts are unavoidable, planning authorities and developers should consider possible mitigation measures and where these are not possible, compensatory measures may be appropriate[31].

Development plan policies should take account of environmental issues *such as the protection of groundwater from contamination and the potential impact of the environment on proposed developments by avoiding new development in areas at risk of flooding and sea-level rise, and as far as possible, by accommodating natural hazards and the impacts of climate change*[32]. The policies should also minimise the consumption of new resources by making more efficient use or reuse of existing resources. The PPS advises that Regional planning authorities and local authorities should promote amongst other things the sustainable use of water resources and the use of sustainable drainage systems in the management of run-off[33].

In delivering sustainable economic development the Government advises that Planning authorities should r*ecognise the wider benefits of economic development and consider these alongside adverse local impacts, ensure that suitable locations are available for developments, actively promote and facilitate good quality development, which is sustainable and consistent with their plans, ensure the provision of sufficient, good quality, new homes in suitable location, ensure that infrastructure and services are provided to support new and existing economic development and housing and ensure that development plans take account of the regional economic strategies of Regional Development Agencies, regional housing strategies, local authority community strategies and local economic strategies*[34]. Sufficient land of a suitable quality in appropriate locations needs to be brought forward to meet the expected needs taking into account issues such as *the need to avoid flood risk and other natural hazard* and *to address the management of pollution and natural hazards, the safeguarding of natural resources, and the minimisation of impacts from the management and use of resource*[35]*s*.

The supplement to PPS1: *Planning and Climate Change* published in December 2007 seeks to set out how planning should contribute to reducing carbon emissions and stabilising climate change.

[30] Paragraph 13 of PPS 1
[31] Paragraph 19 of PPS 1
[32] Paragraph 20 of PPS 1
[33] Paragraph 22 of PPS 1
[34] Paragraph 23 of PPS 1
[35] Paragraph 27 of PPS 1

PPS 12 – Creating Strong Safe and Prosperous Communities through Local Spatial Planning

Planning Policy Statement 12 (PPS 12) was published in June 2008. It explains local spatial planning and its benefits; and outlines the key components of local spatial plans and the key government policies on how they should be prepared. It should be taken into account by local planning authorities in preparing development plan documents and other local development documents. It should be noted that transitional arrangements apply until 1 September 2008.

With regard to infrastructure it states *the core strategy should be supported by evidence of what physical, social and green infrastructure is needed to enable the amount of development proposed for the area, taking account of its type and distribution. This evidence should cover who will provide the infrastructure and when it will be provided. The core strategy should draw on and in parallel influence any strategies and investment plans of the local authority and other organisations*[36].

PPS 25 – Development and Flood Risk

Planning Policy Statement 25 (PPS 25) was published in December 2006. Its aims are to ensure that flood risk is taken into account in the planning process to avoid inappropriate development in areas at risk of flooding and to direct development away from areas at highest risk. Where, in exceptional circumstances, new development is necessary in such areas then the aim is to make it safe without increasing flood risk elsewhere and, where possible, to reduce flood risk overall[37].

Regional planning bodies (RPBs) and local planning authorities (LPAs) are advised that they should prepare and implement planning strategies that assist in delivering sustainable development by appraising the risk, managing the risk and reducing the risk. In so doing they should specifically:

- Identify land at risk and the degree of risk of flooding from river, sea and other sources in their areas;
- Prepare Regional Flood Risk Appraisals (RFRAs) or Strategic Flood Risk Assessments (SFRAs) as appropriate, as freestanding assessments that contribute to the Sustainability Appraisal3 of their plans;
- Frame policies for the location of development which avoid flood risk to people and property where possible, and manage any residual risk, taking account of the impacts of climate change;
- Only permit development in areas of flood risk when there are no reasonably available sites in areas of lower flood risk and benefits of the development outweigh the risks from flooding;

[36] Paragraph 4.8 of PPS 12

[37] Paragraph 5 of PPS 25

- Safeguard land from development that is required for current and future flood management eg conveyance and storage of flood water, and flood defences;
- Reduce flood risk to and from new development through location, layout and design,
- Incorporating sustainable drainage systems (SuDS);
- Use opportunities offered by new development to reduce the causes and impacts of flooding eg surface water management plans; making the most of the benefits of green infrastructure for flood storage, conveyance and SuDS; re-creating functional floodplain; and setting back defences[38].

In addition, LPAs should in determining planning applications:

- Give priority to the use of SuDS; and
- Ensure that all new development in flood risk areas is appropriately flood resilient and resistant, including safe access and escape routes where required, and that any residual risk can be safely managed[39].

Relevant Planning Policies

Regional Spatial Strategy for the South East (RPG9)

Policy INF1 Development should be guided away from areas at risk or likely to be at risk in future from flooding, or where it would increase the risk of flood damage elsewhere. Existing flood defences should be protected where they continue to be relevant.

Policy INF2 New development should be located and its implementation planned in such a way as to allow for sustainable provision of water services and enable timely investment in sewage treatment and discharge systems to maintain the appropriate standard of water quality. Techniques which improve water efficiency and minimise adverse impacts on water resources, on the quality, regime, and ecology of rivers, and on groundwater, should be encouraged. Redevelopment should identify and make provision for rectification of any legacy of contamination and drainage problems.

[38] Paragraph 6 of PPS 25
[39] Paragraph 8 of PPS 25

South East Plan Policies - Secretary Of State's Proposed Changes To The Draft Regional Spatial Strategy (Rss) For The South East

Policy CC1: Sustainable Development

The principal objective of the Plan is to achieve and to maintain sustainable development in the region. Sustainable development priorities for the South East are identified as:

- Achieving sustainable levels of resource use;
- Reducing greenhouse gas emissions associated with the region;
- Ensuring that the South East is prepared for the inevitable impacts of climate change;
- Ensuring that the most deprived people also have an equal opportunity to benefit from and contribute to a better quality of life.

All authorities, agencies and individuals responsible for delivering the policies in this Plan shall ensure that their actions contribute to meeting the objectives set out in the Regional Sustainability Framework. (1)

Policy CC2: Climate Change

Measures to mitigate and adapt to current and forecast effects of climate change will be implemented through application of local planning policy and other mechanisms. Behavioural change will be essential in implementing this policy and the measures identified.

In addition, and in respect of carbon dioxide emissions, regional and local authorities, agencies and others shall include policies and proposals in their plans, strategies and investment programmes to help reduce the region's carbon dioxide emissions by at least 20% below 1990 levels by 2010 and by at least 25% below 1990 levels by 2015. A target for 2026 will be developed and incorporated in the first review of the Plan. Adaptation to risks and opportunities will be achieved through:

- Guiding strategic development to locations offering greater protection from impacts such as flooding, erosion, storms, water shortages and subsidence;
- Ensuring new and existing building stock is more resilient to climate change impacts;
- Incorporating sustainable drainage measures and high standards of water efficiency in new and existing building stock;
- Increasing flood storage capacity and developing sustainable new water resources;
- Ensuring that opportunities and options for sustainable flood management and migration of habitats and species are not foreclosed.

Mitigation, through reducing greenhouse gas emissions, will primarily be addressed through greater resource efficiency including:

- Improving the energy efficiency and carbon performance of new and existing buildings and influencing the behaviour of occupants;
- Reducing the need to travel and ensuring good accessibility to public and other sustainable modes of transport;
- Promoting land use that acts as carbon sinks;
- Encouraging development and use of renewable energy;
- Reducing the amount of biodegradable waste landfilled.

Policy CC3: Resource Use

A sustained programme of action to help stabilise the South East's ecological footprint by 2016 and reduce it by 2026 should be incorporated into plans and programmes. Such actions will include:

- Increased efficiency of resource use in new development;
- Adaptation of existing development to reduce its use of energy, water and other resources;
- Changes in behaviour by organisations and by individuals.

Policy CC7: Infrastructure and Implementation

The scale and pace of development will depend on sufficient capacity being available in existing infrastructure to meet the needs of new development. Where this cannot be demonstrated the scale and pace of development will be dependent on additional capacity being released through demand management measures or better management of existing infrastructure, or through the provision of new infrastructure. Where new development creates a need for additional infrastructure a programme of delivery should be agreed before development begins.

