Homes England

Making homes happen

Date: 03/06/2020
Our Ref: RFI2940
Tel: 0300 1234 500
Email: infogov@homesengland.gov.uk

[redacted]
By Email Only

Windsor House
Homes England – 6th Floor
50 Victoria Street
London
SW1H 0TL

Dear [redacted]

RE: Request for Information – RFI2940

Thank you for your recent email, which was processed under the Freedom of Information Act 2000 (FOIA) and the Environmental Information Regulations 2004 (EIR).
For clarification, you requested the following information:

I am researching the successful Medway HIF Bid and would like to formally request the following (under the Freedom of Information Act/ Environmental Information Regulations, if necessary):

1. *Please provide an electronic copy of the HIF bid (redacted if necessary to the extent that information provides names or other information that is commercially sensitive) or a link to the Medway HIF Bid.*
2. *Please state whether Homes England or the Secretary of State, in its approval of the bid*
   - *(i) carried out an assessment or calculation or otherwise considered the effect of the effect of the proposed infrastructure on emissions of carbon and on climate change; (and please provide a copy of the document which provides such assessment)*
   - *(ii) took into account the Government's commitment concerning climate change to comply with the criteria in the Paris Agreement.*

Response
We can confirm that we do hold information that falls within the scope of your request. We will address each of your points in turn.

1.Please provide an electronic copy of the HIF bid (redacted if necessary to the extent that information provides names or other information that is commercially sensitive) or a link to the Medway HIF Bid.

Applicable Regime

Homes England consider the contents of the HIF bid submission to contain information that falls under both the FOIA and the EIR. Regulation 2(1) of the EIR define where information is "environmental" in nature. We have therefore reviewed the contents of the HIF bid submission and assessed whether each document falls under FOIA or EIR as defined in Regulation 2(1).

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FOIA Information

We are able to inform you that we do hold the information that you have requested. However, this information falls under the following exemptions:

Section 22 – Business Case

We rely on section 22 to withhold the Business Case from disclosure, exemption where information is intended for future publication under the FOIA.

The full text of the legislation can be found on the following link and we have quoted section 22 below for ease: https://www.legislation.gov.uk/ukpga/2000/36/section/22

Section 22 - Information intended for future publication

(1) Information is exempt information if:

(a) the information is held by the public authority with a view to its publication, by the authority or any other person, at some future date (whether determined or not),

(b) the information was already held with a view to such publication at the time when the request for information was made, and

(c) it is reasonable in all the circumstances that the information should be withheld from disclosure until the date referred to in paragraph (a).

(2) The duty to confirm or deny does not arise if, or to the extent that, compliance with section 1(1)(a) would involve the disclosure of any information (whether or not already recorded) which falls within subsection (1).

Section 22 is a qualified exemption. This means that in order to withhold information under this exemption, we must consider the public interest in disclosure.

Public Interest Test – Factors in favour of disclosure

- Homes England is compliant with the government agenda of transparency and recognises the benefit of publishing the information, particularly when it concerns how Homes England undertakes its work; and
- Homes England acknowledges there is local interest in the potential development at this site and the assessment of the funding available.

Public Interest Test – Factors in favour of non-disclosure

- Homes England have to support our relationships with councils in order to achieve best value for public money and best possible delivery of Homes. Medway council are currently in discussions with external partners and consultants regarding the delivery at this site. There is a high risk that releasing information contained within the bid submission before this is concluded could prejudice the Council's ability to achieve the objectives set out in the submission and prejudice their statutory role as local authority. This would not be in the public interest as it would put funding at risk and potentially inflate costs, which would negatively effect the public purse;
- Releasing information at this stage prior to this information being in the public domain would undermine Homes England's position as the government's housing accelerator. Release of the

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information would be likely to negatively impact future HIF processes and proposals as third parties may feel unable to provide all the relevant information necessary for fear of disclosure. This would mean that Homes England would have to assess bids that may not be as thorough as they should be which would impact the ability of Government officials to make effective, informed decisions. This would not be in the public interest as public money could be inadequately allocated. It would also undermine Homes England's position and ability to deliver against its objectives and targets in our strategic plan;

- If Homes England were to release the information ahead of the agreed publication this would adversely affect the relationship between Homes England and current and potential partners. There would be significant reputational, commercial and financial loss to Homes England and our partners as third parties could use the information to distort the market for their own gain; and
- The information contained within the bid will be published by the council once the development has progressed and the commercial sensitivities have been resolved. Though we acknowledge the public interest in the information requested, we cannot identify a wider public interest in publishing the information ahead of schedule.

Therefore after careful consideration we have concluded that at this time, the balance of the public interest favours the non-disclosure.

Advice and Assistance
In compliance with the Section 45 Code of Practice (Paragraph 14) and to offer advice and assistance under section 16 of the Freedom of Information Act 2000 we can advise that Medway Council will be publishing their bid submission in full once commercial sensitivities have passed. They have advised that they currently anticipate the publication to be in Autumn 2020 on their website.

Section 21 – Supporting Documents
We are able to inform you that we do hold the information that you have requested. However, we rely on section 21, exemption where information is available to the applicant elsewhere.

The full text of the legislation can be found on the following link and we have quoted section 21 below for ease: https://www.legislation.gov.uk/ukpga/2000/36/section/21

21 - Information accessible to applicant by other means.

(1)Information which is reasonably accessible to the applicant otherwise than under section 1 is exempt information.

(2)For the purposes of subsection (1)—

(a)information may be reasonably accessible to the applicant even though it is accessible only on payment, and
(b)information is to be taken to be reasonably accessible to the applicant if it is information which the public authority or any other person is obliged by or under any enactment to communicate (otherwise than by making the information available for inspection) to members of the public on request, whether free of charge or on payment.

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(3)For the purposes of subsection (1), information which is held by a public authority and does not fall within subsection (2)(b) is not to be regarded as reasonably accessible to the applicant merely because the information is available from the public authority itself on request, unless the information is made available in accordance with the authority's publication scheme and any payment required is specified in, or determined in accordance with, the scheme.

Advice and Assistance

We have a duty to provide advice and assistance in accordance with Section 16 of the FOIA. As such, we have provided the following table which details where the supporting documents submitted with the HIF bid are published:

Document Title	Section 21 – Publication location
S78 Appeal, Gladman Developments	https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/754676/18-11-08_DL_IR_Town_Road_3175461.pdf
North Kent Strategic Housing and Economic Needs Assessment Strategic Housing Market Assessment Final Report Medway Council November 2015	https://www.medway.gov.uk/downloads/file/633/strategic_housing_market_assessment_shma
Medway Authority Monitoring Report 2018 1st April 2017 – 31 March 2018 Volume 1 – Main Report December 2018	https://www.medway.gov.uk/downloads/file/3576/authority_monitoring_report_-_volume_1_2018
Property Price Report Update March 2018	https://www.medway.gov.uk/downloads/file/2975/housing_property_price_report_2018
Medway Guide to Developer Contributions and Obligations May 2018	https://www.medway.gov.uk/downloads/file/2746/medway_guide_to_developer_contributions_and_obligations_2018
Medway Council Procurement Strategy 2016-2021	https://www.medway.gov.uk/downloads/file/1675/medway_council_procurement_strategy
Medway Council Part 7 – Contract Procedure Rules	https://www.medway.gov.uk/downloads/file/1729/contract_procedure_rules

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EIR Information

We are able to inform you that we do hold information that falls within the scope of your request that falls under the definition of Environmental Information (Regulation 2(1) EIR) and this is attached to this response as Annex A.

Please note that we have redacted some of the information contained within Annex A under the following Exceptions:

Regulation 13(1)

Under regulation 13(1) of the EIR, Homes England may refuse to disclose information that constitutes third party personal data. To disclose personal data, such as names, contact details, addresses, email addresses and personal opinions could lead to the identification of third parties and would breach one or more of the data protection principles. Regulation 13(1) is an absolute exception which means that we do not need to consider the public interest in disclosure. Once it is established that the information is personal data of a third party and release would breach one or more of the data protection principles, then the exception is engaged.

The full text of the legislation can be found on the following link:
https://www.legislation.gov.uk/uksi/2004/3391/regulation/13/made

Regulation 12(5)(e)

Under regulation 12(5)(e) of the EIR, Homes England may refuse to disclose information to the extent that its disclosure would adversely affect the confidentiality of commercial or industrial information where such confidentiality is provided by law to protect a legitimate economic interest.

In this case, the Medway HIF bid relating to the delivery of new homes is a commercial operation. HIF grants relate directly to a financial award and contain information on costs, budgets, proposed spend and the prospective terms relating to funding and development that is ongoing/under negotiation. The redacted EIR information is subject to confidentiality provided by law under a common law duty of confidence and contractual obligation. The confidentiality terms within the Housing Infrastructure Fund grant determination agreement shows the parties had the intention that a duty of confidentiality would be created between them. Homes England therefore recognises that this information was intended to be held in confidence between the parties.

The information in the redacted EIR Information is not trivial and is not otherwise in the public domain. Both Homes England and Medway Council would suffer a commercial disadvantage in future negotiations if this information were to be disclosed to the public. The information therefore also has the necessary quality of confidence.

Public Interest Test

Regulation 12(5)(e) is subject to the public interest test. Once the exception has been engaged it is then necessary to consider the balance of the public interest in maintaining the exception or disclosing the information.

Under regulation 12(2) the public authority must apply a presumption in favour of disclosure, in both engaging the exception and carrying out the public interest test. In relation to engaging the exception, this means that there must be clear evidence that disclosure would have the adverse effect listed in 12(5).

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Factors in favour of disclosure

- Homes England acknowledge that there is a presumption in disclosure regarding environmental information as well as a public interest in promoting transparency in how we undertake our work and allocate public money; and
- Homes England acknowledge that there is a public interest in the assessment of submissions for the Housing Infrastructure Fund.

Factors in favour of withholding

- The redacted information relates to ongoing transactions and negotiations between the council and third parties. It is not in the public interest for Homes England to disclose the sensitive contents of Medway Council's bid, because doing so will result in local authorities being deterred from including commercially sensitive information in their bids when submitting them. This will mean that Homes England has to evaluate bids that are less comprehensive than would otherwise have been the case, meaning the decisions will be less robust and less likely to deliver value for money; and
- The public interest is unlikely to be served where disclosure would result in a greater cost to the public purse. Medway Council's negotiating position will be adversely affected if third parties are aware of the sensitive information resulting in poorer value for public money.

Having considered the arguments for and against disclosure of the information, we have concluded that at this time disclosure of the information would have an adverse effect on both Homes England and the council. The balance of the public interest favours non-disclosure.

Advice and Assistance

In accordance with our Section 16 FOIA duty we can advise that the redacted information in Annex A will be publicly available when the council publish their bid submission in full as detailed in our S22 response above.

2.*Please state whether Homes England or the Secretary of State, in its approval of the bid*

(iii) carried out an assessment or calculation or otherwise considered the effect of the effect of the proposed infrastructure on emissions of carbon and on climate change; (and please provide a copy of the document which provides such assessment)

(iv) took into account the Government's commitment concerning climate change to comply with the criteria in the Paris Agreement.

I am able to confirm that Homes England does not hold the information detailed in this part of your request. This is because there is no legal or business reason for Homes England to do so.

In order to conclude that the information is not held, we have searched with our Housing Infrastructure Fund team who would have the requested information if held.

The FOIA does not oblige a public authority to create information to answer a request if the requested information is not held. The duty under section 1(1) is only to provide the recorded information held.