Funding will be provided by a combination of Central Government, Local Government and Private Sector partners, including substantial contributions from Central Government. To help achieve this:

- Infrastructure agencies and providers will aim to align their investment programmes to help deliver the proposals in this Plan;
- Local Development Documents will identify the necessary additional infrastructure and services required to serve the area and the development they propose together with the means, broad cast and timing of their provision related to the timing of development;

- Contributions from development will also be required to help deliver necessary infrastructure. To provide clarity for landowners and prospective developers, local authorities should include policies and prepare clear guidance in their Local Development Documents, in conjunction with other key agencies, on the role of development contributions towards infrastructure.

The phasing of development will be closely related to the provision of infrastructure. In order to create confidence and assurance in the timely delivery of infrastructure in relation to new housing a more proactive approach to funding will be adopted. This will involve a joint approach by regional bodies, local authorities, infrastructure providers and developers. Consideration will be given to the pooling of contributions towards the cost of facilities, development tariffs and local delivery vehicles. Mechanisms to enable forward funding of strategic infrastructure will be agreed between regional bodies and Government, including a possible Regional Infrastructure Fund.

In order to further secure effective delivery of the Plan, and particularly the timely delivery of the necessary supporting infrastructure, an Implementation Plan will be prepared, monitored and reviewed by the Regional Planning Body, which will set out the requirements and obligations for public and private sector bodies at the national, regional and local levels. The Implementation Plan will include a regional and sub-regional investment framework identifying the strategic infrastructure schemes needed to deliver the Plan.

Policy H1: Regional Housing Provision 2006 - 2026

Local Planning Authorities will facilitate the delivery of at least 662,500 net additional dwellings between 2006 and 2026.

In managing the supply of land for housing and in determining planning applications, Local Planning Authorities should work collaboratively to facilitate the delivery of the following level of net additional dwellings in sub-regions and in rest of the sub-regional areas:

Table B1

Sub-region / Rest of the sub-regional area Provision	Net Dwelling Completions - Average Annual	Net Dwelling Completions - Total Provision
East Kent & Ashford	2,835	56,700

Note: The specific housing delivery requirements for districts and/or parts of districts that fall within the above areas are set out in detail in relevant sub-regional and the rest of the sub-regional area chapters.

Local Planning Authorities will prepare plans, strategies and programmes to ensure the delivery of the minimum annual average net additional dwelling requirement as set out in Table H1b:

Table B2

District / Strategic Development Area	Annual Average	Total
Dover	505	10,100

Policy NRM1: Sustainable Water Resources And Groundwater

Water supply and ground water will be maintained and enhanced through avoiding adverse effects of development on the water environment. A twin-track approach of demand management and water resource development will be pursued. In preparing Local Development Documents, and determining planning applications, local authorities will:

- Ensure compatibility with River Basin Management Plans and take account of other plans and strategies including water company asset management plans, the Environment Agency's Regional Water Resources Strategy and Catchment Abstraction Management Strategies, groundwater vulnerability maps and groundwater source protection zone maps;
- Identify any circumstances under which new development will need to be supported by water efficiency standards exceeding extant Building Regulations standards;
- Set out the circumstances under which sustainable drainage solutions should be incorporated into new development;
- Encourage winter water storage reservoirs and other sustainable land management practices which reduce summer abstraction, diffuse pollution and runoff, increase flood storage capacity and benefit wildlife and recreation;
- Direct new development to areas where adequate water supply can be guaranteed from existing and potential water supply infrastructure. Where this is not possible, development should be phased so that sustainable new capacity can be provided ahead of new development.

Policy NRM2: Water Quality

Water quality will be maintained and enhanced through avoiding adverse effects of development on the water environment. In preparing Local Development Documents, and determining planning applications, local authorities should:

- Take account of water cycle studies, groundwater vulnerability maps and groundwater source protection zone maps prepared by the Environment Agency, and water and sewerage company asset management plans

- Ensure that the rate and location of development does not lead to an unacceptable deterioration of water quality, and
- Not permit development that presents a risk of pollution or where satisfactory pollution prevention measures are not provided in areas of high groundwater vulnerability (in consultation with the Environment Agency and Natural England).

Local authorities will work with water and sewerage companies and the Environment Agency to:

- Identify infrastructure needs, allocate areas and safeguard these for infrastructure development;
- Ensure that adequate wastewater and sewerage capacity is provided to meet planned demand, and
- Take full account of the cumulative impacts of wastewater discharges on groundwater, inland and marine receiving waters.

Local authorities should promote land management initiatives to reduce diffuse agricultural pollution.

Policy NRM3: Strategic Water Resources Development

There is a demonstrable need for new water resource schemes and increased demand management over the period of the Plan to cater for water supply needs of current and future development and the protection of the environment.

Strategic new water resource options that may be required to be operational over the Plan period include:

- Upper Thames reservoir, Oxfordshire by 2019/20;
- Enlargement of Bewl reservoir , Kent by 2014/15;
- Broad Oak reservoir, Kent by 2019/20;
- Clay Hill reservoir, East Sussex by 2014/15;
- Havant Thicket reservoir, Hampshire by 2020/21.

Local authorities should work with the water companies and the Environment Agency in assisting in the timely delivery of schemes. Local Development Documents should allocate and safeguard sites identified for the reservoir schemes identified in this policy and others that are identified by the companies and Environment Agency as being required to deliver necessary water infrastructure.

Additional resource schemes, including enlargement of Darwell reservoir, a strategic option in north- west Sussex, together with bulk water transfers, effluent re-use and desalination may also be required.

In considering applications for new water resource schemes, consideration should be given to:

- Need at local, sub-regional, regional, and inter-regional scales;
- Presence of alternative options and environmental impact including water efficiency in new and existing properties;
- Potential to deliver social and environmental benefits.

Policy NRM4: Sustainable Flood Risk Management

The sequential approach to development in flood risk areas set out in PPS25 will be followed. Inappropriate development should not be allocated or permitted in flood zones 2 and 3 (Diagram NRM1), areas at risk of surface water flooding (critical drainage areas) or areas with a history of groundwater flooding, or where it would increase flood risk elsewhere, unless there is over-riding need and absence of suitable alternatives.

Local authorities, with advice from the Environment Agency, should undertake a Strategic Flood Risk Assessment (SFRA) to provide a comprehensive understanding of the flood risk and put in place a framework for applying the PPS25 sequential approach. This will facilitate allocating sites in a decreasing probability of flood risk. The SFRA would assess future climate change and identify appropriate types of development in accordance with the PPS25 sequential test and flood vulnerability of different land uses. Existing flood defences will be protected from development. Where development is permitted in appropriately defended floodplains it must be designed to be resilient to flooding (to minimise potential damage) and to allow for the future maintenance, realignment or management of the defences to be undertaken. In the preparation of Local Development Documents and considering planning applications, local authorities in conjunction with the Environment Agency, should also:

- Take account of River Basin Management Plans, Catchment Flood Management Plans, Shoreline Management Plans and Surface Water Management Plans in developing Local Development Documents and other strategies. Where locationally specific flood risk and land management options such as flood storage, managed realignment and set back from coastal defences are identified, land should be safeguarded for these purposes and appropriate land management practices should be encouraged
- Consider the associated social and environmental costs and benefits to fisheries and biodiversity in assessment of new flood management schemes;
- Require incorporation and management of Sustainable Drainage Systems (SuDS), other water retention and flood storage measures to minimise direct surface run–off, unless there are practical or environmental reasons for not doing so;
- Take account of increased surface water drainage on sewage effluent flows on fluvial flood risk.

Dover District Core Strategy Preferred Options Development Plan Document

Policy CP 1

Provision for Jobs, Labour Supply and Homes

Provision will be made for:

Period	Jobs Growth	Labour Supply Increase	Employment Land (square metres)*	Total New Housing	Strategic Housing Allocations	Housing Allocations- Site Allocations Document	Affordable Housing Targets**
2006-2016	4,000	3,800	250,000	4,400	1,000	3,400	1,320
2016-2026	0	0	0	5,600	1,800	3,800	1,680
Total	4,000	3,800	250,000	10,000	2,800	7,200	3,000

The figures to 2016 are to be taken as phasing targets.

* Employment uses are those falling within classes B1, B2 and B8 of the Use Classes Order and sui generis uses of a similar character

**70% of affordable housing should be social rented and 30% intermediate housing. The targets for affordable housing may be revised depending on the findings of the Housing Market Assessment.