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The full text of section 1 in the legislation can be found here:
https://www.legislation.gov.uk/ukpga/2000/36/section/1

Advice and Assistance

We have a duty to provide advice and assistance in accordance with Section 16 of the FOIA. To comply with this duty we are able to confirm that the HIF assessment process does not include the information you have requested.

Right to Appeal

If you are not happy with the information that has been provided or the way in which your request has been handled you may request an internal review by writing to;

The Information Governance Team
Homes England – 6th Floor
Windsor House
50 Victoria Street
London
SW1H 0TL

Or by email to infogov@homesengland.gov.uk

You may also complain to the Information Commissioner however, the Information Commissioner does usually expect the internal review procedure to be exhausted in the first instance.

The Information Commissioner's details can be found via the following link

https://ico.org.uk/

Please note that the contents of your request and this response are also subject to the Freedom of Information Act 2000. Homes England may be required to disclose your request and our response accordingly.

Yours sincerely,

The Information Governance Team
For Homes England

INFORMATION NOTE

Project Name: **New Routes to Good Growth HIF**

Project Ref: **45426**

Note Title: **Assessment of Additional Utility Provision**

Date: **21/03/2019**

Prepared By: Reg 13(1) [redacted]

Electricity

1.1.1 2 overhead lines Reg 12(5)(e) [redacted] from Kingsnorth Power Station cross the east of the overall site. A 400kV electric cable runs along the edge of Vicarage Road.

1.1.2 Full development (10,600 homes) will require an estimated 18MW. Strood substation has available capacity of 30MW (UK Power Networks records). There is sufficient available capacity.

Gas

1.1.3 A major National Grid High Pressure gas main runs from Grain Liquified Gas Hub to Gravesend. SGN has also identified High Pressure gas mains running through the northern parts of the site. The masterplan has been developed on the basis that these will be retained in their present locations.

Water Supply and Foul Drainage

Water

1.1.4 Kent County Council has a growth target of 40,00 dwellings by 2031 in the Kent - Medway area. Due to differences in the timing of their respective plan periods Southern Water Water Resource Plans has projected a lower growth forecast (c. 85% of Kent County Council projection) which may lead to a water demand shortfall of 2.15ML/D. This shortfall will be addressed in various ways.

1.1.5 Southern Water has demand management policies in its AMP plans. AMP6 provides for water efficient network improvements and Catchment Management to improve water quality. In AMP7 (2020-2025), a Water Reuse scheme is proposed for Medway area with further water efficiency measures and leakage reduction measures planned in AMP8 (2025-2030).

Foul Drainage

1.1.6 The nearest Waste Water Treatment Works (WWTW) to Hoo St. Werburgh is Whitewall Creek. By 2031 it is anticipated to be over capacity by 625m^3/day. Upgrades will be required accommodate flows from new developments.

1.1.7 Southern Water is determining the technical specifications in its AMP 7 to ensure Whitewall Creek WWTW can treat to the permitted levels of BOD and ammonia Reg 12(5)(e) [redacted]

SGN
Your gas. Our network.

Long Term Development Statement 2017

Network Capacity

October 2017

Contents

Foreword

Welcome to our Long Term Development Statement (LTDS) for 2017.

Each year we produce our LTDS and Demand Forecasting Document (DFD). These companion documents allow our stakeholders to identify and evaluate connection or transportation opportunities by detailing planned major reinforcement projects and associated investment, significant completed projects and network developments and our view of how demand may change over the ten year period.

This year we looked at ways to make the information more accessible. As a result, we have combined the LTDS and DFD into one publication and included links to allow you to explore the content more easily. We hopeyou will find this approach helpful.

If you would like to discuss the changes, or any aspect of capacity management, our network capacity team, which produces our LTDS each year, can be contacted at network.capacity@sgn.co.uk

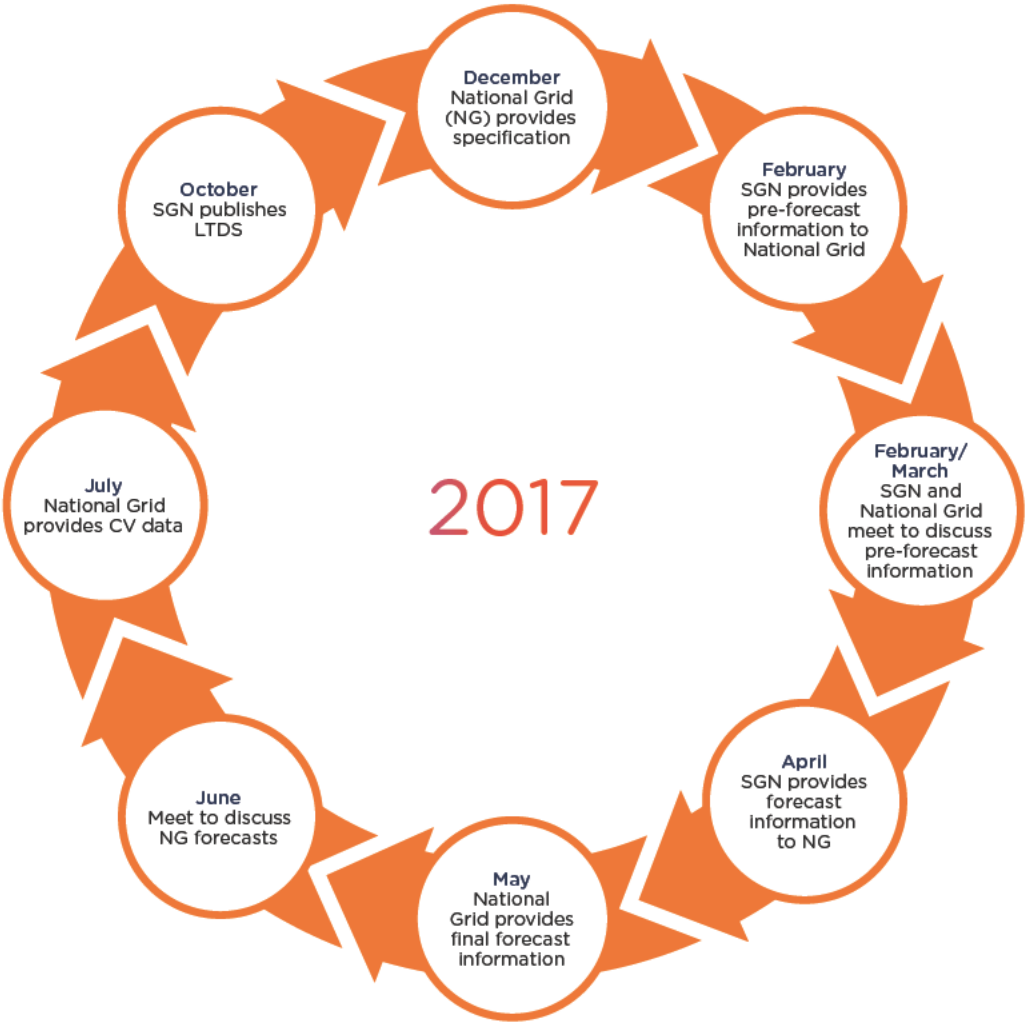
Paul Denniff
Network & Safety Director, SGN

Overview of LTDS process

The publication of our LTDS is the product of a yearly cycle of planning and consultations with our stakeholders.

The forecasts are updated each year with learning from the previous year applied to give a more accurate picture of what may occur.

This gives interested parties an understanding of how we see gas demand developing over the next ten years so they may plan accordingly with consideration to connection and transmission opportunities.



Introduction

The information within this document is presented within four sections.

The first section, 'The next ten years', supplies an overview of our forecasts and how we arrived at them.

The second section, 'Further reading', expands upon several items from section one.

The third and fourth sections, 'More detail' and 'Appendix 1', provides the background data and tables behind our forecasts.

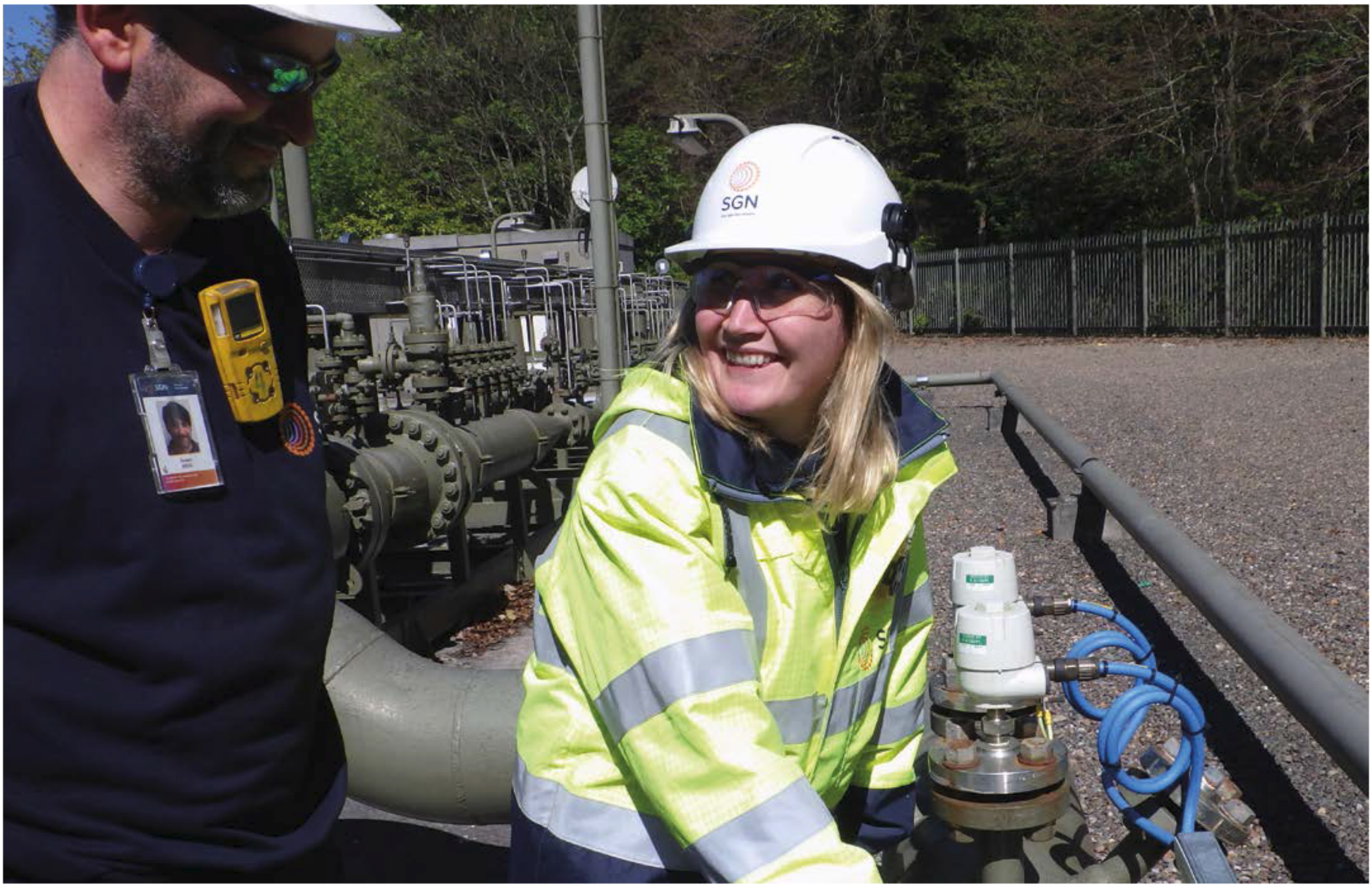
Look out for the blue circle links within the text to help you navigate between the sections allowing you to explore the information in greater detail then easily return to where you were previously reading.

Disclaimer

This document is produced for the purpose of and in accordance with Scotland Gas Network plc's and Southern Gas Networks plc's, collectively known as SGN, obligations.

These are Standard Condition 25 and Standard Special Condition D3 of their respective Gas Transporter Licences and Section O 4.1 of the Transportation Principal Document in the Uniform Network Code in accordance with information supplied pursuant to Section O of the Transportation Principal Document in the Uniform Network Code. Section O 1.3 of the Transportation Principal Document in the Uniform Network Code applies to any estimate, forecast or other information contained in this document.

This document is not intended to have any legal force or to imply any legal obligations as regards capacity planning, future investment and the resulting capacity.



The next ten years

At the end of the ten year forecast period we expect to have seen a net reduction in annual demand of 8.2% and Peak Day of 4.5% across our three LDZs.

In this first section, we will outline how we arrived at these figures and discuss some of the variables we have considered before finalising our forecast.

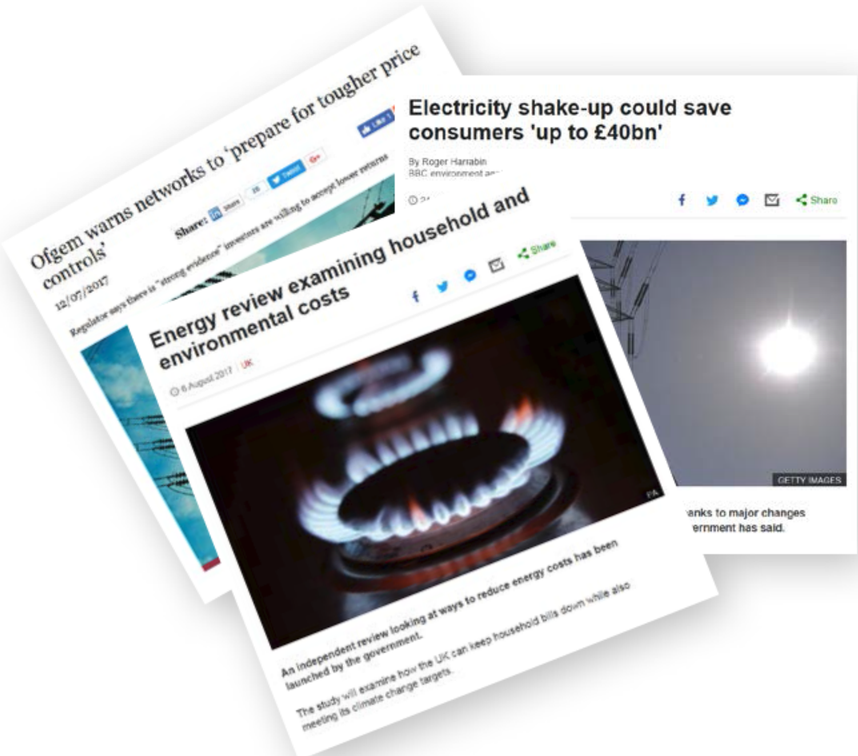
The key factors influencing our current forecasts are:

- Inflation and gas price impacting on domestic customer behaviour.
- GDP and manufacturing output as measures of economic growth and industrial activity.

Manufacturing
Forecasts predict production during 2017/18 show some minor increases.

GDP
The Office for Budget Responsibility (OBR) is forecasting growth of 2% for 2017. However, independent organisations forecast 1.5%.

Inflation
The latest forecast for 2017 is 2.4%, but is expected to fall to a target of 2% by 2019.



Our forecasts were produced in May prior to the June 2017 UK general election.

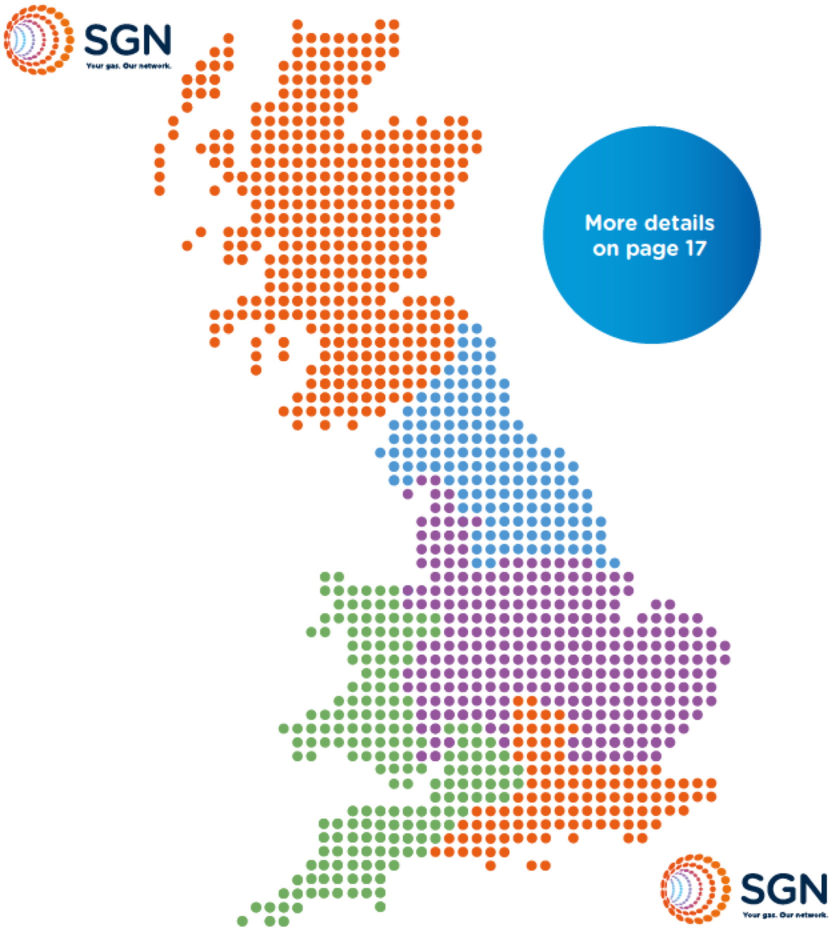
Following the general election, the government began consultations and released policy papers on energy and potential future energy strategies.

These policies indicate the future direction of change in the UK energy market and the potential to influence our forecasts, in the same way the existing UK Climate Change Act committing the UK to reduce emissions by 80% of 1990 levels by 2050, did.

However, until these translate into legislation or government strategy they cannot form part of our forecasting considerations.

We have not made a specific allowance within our forecasts for the potential impact of the UK leaving the EU.

We will continue to monitor events, revising our forecasts as required.



More details on page 17

We own and operate the gas networks in Scotland and the south of England comprising three Local Distribution Zones (LDZs).

Over the last year, we have seen an increase in house building across all three LDZs. However, despite this there has been an overall decrease in net demand.

Of note, Scotland continues to see a high number of requests for commercial and industrial connections whilst the south east's proposed garden villages, announced in 2015, continue to generate a lot of interest.

Although a change in government policy in 2016 removed the obligation of house builders to design within carbon neutral guidelines, a lot of work had already been done within the construction industry to incorporate the standards into new housing stock.

Until data is available to attribute the effect of this to a specific change in demand, we do not intend to make alterations to our approach in demand management nor make an allowance within our forecasts.

More details on page 21

At a local level we recognised the Greater London Authority (GLA) introduced a zero carbon policy for new homes and we will be monitoring the impact of this.

These figures show how we see demand altering year on year for the next ten years.

Scotland
Annual -0.76% av
Peak -0.34% av

South
Annual -0.90% av
Peak -0.54% av

South East
Annual -0.83% av
Peak -0.48% av

SGN Overall
Annual -0.82% av
Peak -0.45% av

The reasons for the demand reductions are:

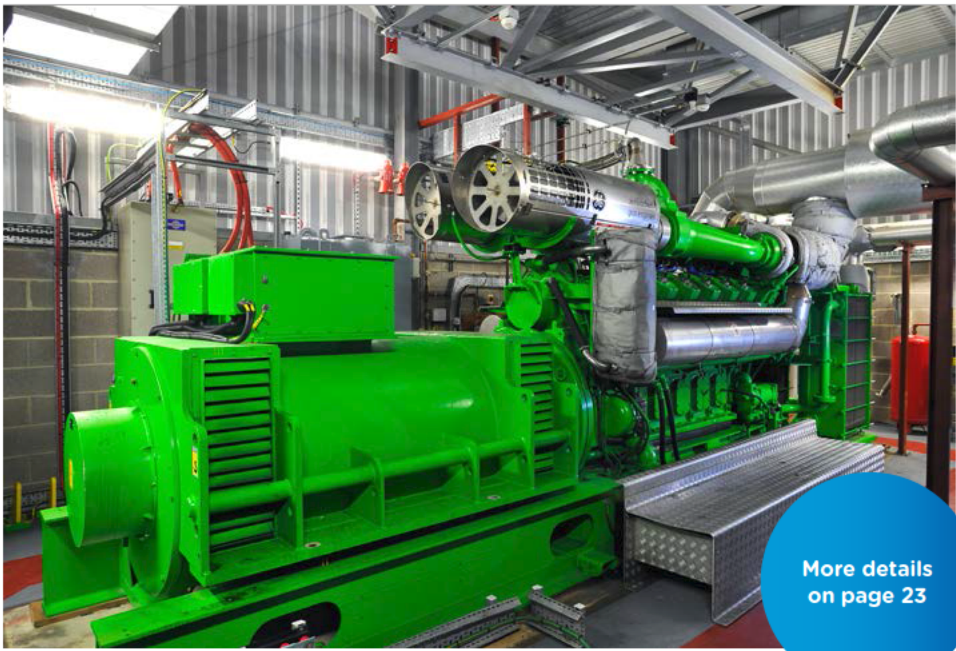
- Efficiency improvements to existing insulation and heating systems
- Increases in domestic and non-domestic gas bills resulting in changes to consumer behaviour
- Uptake of renewable technologies
- Changes to energy tariffs driving industry to manage energy more efficiently
- Government's commitment to climate change targets

More details on page 26

Government policy has resulted in many requests for embedded power stations across all three LDZs over the last year. However, not all requests have developed into actual connections.

These are a relatively new development intended to provide resilience within the local electricity power grid by generating electricity according to varying daily and yearly operational and market factors.

Once connected, due to the variations in operational profiles, these connections create further challenges when forecasting demand. We will continue to examine how this customer base grows before adjusting our forecasts.



More details on page 23

UK government has highlighted the importance Embedded Power Stations will play in the future energy mix. Embedded Power Stations are also referred to as STOR – Short Term Operational Reserve.

We have analysed the impact of renewable energy sources, primarily solar panels and heat pumps, on both annual and peak demand.

Specific adjustments have been made to this year's forecasts for both the annual and peak forecasts taking account of how renewable energy could impact over the ten year period.

It is probable we will need to make further adjustments to both the annual and peak figures, however, any adjustment to the Peak Day demand will be smaller as there is no guarantee renewables would be available at peak periods.

More details on page 21

More details on page 21

Image courtesy of anoukprodcuctions.com

The Queen's speech in June 2017 announced a Smart Energy bill restating that every consumer should be offered a smart meter by 2020.

We continue to support the deployment of smart meters, however with regards to our forecasts currently there is insufficient data to determine the specific impact this technology may have on demand profiles.

We will continue to monitor the evidence and review our approach as more information becomes available.