Policy CP 3

Employment Land

The Site Allocations Document will allocate land to accommodate around 250,000 square metres of employment development floorspace in accordance with the principles of the Settlement Hierarchy.

Policy CP 4

Distribution of Housing Allocations

The quantity of new housing proposed in Policy CP1 shall be divided between the four areas of the District as follows:

- Dover: 5,700
- Deal: 1,600

- Sandwich: 500
- Rural: 2,200

Provision shall be made for this through strategic allocations in the Core Strategy and allocations in the Site Allocations Document.

Policy CP 6

Infrastructure

Development will not be permitted unless the necessary infrastructure to support it is either already in place, or there is a reliable mechanism to ensure that it will be provided at the time it is needed.

Policy DM 21

The quality of the District's air, water and land shall be protected and where necessary improved.

Proposals for development should establish whether:

- The development site is subject to pollution and, if so, its nature and extent and the means of remediation
- The development would be subject to pollution from an external source and, if so, its extent and nature and the means of dealing with it in a way that can allow the development to proceed
- The development would cause pollution either on or off site and, if so, how this would be controlled within acceptable levels.

Policy DM 22

Within Groundwater Source Protection Zones, shown on the Proposals Map, the following will not be permitted in Zones 1 and 2 unless adequate safeguards against possible contamination are provided:-

- Septic tanks, storage tanks containing hydrocarbons or any chemicals, or underground storage tanks;
- Proposals for development which may include activities which would pose a high risk of contamination unless surface water, foul or treated sewage effluent, or trade effluent can be directed out of the source protection zone;
- Proposals for the manufacture and use of organic chemicals, particularly chlorinated solvents;
- Oil pipelines;
- Storm water overflows;

- Activities which involve the disposal of liquid waste to land;

In addition, the following will not be permitted in a Zone 1 unless adequate safeguards are provided:-

- New graveyards or farm waste storage areas;
- New foul or combined sewerage systems.

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Appendix C
Water Resource Availability

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Water Resource Availability - CAMS Status of Catchments

The Environment Agency has published assessments of water availability within individual catchments in the CAMS documents. The CAMS documents classify water resource availability for surface water and groundwater into the following categories:

Resource Availability Status	Definition
Water available	Water likely to be available at all flows including low flows, although some restrictions may apply.
No water available	No water available for further licensing at low flows although water may be available at higher flows with appropriate restrictions. This means that all the water is already fully allocated.
Over licensed	Current actual abstraction is resulting in no water available at low flows. If existing licences were used to their full allocation, they would have the potential to cause unacceptable environmental impact at low flows. Water may be available at high flows with appropriate restrictions.
Over abstracted	Existing abstraction is causing unacceptable environmental impact at low flows. Water may still be available at high flows with appropriate restrictions.

Where the Environment Agency assesses a catchment as being over-abstracted, the Environment Agency's licensing strategy will seek to secure downward variations to abstraction licences under its existing powers when abstraction licences are renewed.

The Habitats Directive and the Water Framework Directive and the Environment Agency's Restoration of Sustainable Abstraction (RSAP) programmes have the potential to impact on water abstractions across the country. Where it can be demonstrated that abstractions are having a detrimental impact upon the environment then the Environment Agency will seek to reduce abstractions at those sites.

The public water supply licences were granted as 'Licences of Right' to abstract water under the 1963 Water Act. No consideration was given to the environmental impact of these abstractions at the time the licences were issued, and they are often licensed at abstraction rates that exceed the capacity of abstraction equipment or the capability of the aquifer to provide the licensed yield. Consequently, there are areas within the catchment that have been assessed as over abstracted.

If the Environment Agency were to consider licensing new licences the applicant would need to demonstrate that:

- Environmental sustainability is not in question;
- There is justification for the need of the licence; and
- Water is used efficiently.

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Appendix D
Water Demand Calculation – Methodology

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The water demand forecast for Dover District has been calculated using data supplied by Southern Water and Folkestone and Dover Water as part of their Draft Water Resource Management Plans (WRMP) 2008. A Microsoft Excel spreadsheet model was created that calculated the total demand based on individual demand components reported by the water companies.

Sources of Information

Data for forecast household numbers and non–household floor space values have been provided by the Local Authority. Table D1 below details the individual elements of demand that have been recalculated for Dover District and the information sources used.

Table D1 Household Demand Components and Sources of Information

Demand Component	Number of households	Household occupancy Rate	Per Capita Consumption
Existing Household	Southern Water	Water Companies	Draft WRMPs
Forecast Household (new households)	Local Authority	Water Companies	Draft WRMPs and Code for Sustainable Homes

Table D2 Non-Household Components and Sources of Information

Demand Component	Floor space	Consumption
Existing Non-Household	N/A	Draft WRMP (apportioned by property numbers)
Forecast Non-Household	Local Authority	Site Allocations Document

Growth Forecasts

The draft WRMPs include allowances for demand for water from new housing and business growth, based on housing targets from the draft South East Plan. The following section reviews the growth allowances within the draft WRMPs to determine the extent to which the growth allowances made by the water companies reconcile with the housing scenarios that have been provided by Dover District Council for this study. At this stage, both Folkestone and Dover Water, and Southern Water have stated that their current draft Water Resource Management Plans were developed based on the most up to date data that was available at the time, namely the draft RSS planning guidance and so the demand forecasts and draft investment strategies may not yet take account of the full

extent of growth being developed by Dover District Council. The water companies have resolved to use the most up to date housing growth data when developing their final Water Resource Management Plans.

Proportioning Water Resource Zones to the Study Area

To determine water demand specific to Dover District, existing and forecast household numbers and forecast non household properties data were provided by the water companies and DDC. To estimate existing non-household water demand data has been taken from the draft WRMP 2008 tables and apportioned to the Dover District. This is necessary as the water companies produce their data based on Water Resources Zones (WRZs) and the geographical areas of these WRZ's do not match the Local Authority boundaries. The Draft WRMP tables contain details of the numbers of non-household properties served within each WRZ and the demand associated with these properties. A demand per existing property figure could be derived from this data. Address point data detailing customers connected to the sewerage system was provided by Southern Water for both WRZs. From this the number of non-household business properties was extracted. The WRZ demand per property value was then multiplied by the number of properties in the District to derive the demand for existing non-households in each WRZ element of the District.

Table D3 Water Resource Zone existing Non-Household demand (Dry year)

Polygon	Demand per property in the base year (Ml/d)	Number of existing non-household properties in the study area	Study area non-household demand by WRZ in the base year (Ml/d)
Dover District		3122	6.011
Hills WRZ	0.002127	1497	3.184
Kent Thanet WRZ	0.00174	1625	2.827

Household Demand

The water demand from the existing households was calculated using the standard water industry approach shown below:

$$D = H \times O \times C$$

where :

D = Water Demand
H = Households (provided by the water companies)
O = Occupancy rate (persons per property, provided by the water companies)

C = per capita consumption (WRMP l/h/d)

This calculation was conducted for two different building types, existing measured households and existing unmeasured households as per standard WRMP methodology.

Existing household numbers (see Table D4) were supplied by the individual water companies having been extracted from their billing databases using a GIS based locating system. These figures were factored against the WRMP data to ensure that the same measured and unmeasured population proportions were used as those used by the relevant water companies. This was necessary as measured and unmeasured properties have different per capita consumption (pcc) values attributed to them.

Table D4 Existing Household Numbers

Occupancy Rate (p/hh)	2007/08
Hills WRZ	24,657
Kent Thanet WRZ	23,404

Per Capita Consumption

The WRMP pcc values used are shown in Table D5. There are many reasons why per capita consumption levels vary geographically. Lifestyle attributed to personal affluence is considered to be a key contributing factor.