This is our view of demand over the next ten years along with the factors which we see as impacting upon any changes which might occur. As mentioned in the introduction, if you wish to discuss any aspect of what we discuss here, or network capacity in general, please feel free to get in touch with the team at network.capacity@sgn.co.uk

We will now show you some of the changes to our systems detailing investment and innovation projects. We will also supply details of how you may get in touch should you wish to discuss a connection opportunity.

The gas we distribute to our customers enters our networks via the National Transmission System (NTS) operated by National Grid, biomethane sites feeding green gas, Wytch farm and Grain LNG terminal which receives Liquefied Natural Gas (LNG) from overseas.

Currently there are no third party-owned storage installations connected to our networks. If you wish to discuss storage or biomethane injection opportunities with us please contact Joel Martin on 0131 469 1813 or alternatively email joel.martin@sgn.co.uk

All supply points are governed by Network Entry Agreements (NEAs). These include all biomethane sites injecting into our network.

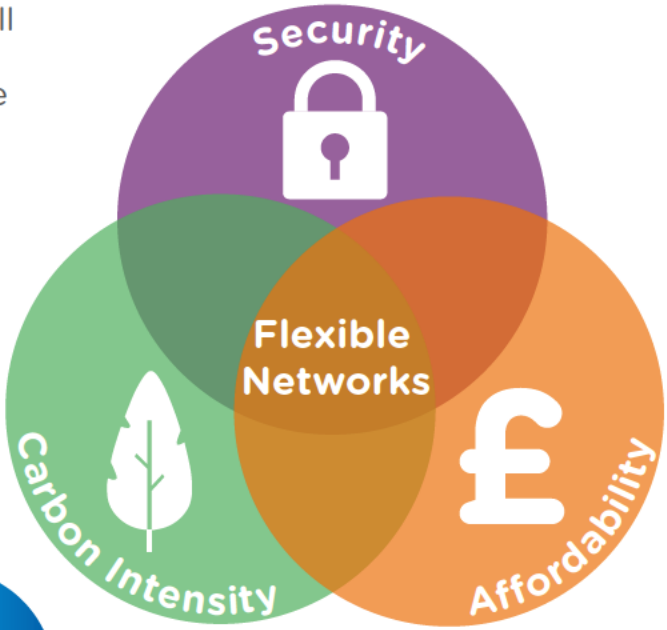
The Isle of Grain Import terminal is also a road tanker filling facility for supplying our SIU networks.

Further reading on page 12

Following the success of our Opening Up the Gas Market project in Oban, we are currently looking at how we can apply what we have learnt to our four mainland Scottish Independent Undertakings (SIUs).

For more information on Innovation visit SGNs website

The success of this project will not only ensure a cost-effective energy supply is available to our customers in these areas of our networks, but will also give further evidence to support changes to the gas quality specification contained within the Gas Safety Management Regulations (GS(M)R).



"Our strategy is very much shaped by our customers and stakeholders, and it's important we really listen to questions they may have about costs, how safe unconventional gases such as hydrogen will be, and how new replacement/maintenance technology might affect their daily lives. Their feedback ultimately helps shape our portfolio by validating the projects we decide to progress."

John Morea, CEO, June 2017

Further reading on page 13

During 2016/17 we spent £4.5m on Network Innovation Allowance projects and £5.4m on our three major Network Innovation Competition projects.

In a speech to the Utility Week energy summit in June 2017, our CEO John Morea highlighted the importance of green gas within the future energy mix.

"We realise no one solution fits all but modernising our gas networks gives us options which underpin the lower carbon UK economy of the future.

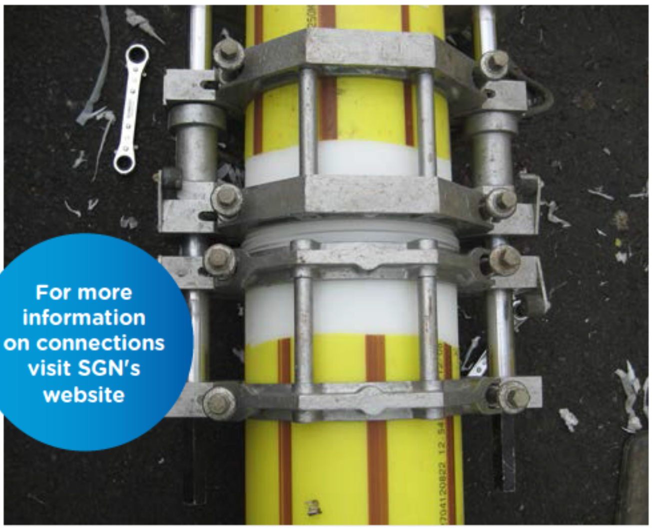
"The use of renewable gases will allow customers to continue to benefit from our valuable gas network infrastructure and, with the right incentives, will provide an affordable, low carbon solution we all want, with the security of supply we all need."

Further reading on page 14

If you have a biomethane project and are interested in injecting into our network you can contact Joel Martin on 0131 469 1813 or alternatively email joel.martin@sgn.co.uk who will be happy to discuss the process for getting connected.

At present, there are no large projects > £1m in planning across our Local Transmission System extending our network.

Further reading on page 15



For more information on connections visit SGN's website

Customers looking to discuss making a connection to our systems should in the first instance contact our third party connections team at soe_gtuip_sgn@sgn.co.uk.

This team is our primary customer facing department in relation to Independent Gas Transporters (iGTs) and Utility Infrastructure Providers (UIPs).

Customers should be aware several areas across our systems are now subject to Planning and Advanced Reservation of Capacity Agreements (PARCAs).

For more information on PARCAs visit National Grid's website

Further reading on page 16

June 2017 saw the successful implementation of Project Nexus. This was the result of over two years of work on the replacement of a number of legacy systems over ten years old. The impact of this was throughout the gas industry, not just restricted to the distribution networks (DNs).

We operate in a regulated environment with an agreed licence that sets out the principles we must adhere to as we manage the network, the standards our customers should expect us to operate to and the industry codes through which we manage our networks.

We have commenced year five of the eight year price control period RIIO GD1 and have been consistently delivering defined regulatory outputs across the range of our activities. The current price control period will come to an end in April 2021. We are now starting to look forward to our next price control which will run from 2021 onwards. Our regulator, Ofgem, has set out the key principles that will govern the next price control period in an Open Letter in July 2017 and how it is looking to ensure network companies deliver value for money and services that consumers want and need. We will build on our existing engagement programme listening to our stakeholders to ensure we can reflect their feedback during the development of RIIO-GD2. If there is anything you would like to discuss with us regarding the next price control period, please get in touch by emailing lets.chat@sgn.co.uk.

We believe that in ten years' time, how the UK produces and uses energy will be very different to today, although, how fast that change happens and in what direction is still uncertain.

"Energy networks should prepare for tougher price controls" Link to Ofgem website

All players in the UK energy industry will need to be adaptive to new technology and ways of working to ensure UK consumers have the energy they need when they need it. We are working on a number of innovative projects to support credible options going forward.

Until the specifics of RIIO - GD2 are known, our forecasting approach is based on RIIO - GD1 with an awareness of existing government targets.

Further reading on page 16

Further reading

In this section, we further explore items covered in section 1 'The next ten years'.

Supply

Developments of our transportation networks are primarily demand driven. National Grid covers the overall UK supply position and security of supply assessment in detail for the National Transmission System (NTS) within its 10-year statement and in its publication Transporting Britain's Energy 2016; UK Future Energy Scenarios. The majority of the gas entering the LDZs flows through national offtakes from the NTS. There are currently several other locations where gas flows directly into the LDZs and these are detailed below.

These facilities are governed by Network Entry Agreements and the amount of gas flowing into the network is currently increasing as viable alternatives to conventional gas are explored. There are no third party-owned storage installations connected to our networks. The main source of gas supplies has predominantly been from the UK Continental Shelf (UKCS), however, this has changed as the gas available from the UKCS diminishes. The last few years have seen a higher level of gas imports from the European interconnector and Norway, and while the dependency on these sources is expected to increase, there is also an increase in LNG importation to meet the nation's requirement, notably at Isle of Grain in Kent and Milford Haven in Wales. The global demand for gas will ensure there is unlikely to be a significant reduction in the price of gas to the UK consumer. The impact of the shale gas industry in the USA is likely to be negligible as few export facilities currently exist and the impact may be felt by the spread of technology potentially allowing other countries to begin large scale production. It should be noted that by its nature as the main source of gas that can be sold to any market in the world, LNG is likely to remain susceptible to periods of short term price volatility.

Gas Supply Facilities

Offtakes

The majority of the gas entering the LDZs flows through 30 national offtake sites from the NTS. These sites are where gas is metered as it enters our networks. The gas pressure is then reduced in line with our requirements. It is also where odorant is added.

Grain LNG (South East LDZ)

Grain LNG, formerly the Isle of Grain storage facility, has now been developed as an LNG import terminal. The first shipment of imported LNG was unloaded in July 2005. Since then Grain LNG has steadily expanded the facilities. In late 2015 a new road tanker loading facility was commissioned and SGN use it as a source of LNG for our SIUs.

Wytch Farm (South LDZ)

The onshore oil and gas field at Wytch Farm in Dorset has been supplying gas into the LTS as a by-product of oil extraction for over 30 years. While gas is still being supplied in small quantities, these are much lower than the original flow-rates due to the field depleting.

Biomethane

Biogas (a renewable source of gas) can be produced from a variety of sources; the prevalent one being anaerobic digestion. Through this process organic material such as sewage, food waste and energy crops is broken down to produce biogas. Once the biogas is treated, the resulting biomethane can be injected into the gas network.

Back to 'The next ten years' - Supply

Innovation

Opening Up the Gas Market

We deliver gas safely and reliably to customers in Scotland and Southern England. The UK is reliant on its gas supply so we need to make sure that the supply is clean, secure and affordable. With the changes in gas supply, especially in the depletion of the North Sea, the UK is increasingly reliant on gas supplies from other countries, all of which have different compositions and therefore quality, depending on its source. While sources of new gas are numerous, the UK's specification for gas composition is prescriptive therefore, restricting the sources of gases that can be used in their pure form and thus limiting the gas market.

To prove the usability of other gas composition within the UK gas networks, SGN carried out a research project, 'Opening Up the Gas Market', which sets out to demonstrate that these regulations could be widened to accommodate more gases without the need for processing, but not compromising on safety. This looked to increase competition for network entry, improving energy security and reducing the cost of gas for customers. This was demonstrated through trials carried out in Oban.

Given the results of the trials this innovation project has been very successful. The outcome we are looking for is a change to the legislation which requires cross industry support. For this to happen, it is hoped the industry will come together and support the use of different gas blends.

If this can be achieved it will result in reduced costs to the customer through avoided composition processing and will have a wider impact on the gas market in terms of widening the number of sources.

The learning from this project should be disseminated through the Institute of Gas Engineers and Managers (IGEM) Gas Quality Standard Working group in support of the changes to GS(M)R.

Readers wishing to discover more about our opening up the gas market may do so at
sgn.co.uk/Publications/Innovation/

Real-Time Networks

Our Real-Time Networks (RTN) project, funded by Ofgem through the Network Innovation Competition (NIC) scheme, aims to demonstrate how a more flexible and intelligent gas network will meet the needs of the changing gas industry in the UK.

The project follows a pilot trial methodology with the procurement and installation of innovative sensor technologies across pressure tiers in a representative section of the UK gas network. These technologies, combined with novel power and communications and a cloud-based data system, will help to create a comprehensive understanding of demand at a distributed level. The technology will be used to develop a prototype real-time energy model. From this we aim to demonstrate the viability and practical reality of a mixed-source, energy-centric gas network for the future.