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Table D5 Draft WRMP Existing Measured Household Per Capita Consumption (Dry Year litres/head/day)

l/h/d	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Hills WRZ	154.53	154.42	154.60	154.60	143.45	145.84	146.39	147.03	146.44	145.55	144.24	142.31	141.29	140.22	139.15	138.78	138.48	138.25	137.99	137.71	137.49
Kent Thanet WRZ	159.57	158.55	157.80	157.22	155.25	154.24	153.65	153.27	153.02	153.13	153.24	153.37	153.51	153.66	153.82	153.99	154.18	154.38	154.59	154.82	155.04

Table D6 Draft WRMP Existing Unmeasured Household Per Capita Consumption (Dry Year litres/head/day)

l/h/d	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Hills WRZ	194.40	193.31	192.30	191.43	190.85	192.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Kent Thanet WRZ	167.43	167.45	167.48	167.50	167.53	167.56	167.58	167.61	167.63	167.66	167.68	167.71	167.74	167.76	167.79	167.81	167.84	167.86	167.89	167.91	167.94

Forecast household demand was calculated using the same formula as shown for existing households. Forecast household numbers as supplied by the Local Authority were used along with water company occupancy rates. Several different pcc values were then applied to give results that related to different house type scenarios. These values are shown in Table D7.

Table D7 Forecast Household PCC Values

Description	Per Capita Consumption Allowance (l/h/d)	Comment
Hills WRZ	125 l/h/d	Remains constant over time
Kent Thanet WRZ	150.68 l/h/d	Remains constant over time
Regulatory Minimum	125 l/h/d	Remains constant over time
CSH 1/2	120 l/h/d (+ 4.8 l/hh/d outdoor use)	Remains constant over time
CSH 3/4	105 l/h/d (+ 4.2 l/hh/d outdoor use)	Remains constant over time
CSH 5/6	80 l/h/d (+ 3.2 l/hh/d outdoor use)	Remains constant over time

Non-Household Demand

Existing Non- Household Demand

Table D8 Existing Non-Household Demand for WRZ and Local Authority.

	Water Resource Level Consumption in the base year (Ml/d)	Dover District apportioned consumption in the base year (Ml/d)
Hills WRZ	11.28	3.184
Kent Thanet WRZ	11.29	2.827
Total (by area) non household consumption	22.57	**6.011**

Forecast Non-Household Demand

The demand from forecast non-household developments was calculated using forecast annual non-household development areas (in hectares) supplied by the Dover District Council. These were supplied as GIS polygons that

could then be divided between the two water resource zones. The development areas were then multiplied by a development area to floor space ratio of 40% to give a forecast non-household floor space figure. Two water demand figures were then applied to these values; upper and lower water demand. These demand values were derived from several published sources and unpublished data sources. The demand values applied were 0.5092 l/d/m^2 for the upper scenario and 1.6427 l/d/m^2 for the lower scenario. This is a necessary departure from the water company planning approach. The water companies forecast demand from non-households using forecasts of economic growth for industrial and commercial sectors and apply these trends at the Water Resource Zone Level. Unlike the approach to forecasting household demand, the water companies do not make allowances for consumption for different property types at the water resource zone level.

Table D9 details values used. A figure for average water use per employee per day was used alongside employment density figures to derive a water demand/m^2 value.

Table D9 Water Demand per m^2

WRZ	Development area (Hectares)	Floorspace (m^2)	Upper scenario demand in 2026 (Ml/d)	Upper scenario demand in 2026 (Ml/d)
Hills WRZ	152.41	609.,640	0.310	1.001
Kent Thanet WRZ	33.02	132,080	0.067	0.217

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Appendix E
Water Efficiency

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Much of the Southern region, including the supply areas of Folkestone and Dover Water has been classified by the Environment Agency as an area of "Serious" water stress (Environment Agency, 2007b). This means that the Environment Agency has classified the area as requiring the highest level of water efficiency activity, which could include allowing compulsory metering of properties across the area. A recently published Environment Agency report showed that most challenging levels of water efficiency in the CSH would only be achievable through the implementation of water recycling or rainwater harvesting technology[40].

Rainwater Harvesting

Rainwater harvesting systems collect and store rainwater from roof areas or hard standing to replace mains water use within the home where potable-standard water is not required (usually toilet flushing, washing machines and outdoor use). Wider benefits include the attenuation of stormwater flows, and thus rainwater systems can form part of an integrated approach to water management in new developments.

An indicative assessment of the potential yield from rainwater harvesting in Dover District is presented in Table E1. The long term average rainfall in the Dover District area is approximately 800mm per year.

The potential rainwater available for harvesting has been estimated for three property types with differing assumptions about roof area. It should be noted that the average rainfall figure does not take into account rainfall variability over the year; during summer months there will be some periods when no rainfall is available, and conversely during periods of heavy rainfall and depending on the storage capacity of the system installed, it may not be possible to collect all the rainwater. Further detailed analysis will be needed at design stage to specify the systems required, and determine their reliable supply.

Table E1 Rainwater Harvesting, Indicative Yield Assessment.

Property type	Assumed roof area (m^2)	Potential rainwater available (l/head/day)
Terraced house	47	27.0
Semi detached house	65	37.6
Detached house	90	52.1

Assessment is based on a runoff factor of 0.9 and a filter loss factor of 0.9. The household occupancy rate of 2.3 persons per property has also been used.

Individual Properties or Collective Schemes

Rainwater harvesting can be installed for individual households, or on a larger scale where water is collected from a number of properties (for example one or more streets), treated centrally then pumped to individual households

for reuse. The advantages of a collective scheme are that surface water runoff from the development site is collected, so increasing the volumes of recycled water, and reducing the risk of flooding during storms. There may also be a cost saving by installing a collective system rather than individual household units (discussed below). A disadvantage is that if surface water runoff is collected this will require additional treatment to remove pollutants from roads, whereas if water from roofs only is collected a simple filtration system is usually all that is required.

The incorporation of rainwater harvesting systems into larger new developments such as those in the Dover District area may present the opportunity for economies of scale when compared to the implementation at the individual property level. In addition, development-scale systems present the opportunity for more reliable systems than at the household level as a suitable maintenance contractor could be appointed. These economies of scale are often referred to within published documentation (MTP 2007), although recent studies have found no published data to support this (Environment Agency 2007e). It should be noted that the available area for rainwater catchment will not necessarily be significantly greater at the development-level when compared to the individual household level.

Rainwater harvesting has been incorporated in the design of an increasing number of new build non-domestic buildings such as schools, community centres and other similar buildings. The technology tends to be less well advanced in domestic new builds mainly due to long payback periods and issues over maintenance once the systems are installed.

Constraints

The constraining factors in the development of rainwater systems are the availability of rainfall and catchment area for the system (e.g. roof and or hardstanding area). If insufficient rainfall is available and the catchment area too small the system will not meet demand and thus will need to be supported by additional mains water.

Other issues that need to be considered include the energy and carbon footprint of the systems. Studies have demonstrated that in theory the pumping requirements for rainwater systems could result in a greater energy demand from these systems than that required to provide mains water to a site.

Feasibility in Dover District

To determine the feasibility of rainwater systems in Dover District it is recommended that the following work (outside the scope of this study) is undertaken the Phase 2 detailed Water Cycle Study, which requires detailed knowledge of the site development plans is available:

- Assessment of the potential catchment area for rainwater systems;
- Quantify the average rainfall specific to Dover District.

If it is determined that there is sufficient rainfall and catchment area within the developments, a rainwater harvesting system manufacturer/installer should be consulted to determine site-specific costs and the wider implications to integrated water management within the development.

An indicative assessment of the potential yield from, and costs of rainwater harvesting in Dover District is presented in Appendix F.

Greywater Recycling

Grey water recycling systems capture and store water that has been used for bathing (either shower or bath use) and from hand basins. The water is filtered and treated using a simple disinfectant treatment process so that is can be used for non-potable purposes such as toilet flushing and, in some cases, garden watering.

New build houses probably offer the greatest opportunity for grey water recycling technology as the system can be designed into the property. There are a number of issues that recur in published documentation on grey water systems, the main ones being high costs and high maintenance requirements. Costs of the systems are comparable to those of rainwater harvesting systems at the individual property level, although the requirement for simple treatment means that the ongoing maintenance costs are likely to be higher than those for rainwater harvesting systems.

A report by the Environment Agency concluded that if grey water systems are to be acceptable to the general public then reliable systems that operate on a “fit and forget” basis will be required. It is unclear whether current designs can be considered a reliable, cost-effective and publicly acceptable solution (Environment Agency, 2005).