The project, which commenced in 2016, is expected to deliver its initial outcomes and benefits in 2018 following successful sensor installation, data collection and real time model development.

100% Hydrogen Networks

The UK has an advanced and efficient gas network that currently supplies the energy to heat to over 80% of the UK's buildings also supplying the vast majority of the UK's industrial heat. This gas network delivers six to seven times more of the UK's peak energy than the electricity network. The gas network therefore has a major role to play in the journey to decarbonisation.

Reducing and eliminating carbon can be done in a variety of ways in the short, medium and long term. In the short term by substituting bio fuels such as biomethane for natural gas and by widening the range of gases the networks can accommodate without processing. In the medium term by blending zero carbon gas such as hydrogen, or in the long term by removing carbon completely and using hydrogen as the medium.

Through a proposed collaborative project with all the other DNs we are continuing to undertake, projects to support the future of energy in the UK, where we are looking to build on specific evidence in support of a future physical demonstration of a 100% hydrogen network. We are also progressing an additional hydrogen network innovation allowance (NIA) project.

Back to 'The next ten years' - innovation

Greening the gas

The UK has a legally-binding target to obtain 15% of its energy consumption from renewable sources by 2020, and the target for 2050 is to reduce greenhouse gas emissions by at least 80%, relative to 1990 levels. We believe there is significant potential benefit from the development of alternative sources of gas.

Biomethane is derived from biogas which is produced by anaerobic digestion. During this process, organic material is broken down in the absence of oxygen to produce biogas and digestate; a nutrient rich fertiliser.

The most efficient use for this biogas is to clean it up and inject it into the gas network. Biomethane is regarded as a low-cost and scalable form of renewable and low carbon heat, which can help towards the country's energy goals.

We believe the gas distribution networks will continue to play a crucial role in the domestic heating market and will provide the most cost effective path for low carbon transition with significant social benefits in terms of energy security and fuel poverty.

A number of independent studies have shown the gas networks can be a major component of a low carbon energy system. We also know from our own research people are generally happy using gas for heating and so, if we can decarbonise the gas flowing to people's homes this then saves households from switching to other more expensive forms of low carbon heat in the future while allowing carbon targets to be met.

Biomethane injection projects are currently supported by the government's 'Renewable Heat Incentive' (RHI). These key incentives have supported the development of renewable heat technologies allowing us to make considerable progress on our declared target of the equivalent of 250,000 houses supplied by biomethane by 2021.

Portfolio of biomethane sites		
LDZ	**Total**	**Equivalent houses**
Scotland	13	86,868
Southern	20	107,387
Total	33	194,255

Table 1: Portfolio of biomethane sites

During 2017 we further expanded the portfolio of biomethane sites in our networks. These sites can potentially provide an additional connected capacity in our networks. Further sites are currently in the process of construction and will be connected in the future. The portfolio as of end August 2017 is as shown in Table 1.

Biomethane for injection into the gas network is produced by cleaning and upgrading biogas that has been created through either an anaerobic digestion or gasification process.

The biomethane may need propane to be added by the biogas producer to ensure it has the required energy content, prior to injecting into the network. To ensure the biomethane meets the requirements for the gas grid, it passes from the producer's plant through a Network Entry Facility where it is checked for both gas quality and energy content, before being metered and odorised to give it the characteristic smell.

Before being injected into the gas network the biomethane must be sold to a gas shipper. Ofgem can provide details of licensed gas shippers.

Back to 'The next ten years' - Greening the gas

Below 7 Bar distribution system

The distribution system is designed and reinforced to meet a peak six-minute demand level, which is the maximum demand level (averaged over a six-minute period) that can be experienced in a network under cold winter conditions. We will continue to invest for reinforcement and new connections consistent with the change in Peak Day demand forecast in this document. Detailed below are the projects to ensure we deliver these conditions. These can be the result of localised growth in a given area.

<7Bar projects under consideration in Scotland		
Project	**Build year**	**Scope**
Glasgow MP	2018/19	2.0Km x 630mm PE / 24" ST
Edinburgh MP (Newcraighall)	2018/19	0.93Km x 500mm PE
Inverness IP	2018/19	1Km x 355mm HDPE / 12" sST
West Mains Rd, Edinburgh MP	2019/20	1km x 500mm PE
Haddington - Dunbar IP (Ph 1)	2019/20	1.8Km x 315mm HDPE
Aberlady - Gullane (Ph 1)	2020/21	2.6Km x 355 mm PE

Table 2: < 7Bar projects in Scotland under consideration

<7Bar projects under construction in southern England		
Project	**Build year**	**Scope**
Wavendon MP	2017/18	2.36km x 355 PE
Allington MP	2017/18	2.3Km x 400mm PE

Table 3: < 7Bar projects in southern under construction

<7Bar projects under consideration in southern England		
Project	**Build year**	**Scope**
London IP	2018/19	0.5km x 24" ST
Gosport MP	2020/21	0.6Km x 355mm PE + 1.6Km x 400mm PE

Table 4: Projects in southern under consideration

Back to 'The next ten years' - < 7Bar distribution system

Regulation and commercial developments

Gas Distribution Price Control (RIIO-GD1)

As a gas distribution company, our activities and revenues are subject to economic regulation by Ofgem. Periodic reviews, known as Price Control Reviews (PCR), are conducted by Ofgem. In April 2013, we entered a new PCR period known as RIIO-GD1. This will run until March 2021. RIIO encapsulates the direct link between the network company charges and the level and quality of the outputs and service provided to its customers.

For more information on RIIO - GD1 visit Ofgems website

Revenue = Incentives + Innovation + Outputs

Uniform Network Code (UNC) developments

As noted in the start of the document, we are obliged to operate the network in accordance with a set of rules, the UNC. There have been several UNC modifications, some key ones are detailed below:

- *Mod 90; Interruption Reform*. This review of interruptible loads resulted in all loads becoming firm as of 1 October 2011. However, where possible we can run annual or ad-hoc interruption tenders. This will allow us to consider specific areas where allowing certain large customers to tender for an interruption contract we can defer of eliminate the need to invest in reinforcement. These annual tenders occur in early June.
- *Mod 390; AQ Review*. This allows an annual review of hourly capacity values with large users through the shipper community. This process ensures that the end user hourly capacity values, used by us for network capacity management, are as accurate as possible and not over or understated. By achieving accurate values we not only protect the safety of the network and security of supply but also maximise the amount of capacity available for use.
- *Mod 420; New Connection*. This modification allows requests from new connection users in areas where their capacity requirements were not immediately available. This modification implemented an application process whereby customers wishing to connect to our network can apply to do so, on an interruptible basis until their full capacity is available.
- *Mod 458; Seasonal Large Supply Points*. We lead the development of this modification to create a process which enables customers to apply for summer capacity only, thus removing the barrier associated with potential reinforcement. This has been put in place to enable summer usage of gas for seasonal businesses, such as drying crops, and will potentially enable more new gas connections in areas of limited capacity and maximising the capacity usage on the network during the off-peak summer season while retaining the security of the network during the peak winter months. From 1 April 2016, we have accommodated a number of these loads. This mod has proven to be of interest to companies keen to improve their environmental credentials by reducing their dependence on heavy fuel oil and has also supported business by providing a wider choice of fuel sources.

Back to 'The next ten years' - Regulation

Project Nexus

Project Nexus was the largest industry change programme the gas industry has undertaken in many years. The scope of the programme was for Xoserve to replace its disparate end of life systems with a new centralised SAP solution. The new systems create improvements to data processing and settlement, resulting in more accurate allocation of energy, which in turn provides the consumer with a more accurate bill. The programme included changing and migrating all existing meter points into the updated systems.

This was an industry-wide programme which required extensive co-ordinated market trials testing. All GDNs had network obligations to deliver the programme within timeframe. Ofgem took over the formal programme sponsor's role in April 2016 and the programme was successfully delivered on 1 June 2017.

SGN mobilised an IT lead programme team to deliver Project Nexus for the business. The internal programme was complex covering five directorates, 293 functional requirements, development, testing and implementation to 16 downstream applications, and changes to 104 interfaces.

SGN was influential during Project Nexus, representing the gas networks at the monthly steering group meetings and risk advisory boards. We worked closely with Ofgem, Xoserve and assurance partners to support a successful implementation.

Back to 'The next ten years' - Project Nexus

More detail

This section with Appendix 1 provides details of the econometric assumptions used for the forecasts and more details of the demand forecasts.

The LTDS provides an overview of the ten-year forecast of annual and Peak Day demands we use. This is in accordance with the obligations within our Gas Transporter Licence and Section O of the Uniform Network Code Transportation Principal Document.

The Uniform Network Code Offtake Arrangements Document sets out the framework for exchanging the necessary information to assist transporters to generate long term demand forecasts. The publication of our LTDS forms part of this process.

Development of our transportation networks is primarily demand driven, although, there have been some onshore gas production enquiries in the past in the form of biogas which has necessitated capacity analysis and development.

The overall UK supply position and security of supply assessment is covered in detail by National Grid in its Ten Year Statement for the National Transmission System and in its various publications and consultations associated with the Future Energy Scenarios 2017 process.

The data and assumptions used to develop the 2017 demand forecasts were collated and compiled in the first quarter of the year when there has been continued growth in the UK economy. However, the impact on the economy of the decision to leave the European Union will depend heavily on the ongoing negotiations with the EU. This may affect the final demand that will be seen by the end of this year and subsequent years.

Demand forecasting performance

The following section provides an assessment of the forecast process used last year and outlines the conclusions that were reached regarding the performance of last year's process. It also outlines the high-level developments incorporated into this year's process as a result of the performance assessment. Each LDZ's load band is examined separately.

0 to 73 MWh – Domestic

In Scotland, we saw a rise in the level of demand in this sector (3.9%), compared to last year. Our analysis has shown this to be due to a lower than expected gas price.

In the south east, there has been no overall change in demand in this sector compared to a decline in demand last year of 3.7%.

The south LDZ has seen a small increase in the level of demand in the last two years of 0.5%.

73 to 732 & >732 MWh – Industrial/Commercial

There has been sustained growth in the economy during 2016 despite the referendum vote on the 23 June 2016 to leave the EU, with all four quarters showing quarter on quarter growth. This seems to have had an impact on the level of demand with all three LDZs showing growth in this sector, continuing the trend from last year.

The data on customer numbers appears to show a fall in the number between 2015 and 2016 for all LDZs, compared to a rise in the previous year.

This whole sector has seen some unexpected results where there are pockets of growth and decline, some counter to previous years' behaviour. This volatility is not particularly surprising in a period where the future stability of the economy is uncertain after the EU referendum, but gas prices are still falling, driven by the decline in oil prices.

UK Outlook

Medium to long-term LDZ economic outlook

This section provides a general overview of the UK economy to give some context to the data that is provided in this report. It also outlines some of the key econometric assumptions used to develop the forecasts.

Inflation

After a period of instability during 2009 to 2012 the Consumer Price Index (CPI) had started to stabilise in the 2 to 3 per cent range in 2013 and then fallen steadily to end up hovering around zero towards the end of 2015; see figure 1. However, during 2016 and into the first half of 2017 the CPI has steadily risen to around 2.5%.

Figure 1: Change in rate of CPI

The latest forecast for the whole of 2017 as provided by the Office of Budget Responsibility (OBR) in March 2017 is 2.4%, but expected to fall to the target of 2% by 2019.

UK Gross Domestic Product (GDP) and Gross Value Added (GVA)

Gross Value Added (GVA) measures the contribution to the economy of each individual producer, industry or sector in the United Kingdom. GVA is used in the estimation of Gross Domestic Product (GDP). GDP is a key indicator of the state of the whole economy and equates to GVA plus taxes on products minus subsidies on products. A significant decline in GDP occurred during 2008/9 set against a long period of growth from 1992. However, there has been some sustained recovery in GDP since that time.

The latest economic figures included in the graph taken from the Office of National Statistics show a sustained growth in the economy during 2016 of 1.8%. The Office for Budget Responsibility (OBR) is forecasting growth of 2% for 2017. Independent external forecasters are forecasting in the range 1.1% to 2.0% for 2017. The overall average of these external forecasters is a rather pessimistic 1.5%, presumably resulting from the ongoing uncertainty of the impact of the UK leaving the European Union.

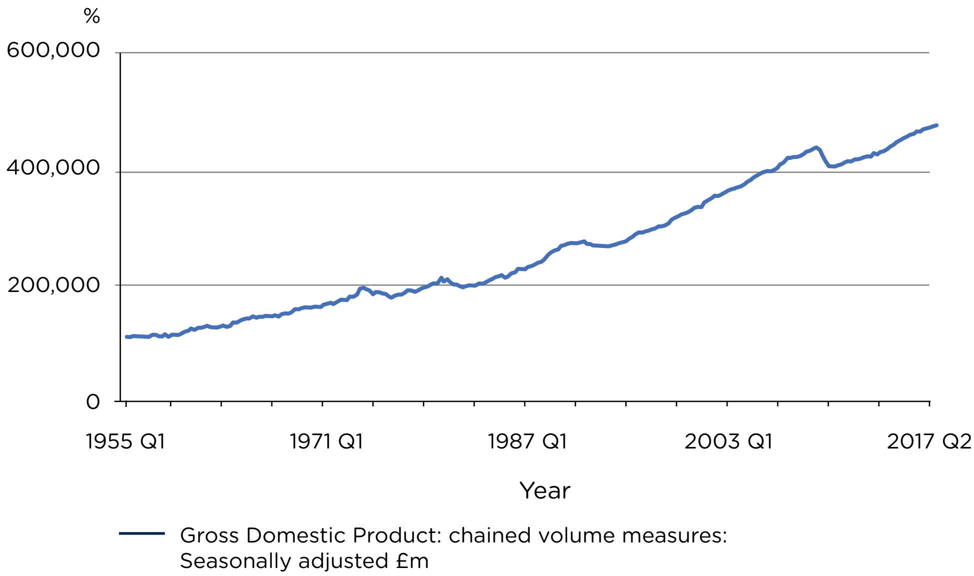


Figure 2: Change in GDP

The OBR published its central forecast for inflation in March 2017 which is shown in figure 3.

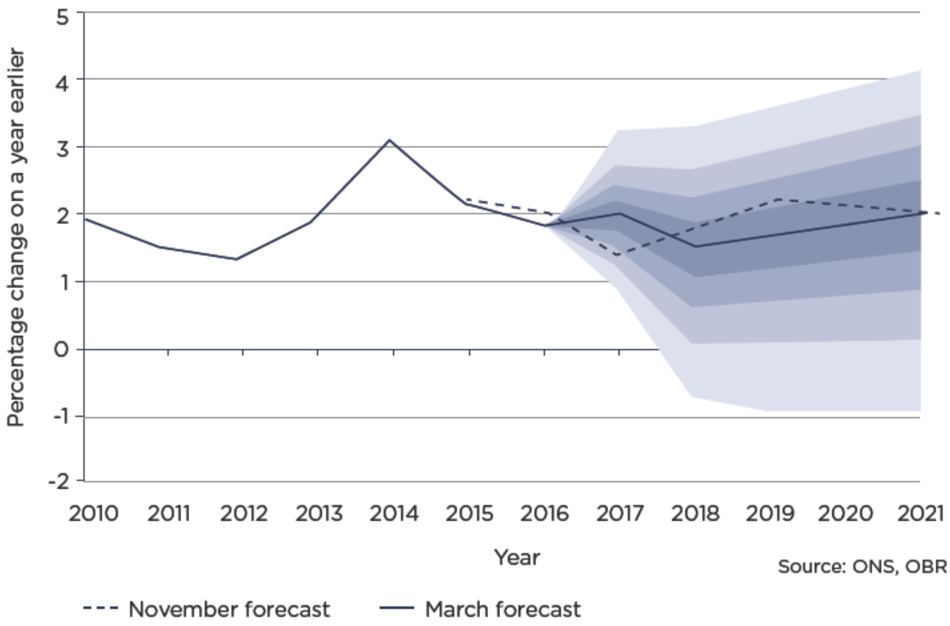


Figure 3: Forecast inflation rate

Gross Disposable Household Income (GDHI)

This can be used as an indicator of householders' ability to absorb rising energy prices and provides a reasonable indication of how affluent households are in a particular area.

Manufacturing output

Manufacturing output trends provide an assessment of how this type of industry is performing. There was a significant downturn in manufacturing during 2009 but it has shown recovery and decline since then. This can be seen in the figures for the Manufacturing Index from the Office of National Statistics.

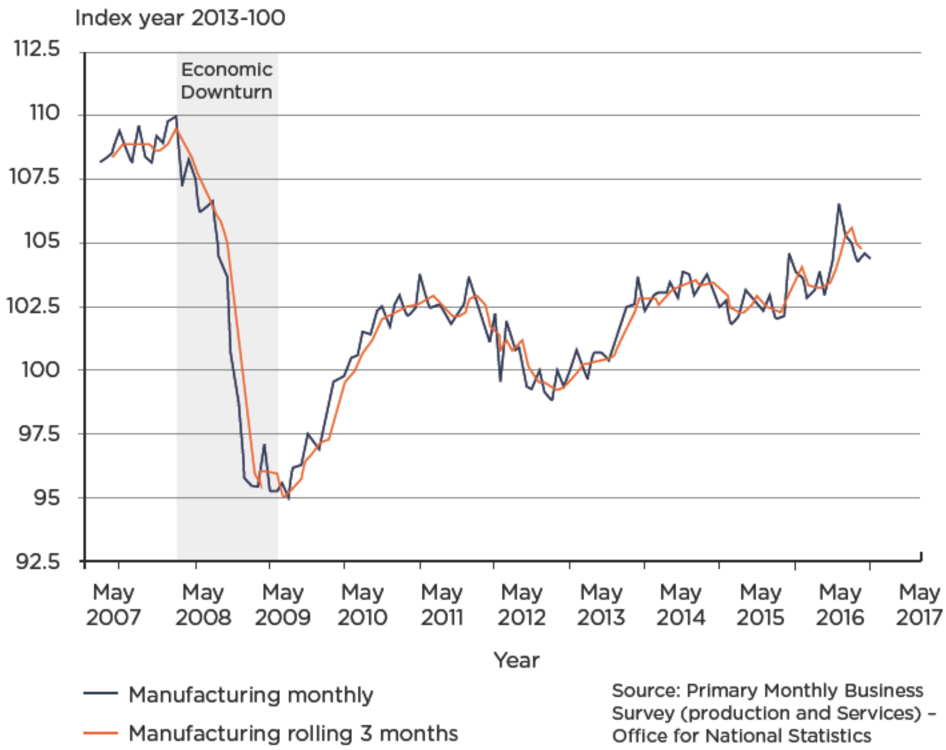


Figure 4: Change in rate of manufacturing output

Household numbers

The historical data provided is based on the Department for Communities and Local Government (DCLG) website reported data (mid-year) adjusted to year end and is broadly consistent with historical data provided by our data service provider last year.

Employment
After a steady rise in employment for nearly 20 years, there has been a quite steady decline in the number of workforce jobs between 2007 and 2009, with a small recovery in 2010 and 2011, dip in 2012 and stronger recovery in 2013 to 2015. In 2016 300,000 jobs were created of which 160,000 were employee jobs as opposed to self-employed. This pattern is reflected in the commercial/services sector with 247,000 jobs created. Manufacturing has seen a steady decline since 1998 after a period of small growth from 1992 to 1998. The figures for 2011 to 2014 however show a small rise of around 160,000 over the three years, but then a fall of 70,000 by 2016.

Regarding the future employment levels in the commercial/service sector we are expecting the level of rise in the number of jobs created in 2015 will not be repeated in the short term and therefore, there will be a pattern of growth that reflects the pattern that has been seen over the last 10 years.

Future employment levels in manufacturing are expected to decline in line with a pattern reflected over the last 10 years.

Gas/fuel price
Prices in all markets have shown, until very recently, rises from 2002 for households and effectively from 1999 in the non-domestic market. This has been driven by the wholesale gas price rises, which has in turn been driven by rising oil prices. However, this has been turned around significantly with the recent sharp decline in oil price, driven by the entry into the market of the shale oil in North America, decline in worldwide consumption and the refusal of OPEC to cut back production until recently.

On balance, it can be expected that oil prices may fluctuate a little before rising again slowly unless there is a major supply disruption, which would almost certainly see a significant rise in oil prices and hence wholesale gas prices. Any assertions made by commentators in the past regarding the delinking of gas prices from oil do appear to have been unfounded given the fact that wholesale gas prices have fallen broadly in line with oil prices although not as dramatically.

Efficiency Improvements
In general gas demand has been declining in recent years, although there are some instances of growth in some sectors in parts of the country, possibly driven by falling gas prices and the improving economy. However, it is difficult to separate the impact of efficiency improvements from the impact of variations in gas prices and the effects of variations in the number of supply points.

There has been a programme of gas fired domestic boiler replacement and improved insulation initiatives for many years. The higher levels of efficiency achieved with these is a contributory factor in the decline of gas demand. However, the increases in efficiency may in some circumstances have been used to provide warmer comfort levels resulting in higher than expected gas usage especially in winter.

Energy Bill 2011 (Updated 2017)
There are a range of provisions in the bill to encourage energy efficiency and to remove barriers to investment in energy efficiency:

Private rented sector
Powers established for the Secretary of State, which will, in the event of continued poor energy efficiency performance in the private rented sector, prevent private residential landlords from refusing a tenants' reasonable request for energy efficiency improvements to be undertaken in their properties, where a finance package is available. It will also require private landlords in the domestic and non-domestic sector to improve some of the least energy efficient properties where finance is available.

Energy Company Obligation (ECO)
This is the government's new domestic energy efficiency programme which has replaced the existing CERT and CESP programmes, both of which closed at the end of 2012. ECO works to provide additional support for packages of energy efficiency measures. ECO also provides insulation and heating packages to low income and vulnerable households and insulation measures to low income communities.

ECO creates a legal obligation on energy suppliers to improve the energy efficiency of households. The scheme is administered by Ofgem.

Further measures to improve energy efficiency

- Amendment of the smart meters powers in the Energy Act 2008
- Amendment of the Energy Performance of Buildings (Certificates and Inspections) (England and Wales) Regulations 2007
- Establish powers for the Secretary of State to require energy companies to provide information on the cheapest tariff on energy bills

As high level principles the provisions cannot be seen as providing the only solution to cut carbon emissions to the target levels. Relatively low cost measures to improve efficiency like boiler replacement and cavity wall and loft insulation benefit from some government incentives, but higher cost solutions like renewable heat or solid wall insulation would need to allow protracted payback periods (approaching 50 years or more) to be viable, unless a significant subsidy is obtained. This is noticeable when the Warm Homes Fund is examined. This is a fund aimed to provide heating solutions to fuel poor households who do not currently use gas. The current bidding round is due be announced in October 2017 and is heavily oversubscribed.