Relevant Studies on Demand Management in Growth Areas

The Environment Agency has published a number of studies examining the potential to retrofit existing buildings with water efficiency measures. Of particular relevance to this water cycle study are the findings in the Thames Gateway Water Neutrality study (Environment Agency, 2007e). This report examines how development within a Growth Area can be water neutral (i.e. no net increase in demand for water after development is completed). At the same time the Environment Agency also published its report examining opportunities and constraints to retro-fit water efficient devices and systems in existing homes in the South East of England (Environment Agency 2007f).

Both studies demonstrate the potential to achieve significant water savings by implementing simple retrofit options (such as low flush toilets, low flow showerhead and tap inserts) in existing homes, at a cost comparable to other water resource developments and demand management options (Environment Agency, 2007e).

Potential Cost and Water Savings from Retro-fitting Existing Households

The Water Neutrality study showed that for an estimated cost of £100 per house a dual flush toilet device, a low flow showerhead and low flow tap inserts could be retrofitted in an existing home. This could result in a saving of approximately 40 litres per property per day, or around 10% of existing household demand.

In the Dover District area there are approximately 60,000 households. Applying the data from the Environment Agency studies indicates retrofitting existing homes could have the potential to deliver up to 2.4 Ml/d at a cost of £6 million.

Uncertainty and Constraints

It should be noted that there are a number of limitations to this assessment that result in considerable uncertainty in the delivery of savings from retrofitting. The high level assessment presented here is based on the assumption that all houses use the same volume of water and that they would make the same demand reduction on installation of the devices. In reality, water use varies with the number of people in a house and the appliances, fixtures and fittings installed in the property. A further consideration is that retrofitting existing homes would require the consent of the owners of the building to install water efficient devices, and that once installed, the owners would not replace them with fixtures and fittings that consume a larger volume of water. The Environment Agency concluded that household retrofits may best be delivered through organisations such as Housing Associations, where access to larger numbers of properties could be gained through a central organisation (Environment Agency, 2007e).

Retrofitting Existing Non Households

In the case of existing non-household buildings there is published information available from organisations such as Envirowise indicating that savings of 20-50% could be achieved through the implementation of simple water efficiency measures in non-household buildings (www.envirowise.gov.uk). The Water Neutrality study also acknowledged the limited information available on which to base an assessment of the potential savings in that study area, and adopted a conservative approach assuming a 10% reduction in existing non-household demand through retrofitting. The uncertainties surrounding building types mean that it is very difficult to assess the likely costs to implement these measures. However, costs are unlikely to be significant (tens to hundreds of pounds per property, rather than thousands) for smaller retail, commercial or industrial buildings.

The overview assessment presented in this section illustrates that there may be potential to offset demand from new development through the retrofitting of existing buildings. However, issues over accessing buildings to install devices and maintaining the savings mean that there is considerable uncertainty in delivery of the estimated demand savings.

Indicative Costs for Water Efficient New Households

Indicative costs have been produced for the housing scenarios based on work published by the Environment Agency (Environment Agency, 2007g). This shows that constructing an individual house to a standard equivalent to the water consumption standard in Level 3/4 of the Code for Sustainable Homes costs around £82 more than constructing a new home to a standard equivalent to CSH Level 1/2. The cost of constructing a new home to the most challenging level of water efficiency would cost around £2,560 more than CSH Level 3/4.

Table E2 Indicative Costs of Building New Homes to the Code for Sustainable Homes Standards (Water Fittings Only)

Code for Sustainable Homes Standard	Cost per house (£)	Present value cost of scenario (£ per annum)	
		300 new builds per annum	500new builds per annum
Level 1/2	£1,385	£415, 500	£692, 500
Level 3/4	£1,467	£440, 100	£733, 500
Level 5/6	£4,024	£1.2M	£2.0M

Improvements in Water Efficiency in New Non Household Buildings

Non household buildings vary widely in nature and include buildings such as schools, hospitals, offices, hotels and retail units. The buildings have very different functions and water uses, with some buildings having an element of "residential" or "domestic" type water uses (e.g. hospitals and hotels), and others having "industrial" or "commercial" water uses (e.g. manufacturing process water use). For these reasons, the Government is not minded to set a whole building standard for non-domestic buildings (equivalent to the Code for Sustainable Homes) and is instead intending to rely on setting standards for key fittings via the Water Supply (Water Fittings) Regulations (CLG, 2007).

For "domestic-type" water uses in non-household buildings such as drinking, washing and cleaning and toilet flushing many of the fixtures and fittings that can be implemented in the home can also be installed in non-household buildings. The Government maintains a website providing information about the Enhanced Capital Allowance Scheme for Water Technologies. This scheme enables businesses to claim 100% first year capital allowances on investments in technologies and products that encourage sustainable water use, and the website lists those technologies that attract the ECA.

Rainwater harvesting technologies can be better suited to non-household buildings. These buildings often have large roof areas and areas of hardstanding (such as car parks) where rainwater can be captured.

Demand reductions and the cost of implementing the measures will vary due to the scale of the building being constructed and the number of fixtures and fittings within the building. For these reasons, it is not possible to estimate the costs for constructing an "average" non-household building to improved standards.

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Appendix F
The Code for Sustainable Homes and Water Consumption

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Water Consumption Standards in the Code for Sustainable Homes

The Government has launched the Code for Sustainable Homes (CSH), which introduces whole-building performance standards against which new homes can be rated. For water, performance against the CSH is measured in terms of per capita consumption or pcc, expressed in litres per head per day (l/h/d). There are three standards for water efficiency in the CSH as follows:

CSH Level 1/2	120 l/h/d
CSH Level 3/4	105 l/h/d
CSH Level 5/6	80 l/h/d

It should be noted that the pcc figures quoted above exclude an allowance for water use outside the home (for example, for car washing or garden water use). The Department for Communities and Local Government (or CLG, the Government department responsible for the CSH) estimate that the outdoor element of water use is approximately 4% of indoor use. The CSH is currently voluntary, although from April 2007 and all housing built on English Partnerships' land and from April 2008 all social housing funded through the Housing Corporation has to be built to CSH Level 3.

Following the publication of the CSH, the Government has committed to the introduction of a minimum regulatory standard for water consumption in new homes. This has been set at 125 l/h/d (including external water use) and will be introduced through amendments to the Building Regulations in 2008 (CLG, 2007). The regulatory minimum is approximately equal to the CSH Level 1/2 standard, when an allowance for external use is included.

Costs of Achieving Water Consumption Standards in the Code for Sustainable Homes

The following tables present a breakdown of the costs for the fixtures and fittings required to deliver a new home to the CSH standards. These estimates are based on information from published reports[40]. To achieve the more challenging water consumption standards of CSH Level 5/6 requires the installation of rainwater harvesting technology, adding considerably to the cost when compared to constructing a new home to the standards in CSH Level ¾.

[40] Environment Agency (2007g) Assessing the cost of compliance with the Code for Sustainable Homes. Environment Agency, Bristol

Table F1 Cost of Fixtures and Fittings Required to Deliver New Home to the 125 l/h/d pcc Standard (Equivalent to CSH Level 1/2)

Micro-component of demand	Flow rate or capacity	Cost per item	Number per property	Cost per property
WC	6/3 litre dual flush	£119	2	£238
Basin taps	3 litres/min	£20	2	£40
Shower	8 litres/min	£209	1	£209
Bath	160 litres capacity	£198	1	£198
Kitchen sink taps	3 litres/min	£60	1	£60
Washing machine	45 litres/cycle	£280	1	£280
Dishwasher	12 litres/cycle	£350	1	£350
Outdoor Tap		£10	1	£10
TOTAL				£1385

Table F2 Cost of Fixtures and Fittings Required to Deliver New Home to the 105 l/h/d pcc Standard (CSH Level 3/4)

Micro-component of demand	Flow rate or capacity	Cost per item	Number per property	Cost per property
WC	4.5/3 litre dual flush	£120	2	£240
Basin taps	1.7 litres/min	£60	2	£120
Shower	6 litres/min	£209	1	£209
Bath	160 litres capacity	£198	1	£198
Kitchen sink taps	3 litres/min	£60	1	£60
Washing machine	45 litres/cycle	£280	1	£280
Dishwasher	12 litres/cycle	£350	1	£350
Outdoor Tap		£10	1	£10
TOTAL				£1,467

Table F3 Cost of Fixtures and Fittings Required to Deliver New Home to the 80 l/h/d pcc Standard (Equivalent to CSH Level 5/6)