Back to 'The next ten years' - Demand forecasting

In summary it appears there are still some barriers to major investment in efficiency savings, although recent incentive developments have reduced these, but the key driver, at least in the short term, will be the price of gas when compared to the cost of installing new energy efficient appliances or means of reducing heat loss from premises.

Smart meters

Ofgem's report for the Energy Demand Research Project (EDRP) in December 2010 recognised the evidence suggesting smart meters can be a vehicle for effective action to reduce domestic energy demand. However, there was no distinction between gas and electricity meters.

The most recent formal update on the full roll-out programme was from the DECC 4 Annual Report. This stated that it had been delayed again until mid-2016 compared to the previous date of autumn 2015. The target date for completion of the full roll-out stays at the end of 2020 however the Queen's speech in June 2017 contained a Smart Meter Bill which restated every consumer should be offered a smart meter by 2020.

Back to 'The next ten years' - Smart metering

It is widely acknowledged that smart meters have the potential to alter how consumers use energy, however, as yet there is insufficient data available for us to alter our approach to demand forecasting.

Carbon neutral housing

The previous government policy on carbon neutral new housing, or sometimes called 'zero carbon' housing, has been interpreted by some as being taken literally from the headline title. This was planned to come into force but the current government axed this policy last year. It should therefore not be necessary to make any specific adjustments to forecasts of household demand for this issue but to keep this area under review for future forecasts. As many groups have been involved in trying to achieve carbon neutrality there could still be many new housing sites that will be developed as if the policy was still in place.

Back to 'The next ten years' - Carbon neutral housing

Renewables

In March 2011, the government announced the introduction of the Renewable Heat Incentive Scheme (RHI).

The RHI was aimed at helping to accelerate deployment of renewable heat sources by providing a financial incentive to install renewable heating in place of fossil fuels. Initially, in the first phase, long-term tariff support was targeted at the big emitters in the non-domestic sector. This sector, which covers everything from large-scale industrial heating to small business and community heating projects, was anticipated to provide the majority of the renewable heat needed to meet the targets and represents the most cost-effective way of increasing the level of renewable heat.

Under the revised domestic RHI scheme introduced in April 2014 there is financial support for renewable heat, targeted at, but not limited to, off gas grid households. The support is paid at a set rate per unit of renewable heat produced (kWh), for seven years, to the owner of the heating system.

The scheme is administered by Ofgem, to control costs a system of tariff reductions has been introduced, triggered as threshold spend figures are reached.

On 14 December 2016, the UK Government published its response to the consultation on the Renewable Heat Incentive scheme as a result the Department for Business, Energy & Industrial Strategy (BEIS) announced there will be further reductions in certain tariffs effective from 1 July 2017.

Back to 'The next ten years' - Renewables

Regional economy

Scotland

Scotland LDZ possesses a strong commercial and services sector base, accounting for over 75% of the Scottish economy. Financial and insurance services growth underpinned by the presence in Edinburgh and Glasgow of many leading financial institutions is the third largest in GVA terms in the UK behind London and the south east. The recent economic downturn did have a negative effect as banks consolidated offices and functions. There is some speculation that banks based in the UK could move their operations to another EU country when the UK leaves the EU and this could have an impact on the large number of banking and finance related jobs in Scotland.

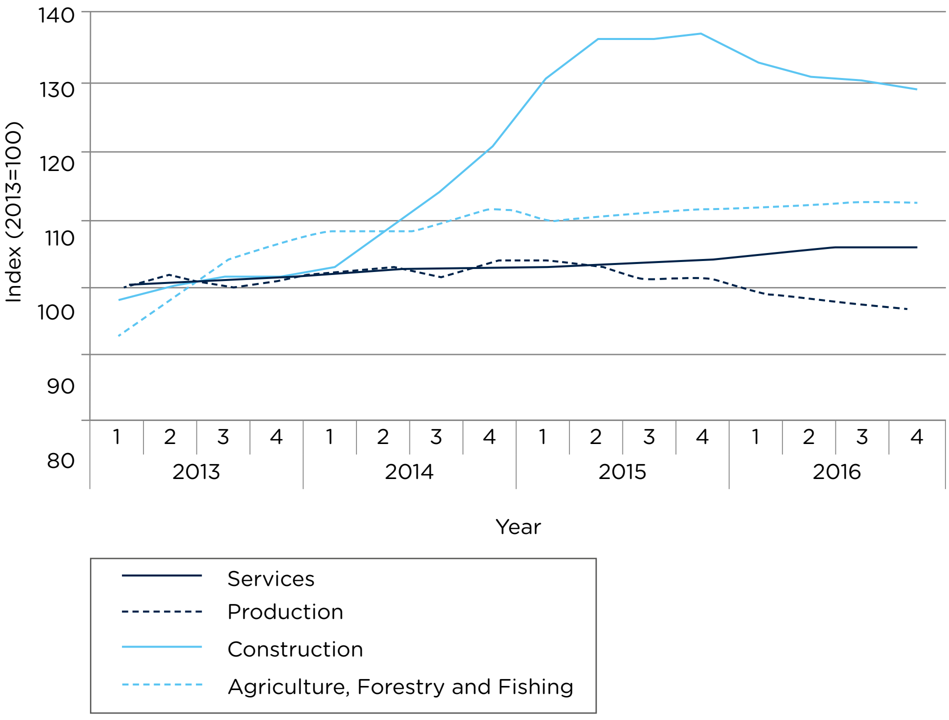


Figure 5: Change in activity in Scottish industry

The growth in the different sectors has been quite variable over the last few years with the greatest fluctuation in the construction sector, with exceptional growth in 2014 and 2015 as illustrated by the graph above. This is starting to downturn in 2016, however, but is still the largest and any economic upturn will be reflected in this sector as shown in figure 5.

There is reliance on exports to the EU (43% in 2015), the largest markets are those of the Netherlands, France and Germany. This trade could be affected by any sustained impacts of the ongoing economic problems in the Eurozone, and there could be greater uncertainty resulting from the exit of the UK from the EU. There could be some impact of the UK leaving the EU on this market, depending firstly on the result of new trade deals with the EU and secondly on the ability to set up new trade deals with the US. There is also significant potential for exports, particularly whisky, under new trade deals with India, China and possibly the USA. Whisky currently has a 150% tariff applied to it for sales to India.

In the medium term the Scottish economy will continue to develop opportunities in renewable technology with the Scottish Parliament targeting a potential 16,000 to 70,000 new job opportunities in these emerging areas of employment. It is estimated that 26,000 jobs are supported by the renewables industry which is driven largely by onshore wind if you exclude those in the hydro industry which accounts for nearly half of those jobs. These industries do however rely on the continuance of certain incentive schemes, which can be removed at short notice, but the Scottish Parliament has set a target of 50% renewables by 2030. There are concerns from the Scottish parliament that recent changes to subsidies for technologies which generate renewable electricity and uncertainty about future support have affected the confidence of investors in supporting the deployment of new generating capacity. The removal of the subsidy for onshore wind is of particular concern within this region.

South East

In South East LDZ, the strong representation in financial and business services and transport and communications, the best-performing sectors of the national economy, are further encouraged by favourable demographics. This should be boosted by a steady economic recovery. This will be especially significant should confidence in London as a banking stronghold be adversely affected by the various enquiries into the banking sector, changes in regulation and the impact of the UK leaving the EU. Some banks have already indicated their desire to move to another country within the EU but speculation of widespread moves seems to be unlikely given that London is still ranked as the highest financial centre in the world. The next ranked is Frankfurt at no. 23.

The pattern of growth and development remains unbalanced, with economic hot and cold spots in the region. Manufacturing is still an element of the south east economy at 7.8% with some small levels of growth in recent years followed by a small decline in 2015, but remains the lowest manufacturing base outside London. The impact on this sector of the level of economic recovery could still be significant assuming there is to be continued growth, but the uncertainty created by the UK leaving the EU could depress any economic growth. The sector of the economy that has generally performed the best appears to be the wholesale and retail sector (12.6% of south east GVA). This is noticeable with the agriculture trade in high value fruit and vegetables for supermarket and catering industries.

Strong expansion of tourism, both internal and international provides opportunities for south east region, given London's attraction as a tourist centre and the ongoing lower value of the pound against several currencies such as the dollar and the euro.

Housing development is forecast to grow by UK Government in this region, this includes the Thames Gateway regeneration project where there are plans to build river side and park side homes over the next 20 years.

South

In South LDZ, the rail, sea and airport links provide a favourable environment for investment opportunities and employment growth. This combined with a reasonably broad mix of commerce, industry, housing and tourism should create the ideal opportunity for sustained economic growth.

Further cuts by the Ministry of Defence to three sites in this area were planned for 2017 and this will have some effect on the local economies in the vicinity of these facilities in the South LDZ. However this also results in ex-MOD land becoming available for development as barracks are rationalised and regiments are merged. This is despite the continued commitment by UK Government to meet the NATO target of spending 2% of GDP on defence.

Housing development is forecast to grow, which will be boosted by the fact that money raised from the right-to-buy scheme for council houses may be used to build replacement houses. It is not clear how this will impact the number of new homes given the substantial discounts being offered to potential buyers will reduce the revenue. Constraints on development and infrastructure could further dilute the growth in new housing. A new development that may impact housing in the area is the inclusion of housing association tenants in the right-to-buy schemes. This will reduce the housing stock available for low income families which may result in pressure on government and local authorities to build more homes. The government has stated it is committed to building 1.5 million new homes, which would require at least a doubling of the current level of house building nationally. As with the south east there is growth in power and heat generation.

Embedded power and heat generation

Recent areas of growth across all three LDZs is embedded power and heat generation. Several power stations connecting to our networks are currently in progress or have connected for this winter coming. This is to provide back-up termed Short Term Operational Reserve, or STOR, to the electricity networks. These sites will be called on in periods of high electricity demand and will create challenges for our networks in terms of planning and running networks. A secondary aspect of this is the potential growth in bulk heating systems where a single Combined Heat and Power (CHP) system will provide heat and power for an estate or development. The combined effect these two developments will have on annual and peak demands is undefined.

Back to 'The next ten years' - Embedded power

Forecast methodology

General assumptions

The starting point for production of the full set of demand forecasts is the annual average demand. The following general assumptions were used to assist in the development of the annual forecasts.

- All forecasts are seasonal normal demands calculated using the latest Seasonal Normal Composite Weather Variable basis otherwise known as EP2
- Historic annual demand data provided by SGN is provided on the same basis and daily demand data is available broken down by load band
- The historic data was corrected using the reconciliation data provided by SGN as part of the Pre-forecast information.
- SIU demand is not incorporated into the Scotland LDZ numbers
- Shrinkage was forecast on a fixed daily basis irrespective of demand levels to be consistent with UNC
- Retail gas price forecasts used as part of the demand modelling process continue to be developed by our service provider and then agreed with ourselves
- Load band 0-73 MWh is assumed to consist predominantly of households and that the behaviour patterns are linked to household behaviour
- Load band 73 to 732 MWh is predominantly small commercial/retail premises with some small industrial. Although there are some households within this band it is assumed that the behaviour patterns will be linked to predominantly commercial/retail behaviour
- The load bands >732 MWh will be predominantly industrial and commercial premises and therefore exhibit behaviour related to these types of load

General methodology

The forecasting models for the different load bands have been refined over a number of years. The underlying principle is that the models make specific linkages between the load bands and traditional market categories like households and industrial and commercial customers. These models are tailored specifically to each LDZ, although the underlying approach is the same across the whole of our networks.