Micro-component of demand	Flow rate or capacity	Cost per item	Number per property	Cost per property
WC	4.5/3 litre dual flush	£120	2	£240
Basin taps	1.7 litres/min	£60	2	£120
Shower	6 litres/min	£209	1	£209
Bath	140 litres capacity	£455	1	£455
Kitchen sink taps	1.7 litres/min	£60	1	£60
Washing machine	45 litres/cycle	£280	1	£280
Dishwasher	12 litres/cycle	£350	1	£350
Rainwater harvesting	-	£3,200	1	£3,200
Outdoor Tap		£10	-	-
TOTAL				£4,024

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Appendix G
Water Quality and Wastewater Treatment

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Table G1 Rivers and Catchments in the Study Area

River	Length (km)	Catchment
Rivers Affecting Study Area:		
River Wingham	8107	Stour (south)
River Stour Tidal	37740	Stour (south)
Little Stour	14256	(x) - Stour
Richborough Stream	9225	Stour (south)
Minster & Monkton Marshes	10570	Stour (north)
Gosshall Main Stream	5224	Stour (south)
Sandwich Bay & Hacklinge Marsh	33540	Stour (south)
Lampen Stream	2818	(x) - Stour
River Dour	7508	Dour
Little Stour	2077	(x) - Stour
Nailbourne	15978	(x) - Stour
Rivers Not Inflowing to Study Area but Potentially Affecting Coastal Waters:		
Pent Stream	7795	x – Folkestone
Rivers Close to but Not Affecting Study Area*:		
Sevenscore Dike	1545	x - North coast
River Wantsum	10702	x - North coast
Chislet Pumping Drain	6533	x - North coast
North Stream (Chislet)	8625	x - North coast
Sarre Penn	13444	x - North coast

Key

	>10,000 km
	5-10,000 km
	<5,000 km
Stour (south)	Discharges into Stour on south side of estuary
Stour (north)	Discharges into Stour on north side of estuary
x - North coast	River not in study area, discharges to north coast
x - Folkestone	River not in study area, discharges at Folkestone
(x) - Stour	River not in study area, but discharges into Stour

* These rivers are connected to the Stour catchment rivers so there is potential that these may flow into the Stour estuary but generally it is considered that they flow to the north coast.

Table G2 Sensitive Water Bodies and Designations in Study Area

Type of designation	Name	Areas that impact on designation
Special Area of Conservation (SAC)	Lydden and Temple Ewell Downs	Dour catchment (no rivers marked on map but <1km upstream of Dour river) Not affected by water courses or abstractions
	Folkestone to Etchinghill Escarpment	Not affected by water courses or abstractions
	*Stodmarsh	
	*Dungeness	
	Sandwich Bay	River Stour tidal river and Hacklinge Marsh Stour estuary Sandwich Bay coastal area
	*Thanet Coast	Stour estuary
	Dover to Kingsdown Cliffs pSAC	Not affected by water courses or abstractions
	Parkgate Down	Not affected by water courses or abstractions
Special Protected Areas (SPA)	Thanet Coast and Sandwich Bay	River Stour tidal river and Hacklinge Marsh Stour estuary Sandwich Bay coastal area
	Stodmarsh	
	Dungeness to Pett Level	
Site of Special Scientific Interest (SSSI)	Sandwich Bay to Hacklinge Marshes	River Stour tidal river and Hacklinge Marsh Stour estuary Sandwich Bay coastal area
	Lydden and Temple Ewell Downs	Dour catchment (no rivers marked on map but <1km upstream of Dour river)
	Dover to Kingsdown Cliffs	No water courses Coastline northeast of Dover
	Fokestone Warren	No water courses Coastline southwest of Dover
	*Thanet Coast	Stour estuary
	Stodmarsh	
	Alkham, Lydden, and Swingfield Woods	
	Chequers wood and Old Park	
	Preston Marshes	River Wingham (inflow to River Stour)
Ramsar	Thanet Coast and Sandwich Bay	River Stour tidal river and Hacklinge Marsh Stour estuary Sandwich Bay coastal area Thanet Coast
	Stodmarsh	

Table G3 (continued) **Sensitive Water Bodies and Designations in Study Area**

Type of designation	Name	Areas that impact on designation
Area of Outstanding Natural Beauty	Kent Downs	River Dour its northern catchment Coastline either side of Dover
Heritage Coastline	South Foreland	Coastline northeast of Dover
	Dover - Folkestone	Coastline southwest of Dover
Biodiversity Action Plan chalk rivers (check important sites from BAP report)	River Dour	River Dour
	Wingham River	River Wingham
	North Stream and South Stream	Hacklinge Marsh
Biodiversity Action Plan intertidal mudflats	Stour	From Stour estuary towards Hacklinge Marsh
Bathing Waters	St Margaret's Bay (Guideline)	
	Folkeston (Guideline)	
	Deal Castle (Imperative)	
	Sandwich Bay (Guideline)	River Stour tidal river and Hacklinge Marsh Stour estuary Sandwich Bay coastal area
Nitrate Vulnerable Zones	None in sea	
Shellfish Waters	Stour Estuary – need boundary	
Freshwater Fish Directive	Little Stour	
	River Dour	
Urban Wastewater Treatment Directive – Sensitive Areas [Eutrophic]	Stour Estuary	

**** Outside study area but potentially impacted by activities in study area***

Table G4 Outcome of Appropriate Assessments - low priority sites

Site Name	Outcome of AA	Requirements and vulnerability of interest features	Significance of abstractions
Dover to Kingsdown Cliffs SAC	90% of the Dover to Kingsdown Cliffs SSSI was considered to be in 'favourable' condition (includes 'unfavourable recovering' status). Reasons for unfavourable condition are under grazing and inappropriate scrub control.	This stretch of undefended sea cliff is subject to natural coastal erosion. The main pressure is on cliff-top grassland, which is being squeezed between the eroding cliff and arable land behind. However, erosion rates are such that the features of the site will be preserved, within the existing site boundary, for at least the next 25 years. There is no immediate pressure on the vegetated sea cliffs.	Further understanding and a review of Stage 1 and 2 allows confirmation to be made that abstraction is not likely to have a significant effect upon the interest features of the SAC. There is therefore no requirement for Stage 3 of the Review of Consents to be conducted.
Folkestone to Etchinghill Escarpment SAC	As of February 2007 just over 95% of the Folkestone to Etchinghill Escarpment SSSI was considered to be in 'favourable' condition (includes 'unfavourable recovering' status). Reasons for unfavourable condition are primarily due to under grazing.	The retention of characteristic features of the habitat depends largely on appropriate agricultural practices and the control of habitat threats. The main threat to the favourability of this site, as noted by the Natura 2000 data form is the intensification of livestock grazing by improving the grassland. This is currently managed through management agreements, with both Natural England and the Countryside Stewardship scheme.	Further understanding and a review of Stage 1 and 2 allows confirmation to be made that abstraction is not likely to have a significant effect upon the interest features of the SAC. There is therefore no requirement for Stage 3 of the Review of Consents to be conducted.
Lydden and Temple Ewell Downs SAC	As of February 2007 all of the composite SSSI was considered to be in 'favourable' condition (includes 'unfavourable recovering' status). Almost 40% of the site was considered to in 'unfavourable recovering' status because of inappropriate grazing.	The retention of characteristic features of the habitat depends largely on appropriate grazing practices and the control of habitat threats. This is managed by Kent Wildlife Trust.	Further understanding and a review of Stage 1 and 2 allows confirmation to be made that abstraction is not likely to have a significant effect upon the interest features of the SAC. There is therefore no requirement for Stage 3 of the Review of Consents to be conducted.

Table G5 (continued) **Outcome of Appropriate Assessments - low priority sites**

Site Name	Outcome of AA	Requirements and vulnerability of interest features	Significance of abstractions
Parkgate Down SAC	As of June 2006 100% of the Parkgate Down SSSI was considered to be in 'favourable' condition.	The retention of characteristic features of the habitat depends largely on appropriate management and grazing. The main threat to the favourability of this site would be lack of management. In June 2006, it was noted that sward height was getting a bit high in a few places but the site was still adequately grazed.	Further understanding and a review of Stage 1 and 2 allows confirmation to be made that abstraction will not have a significant effect upon the interest features of the SAC. There is therefore no requirement for Stage 3 of the Review of Consents to be conducted.

Table G6 Outcome of Appropriate Assessments - Medium Priority Sites

Site	Internal multifunctional in combination effects	Additional in combination impacts	Likely effects of existing permissions	Conclusion of assessment
Dungeness SAC	None	Impacts on perennial vegetation of stony banks by nutrient enrichment and changes in hydrological regime from aerial deposition and waste permissions respectively.	Cannot show that all of the permissions considered will have no adverse effect on the integrity of the site. Adverse effect on perennial vegetation of stony banks (Coastal shingle vegetation outside the reach of waves) from: • Interruption or degradation of the physical, chemical, and biological processes that support the species population due to impacts from changes in groundwater and surface water levels affecting standing waters. • Indirect effects on the populations of species due to loss or degradation of their habitat as a result of changes in groundwater and surface water levels affecting standing water	The existing permissions are a combination of those which can be shown to have no adverse effect on site integrity and those which cannot. Permissions which cannot be shown to have no adverse effect on site integrity will be taken forward for consideration in Stage 4 of the Agency's Review of Consents process; those which can be shown to have no adverse effect on site integrity will be affirmed in Stage 4.
Dungeness SPA	Yes	Impacts on Standing water (migratory species) by nutrient enrichment and changes in hydrological regime from water quality and water resources permissions respectively.	The Internationally important populations of regularly occurring Annex 1 migratory species is likely to be adversely affected by: • There will be an interruption or degradation of the physical, chemical, and biological processes that support the species population due to impacts from nutrient enrichment. • There will be indirect effects on the populations of species due to loss or degradation of their habitat as a result of nutrient enrichment.	The existing permissions are a combination of those which can be shown to have no adverse effect on site integrity and those which cannot. Permissions which cannot be shown to have no adverse effect on site integrity will be taken forward for consideration in Stage 4 of the Agency's Review of Consents process; those which can be shown to have no adverse effect on site integrity will be affirmed in Stage 4.

Table G7 (continued) Outcome of Appropriate Assessments - Medium Priority Sites

Site	Internal multifunctional in combination effects	Additional in combination impacts	Likely effects of existing permissions	Conclusion of assessment
Sandwich SAC	None	There are likely to be impacts from nutrient enrichment on Fixed dunes with herbaceous vegetation ('grey dunes'), Dunes with *Salix repens* sp., Argentea (creeping willow), Embryonic shifting dunes, Shifting dunes with *Ammophilia arenaria* ('white dunes'), and Humid dune slacks from aerial deposition. The critical loads for nitrogen deposition were predicted to be exceeded on the dune features. Hence the dunes are at risk from aerial nitrogen deposition impacts. However, since no other functional or external impacts have been identified on the dune features it can be concluded that there is no risk of any in-combination effect impacting on site integrity.	None	The existing permissions can be shown to have no adverse effect on the integrity of the site and will be affirmed in Stage 4.
Stodmarsh SAC	None	None	None	The existing permissions can be shown to have no adverse effect on the integrity of the site and will be affirmed in Stage 4.
Stodmarsh SPA	None	None	None	The existing permissions can be shown to have no adverse effect on the integrity of the site and will be affirmed in Stage 4.
Thanet SPA	None	Impacts from Environment Agency permissions on the designated interest features of the Thanet Coast and Sandwich Bay SPA were identified arising from toxic contamination and low dissolved oxygen values (Part B1 and Part C1.4).	None	The existing permissions can be shown to have no adverse effect on the integrity of the site and will be affirmed in Stage 4.

Table G8 Environment Agency GQA Data at All Sample Sites within Study Area

Year	Parameter	Little Stour	Wingham River	R. Dour	R. Dour	North/South Streams
		R. Great Stour Conf - Winham River Conf	Little Stour Conf - Durlock G.S.	Wellington Dock - Ds Buckland Paper Mill	Buckland Paper Mill - Chilton	Tidal R. Stour Conf - Eastry
2006 results	Chemistry	D	E	A	A	D
	Biology	no data	no data	B	no data	no data
	Nitrates	5	6	4	3	6
	Phosphates	5	6	2	2	5
1998-2005: best results	Chemistry	B	D	A	A	B
	Biology	A	C	B	B	B
	Nitrates	5	5	3	3	4
	Phosphates	5	4	2	2	3
1998-2005: worst results	Chemistry	C	E	B	B	D
	Biology	A	D	C	C	D
	Nitrates	5	6	4	4	6
	Phosphates	5	6	2	2	5
Summary		*Generally poor except for biology which is good*	*Generally poor*	*Generally good with periodic poor grades in nitrates and biology*		*Generally poor with some exceptions in chemistry / biology in good years*

Key : A and 1 are best, F and 6 are worst end of scale, as shown below

1 A Very good	2 B Good	3 C Fairly good	4 D Fair	5 E Poor	6 F Bad

Table G9 Bathing Water Directive Compliance 1998-2007

	Ramsgate	Sandwich Bay	Deal Castle	St Margaret`s Bay	Folkestone
1988	Fail	Fail	Fail	Imperative	Fail
1989	Fail	Fail	Fail	Imperative	Fail
1990	Fail	Fail	Fail	Imperative	Fail
1991	Fail	Fail	Fail	Imperative	Fail
1992	Fail	Fail	Imperative	Imperative	Fail
1993	Fail	Fail	Fail	Guideline	Imperative
1994	Fail	Fail	Fail	Imperative	Fail
1995	Imperative	Fail	Guideline	Guideline	Imperative
1996	Imperative	Guideline	Guideline	Guideline	Fail
1997	Guideline	Guideline	Guideline	Guideline	Fail
1998	Imperative	Imperative	Guideline	Guideline	Fail
1999	Imperative	Guideline	Guideline	Guideline	Fail
2000	Imperative	Guideline	Guideline	Guideline	Imperative
2001	Imperative	Imperative	Imperative	Guideline	Imperative
2002	Guideline	Imperative	Guideline	Guideline	Guideline
2003	Guideline	Guideline	Guideline	Guideline	Guideline
2004	Imperative	Guideline	Imperative	Guideline	Imperative
2005	Guideline	Guideline	Guideline	Guideline	Imperative
2006	Guideline	Guideline	Imperative	Guideline	Imperative
2007	Guideline	Guideline	Imperative	Guideline	Guideline

Wastewater Treament

The mechanism for deriving DWFs has evolved over recent years. All WwTWs should now have certified flow monitoring equipment that enables effluent flows to be accurately monitored. The DWF is calculated based on the 20th percentile flow on the basis of 12 months daily data (i.e. the flow that is exceeded 80% of the time).

For water quality planning and design purposes, dry weather flow can also be estimated based on the following equation:

Box 1 Estimating Dry Weather Flow

DWF = PG + I + E

where:

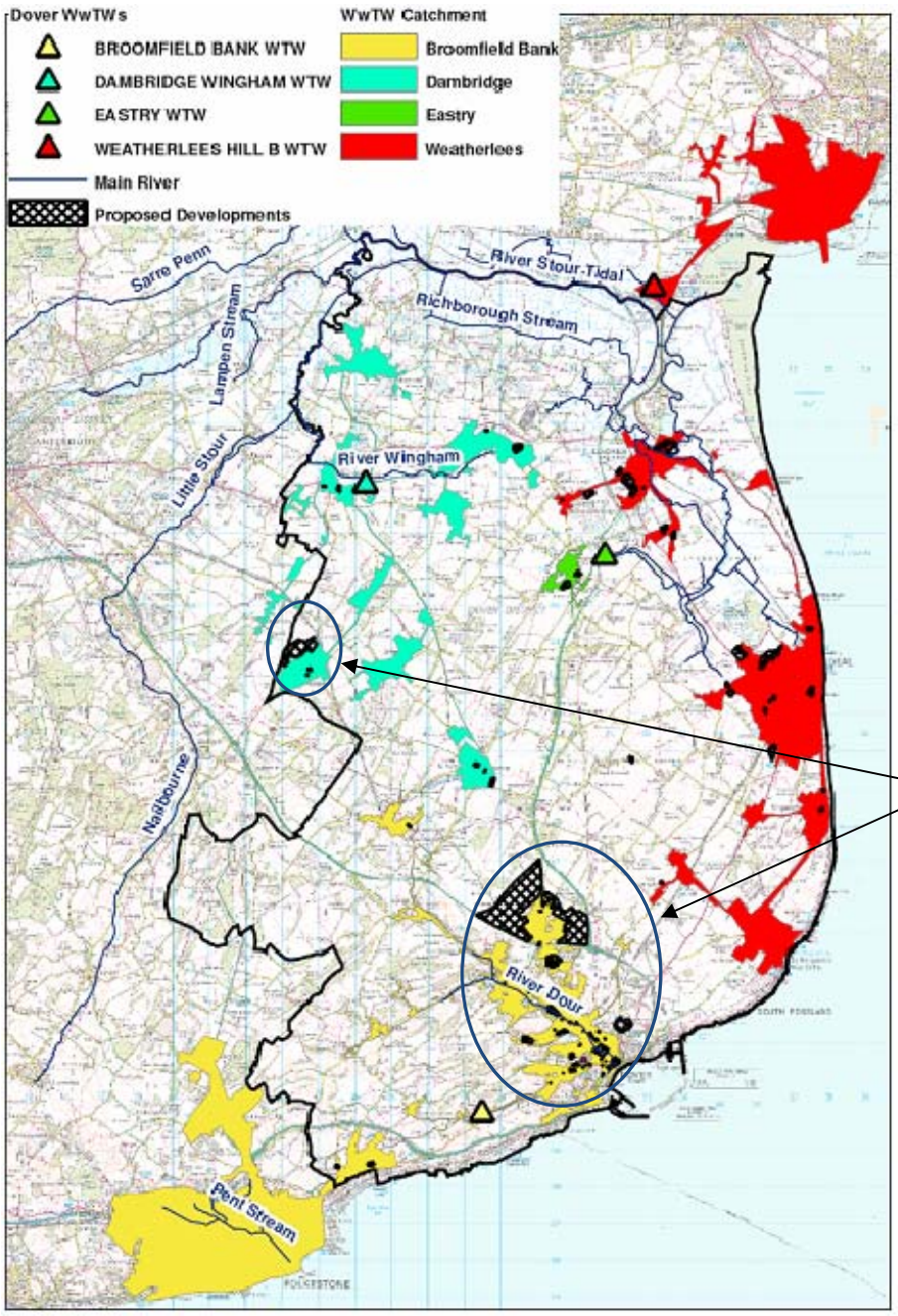
P = Population served
G = Water consumption per head per day
I = Infiltration allowance
E = Trade Effluent flow to sewer as applicable

Box 2 Formula A

Formula A = (PG+I+E) + 1360P

The locations of the WwTW catchments, outfalls and CSO outfalls are presented in the Figures below

Figure G1 WwTW Locations and Catchment Areas



Sewerage system improvements planned

Figure G2 WwTW Continuous Discharges and CSO Intermittent Discharges

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Appendix H
Drainage and SuDS Adoption

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The use of infiltration techniques across the study area is likely to be generally acceptable due to the permeability of the Chalk geology, however, a more detailed review of the soils will be required at a site specific level to determine the potential for use of infiltration techniques. Restrictions will apply to developments that overlie groundwater Source Protection Zones (SPZs) of the Chalk aquifer, classified as Major Aquifer by the Agency's groundwater vulnerability mapping.

There are three types of SPZ, defined as follows:

Zone I (inner zone): the area defined by a minimum of 50 m radius, or the distance corresponding to a 50 day travel time from any point below the water table, to the point of abstraction

Zone II (outer zone): similar to the inner zone (I), with a 400 day travel time and or a minimum of 25% of the source recharge area, whichever is the larger.

Zone III (catchment zone): includes the whole catchment area for the source.

Each of these zones has different requirements for the quality of the water that can be discharged to it and consequently the types of development from which runoff may infiltrate. Table H1 shows the development types that are permissible in each zone and the techniques required to control pollution before it is discharged.

Table H1 Acceptability for Discharges to SPZs

Impermeable Area	Zone I	Zone II	Zone III
Roof Drainage	No objection (provided for sole use of roof drainage)	No objection	No objection
Public/Amenity	Not acceptable	Acceptable	Acceptable
Large Car Parks	Not acceptable	Acceptable (with interceptor)	Acceptable (with interceptor)
Lorry Parks	Not acceptable	Presumption Against	Acceptable (with interceptor)
Garage Forecourts	Not acceptable	Presumption Against	Acceptable (with interceptor)
Major Roads	Not acceptable	Presumption Against. Acceptable only in exceptional circumstances	Acceptable only if investigation favourable and with adequate precautions
Industrial Sites	Not acceptable	Presumption Against	Acceptable only if investigation favourable and with adequate precautions

CIRIA R156 Infiltration Techniques

Proposed development allocations that lie within the Inner SPZ are presented in Table H2 below. These developments should consider attenuation SuDS techniques, and the use of additional treatment measures such as oil interceptors prior to using infiltration, if deemed appropriate.

Table H2 Proposed Development Allocations Overlying Part of Inner SPZ

Development ID	ADDRESS	Housing Numbers
31139	22 Park Avenue	10
31008	Reliance Garage, Beaconsfield Road	9
40379	Contex House, Primrose Road	5
990415	Land adj to & rear of 21 Cherry Tree Avenue	10
40365	Former Westmount College, Folkestone Road	16
51271	Former Astor Primary School, Astor Avenue	15
41139	Former Astor Primary School, Astor Avenue	59
50775	14 Godwyne Road	8
848	NCB Site, Beauchamp Avenue	5
PDL	Land adjacent Former Westmount College, Folkestone Road	44
PDL/UC	Charlton Green Sorting Office, Frith Road & Maison Dieu Road	34
PDL/UC	Eclipse Recovery Services and Sorting Office, Maison Dieu Road	24
PDL/UC	Factory Building, Lorne Road	17
UC/PDL	The Yew Tree PH, Mill Hill	24
AAP15	Connaught Barracks	500
31139	22 Park Avenue	10

Outside of the SPZs, infiltration can discharge to the underlying aquifer, whilst this may not be in a water supply catchment many aquifers have protected status and discharges are still restricted. Table H2 shows the development types that can discharge to major and minor aquifers.

Table H2 Acceptability for Discharges to Protected Resources

Impermeable Area	Major Aquifer	Minor Aquifer	Non-Aquifer
Roof Drainage	No objection	No objection	No objection
Public/Amenity	Acceptable	Acceptable	Acceptable
Large Car Parks	Acceptable (with interceptor)	Acceptable (with interceptor)	Acceptable (with interceptor)

Table H2 (continued) **Acceptability for Discharges to Protected Resources**

Impermeable Area	Major Aquifer	Minor Aquifer	Non-Aquifer
Lorry Parks	Acceptable (with interceptor)	Acceptable (with interceptor)	Acceptable (with interceptor)
Garage Forecourts	Acceptable (with interceptor)	Acceptable (with interceptor)	Acceptable (with interceptor)
Major Roads	Acceptable (subject to investigation and with interceptor)	Acceptable (subject to investigation and with interceptor)	Acceptable (with interceptor)
Industrial Sites	Acceptable only if investigation favourable and with adequate precautions	Acceptable (subject to investigation and with interceptor)	Acceptable (subject to investigation and with interceptor)

CIRIA R156 Infiltration Techniques

Management of SuDS differs from traditional drainage system management. There are currently no legally binding obligations relating to the maintenance of SuDS. Instead an agreement under Section 106 of the Town and Country Planning Act should be implemented to assign responsibility for managing and maintaining the SuDS prior to the approval of the planning application for each development. The Interim Code of Practice[41] provides a model to assist with this process and is summarised in Table H.3 below.

Table H3 **Excerpt from Interim Code of Practice for Model Agreements**

Figure 5.3 Model agreements for use with the Interim Code of Practice for SUDS	
Reference	**Title and description**
ICoP SUDS MA1	**Planning obligation – incorporating SUDS provisions** Implementation and maintenance of SUDS either as a planning obligation under Section 106 of the Town and Country Planning Act, 1990 or as a condition attached to planning permission.
ICoP SUDS MA2	**SUDS maintenance framework agreement** Legal framework that defines which body takes over and maintains the SUDS.
ICoP SUDS MA3	**Model discharge agreement** A model deed in relation to owners of SUDS facilities granting sewerage undertakers rights in perpetuity to discharge, flood and maintain in default.

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