An important factor affecting recent demand levels has been the decline in the price of gas over most of the last two years, which has resulted in growth in some demands. Many consumers may have already taken action with regard to energy saving, including a switch to renewable energy sources, as a result of sustained price rises in earlier years. However, as a result of lower prices there may be some consumers who are retaining their comfort levels. Despite the loss of non-domestic customer numbers, there are pockets where growth is being seen. This may be partially a result of holding off investment in efficiency measures due to uncertainty about the future of certain businesses following the EU referendum or the fact that energy prices have been falling for some time.

The latest economic figures taken from the ONS show a sustained growth in the economy during 2016 of 1.8%. The Office for Budget Responsibility (OBR) is forecasting growth of 2% for 2017. Independent external forecasters are forecasting in the range 1.1% to 2.0 for 2017. The overall average of external forecasters is a rather pessimistic 1.5%, presumably as a result of the ongoing uncertainty of the impact of the UK leaving the European Union.

A further factor influencing annual demand is the gradual introduction of renewable sources of energy but the true extent of this is not fully known at this stage. Clear assumptions regarding the impact of renewables is made within the renewable section.

0 to 73MWh – Domestic
The primary driver in this sector is still believed to be the behaviour of households. Annual demand growth has traditionally been driven by the number of houses being built and how many will be using gas.

Data was collected on all aspects of the housing market and regression analysis was carried out to establish if there is any need to amend the models from last year.

Average consumer gas bills had fallen again in 2016 but some quite substantial price rises have been announced by two of the major suppliers in early 2017. The models were tailored to each LDZ, as customer behaviour proved to be materially different in each LDZ and a current retail gas price forecast specifically developed for the purposes of this project each year. Consideration will need to be taken, when analysing Scotland LDZ in future years, of a Scottish Parliament target that 80% of households should be heated using low-carbon technologies by 2032.

73 to 732MWh – Commercial
Traditionally this sector is influenced by energy prices and economic drivers. Following detailed evaluation of alternative econometric models as part of last year's analysis, the best fit was achieved by using a multi-variable model that related annual gas consumption to a combination of drivers:

- Current and real retail gas prices for this type and size of load
- Average non-domestic retail gas price
- GDP indices, actual GDP (seasonally adjusted) and GDP growth, regional GVA
- Manufacturing output
- Consumption per unit of GDP
- Efficiency improvements
- Impact of renewables

>732MWh – Large Industrial
This sector can be significantly affected by the behaviour at a small number of large loads and therefore the forecasts continue to be split into two elements. The large loads are forecast individually and separately from the rest of the market sector. The remaining demand is forecast as a whole. As mentioned earlier the increase in embedded power stations will have an impact.

Peak demand forecasts

General assumptions

The traditional primary basis for calculating the Peak Day demand in any market is the relationship between average daily demand and Peak Day demand, typically known as the load factor, where:

Peak Day Demand = Average Daily Demand divided by Load Factor

The following assumptions were made when producing the 1 in 20 Peak Day demand:

- The modelling method results in no additional requirements for demand diversity analysis
- The use of 1 in 20 CWVs, provided by Xoserve to calculate the 1 in 20 Peak Day meets the requirements of the licence and UNC with respect to the specified methodology for determining 1 in 20 peak day demand
- No allowance will be made in calculating the base case 1 in 20 Peak Day for the differences between the calculated peak demand and the SOQ booked by shippers for larger loads
- No demand reduction will be allowed associated with demand management products offered by Shippers
- No allowance will be made to take account of any capacity buy-back contracts that may have been negotiated between SGN and its customers

LDZ specific assumptions

All the general assumptions are applied across all the LDZs and there were no specific assumptions that relate to the individual LDZs used in this analysis, unless the weather demand analysis suggests this should be considered.

Methodology

Forecast base case Peak Day demands were calculated from projections of annual demands by using the following relationship:

Peak demand = (Annual demand/365)/load factor

The relationship was applied in each of several different market sectors, for which the load factor may be assumed to be constant over the forecast period. The following market sectors have been used as the starting point for producing the base case Peak Day forecasts:

- - NDM Firm 0 to 73.2 MWh
- - NDM Firm 73.2 to 732 MWh
- - NDM Firm >732 MWh
- - DM Firm Consumption

Load factors for each market sector were estimated from historical daily demand and other data.

Forecast demands

This section provides an overview of our latest annual and peak gas demand forecasts through to 2026/27. A more detailed view can be found in Appendix 1, which includes the forecasts for both annual and peak demand on a year-by-year and LDZ basis. These forecasts have been developed around the UNC load band categories and relate only to gas that is transported through SGN systems.

Annual demand
These figures show historical gas demand growth and the forecast going forward. Note specifically the sudden demand reduction in historical demand in 2009 followed by a minor recovery in 2010 and then a further decline between 2011 and 2014. Note that Interruption ceased to exist in 2011 as a standard type of load, this is shown in blue in these graphs.

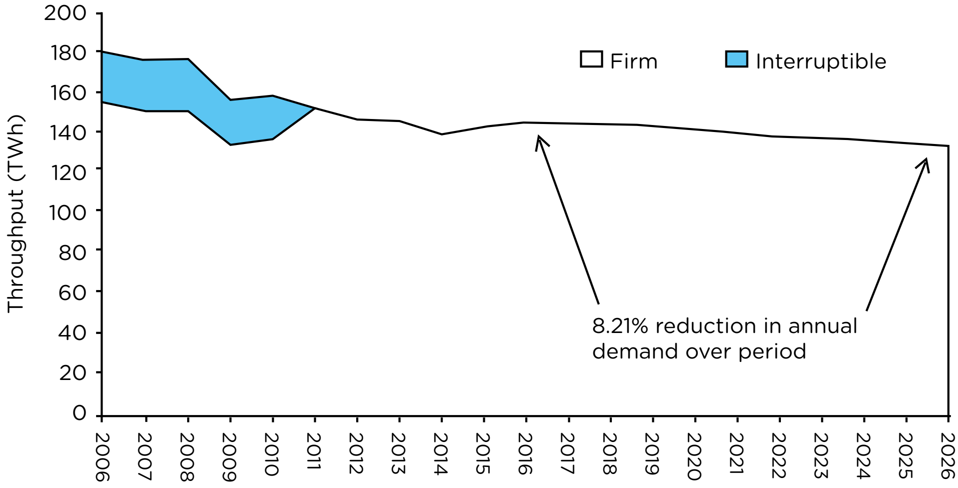


Figure 7: Change in historic and future annual demand – SGN overall

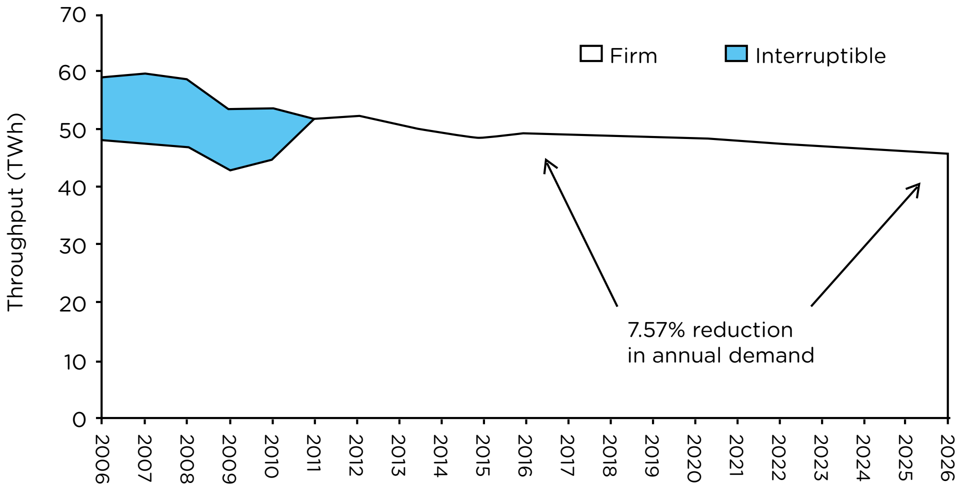


Figure 8: Change in historic and future annual demand – Scotland

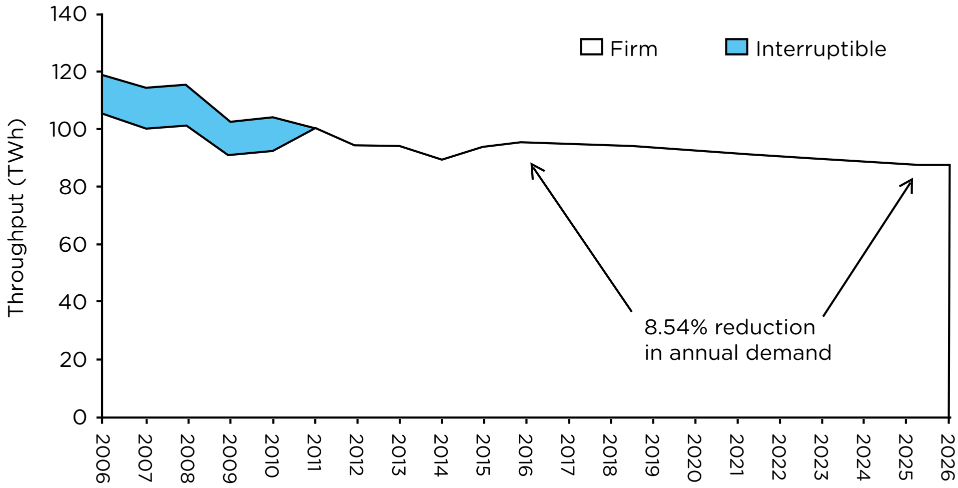


Figure 9: Change in historic and future annual demand – South & South East

Change in forecast annual growth (2017 – 2026)				
	SGN	Scotland	South East	South
Annual Demand Change	-8.21%	-7.57%	-8.26%	-8.96%

Table 5: Change in forecast annual growth (2017 – 2026)

Peak demand

The following figures show the equivalent view for peak demand, the key driver for investment in SGN. Note again the down turn in demands in 2009/10 due to the recession followed by a recovery.

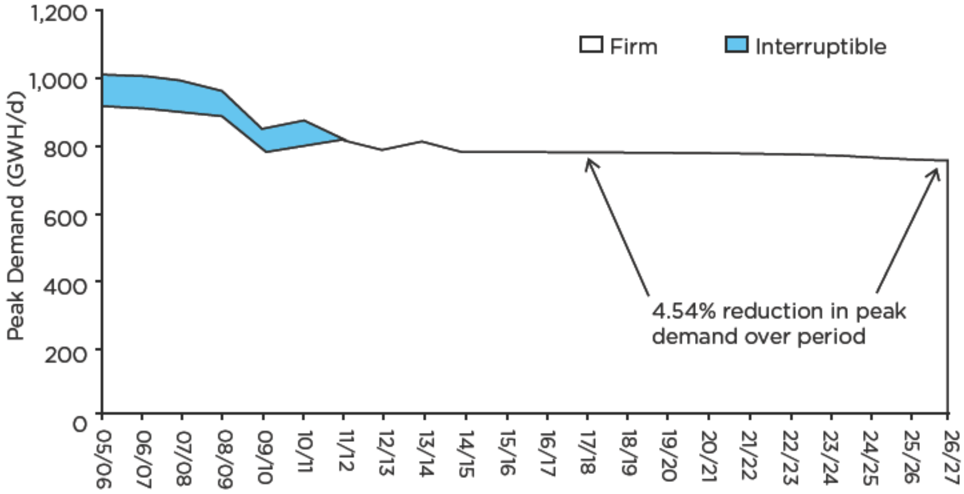


Figure 10: Historic demand and forecast change of peak gas demand – SGN overall

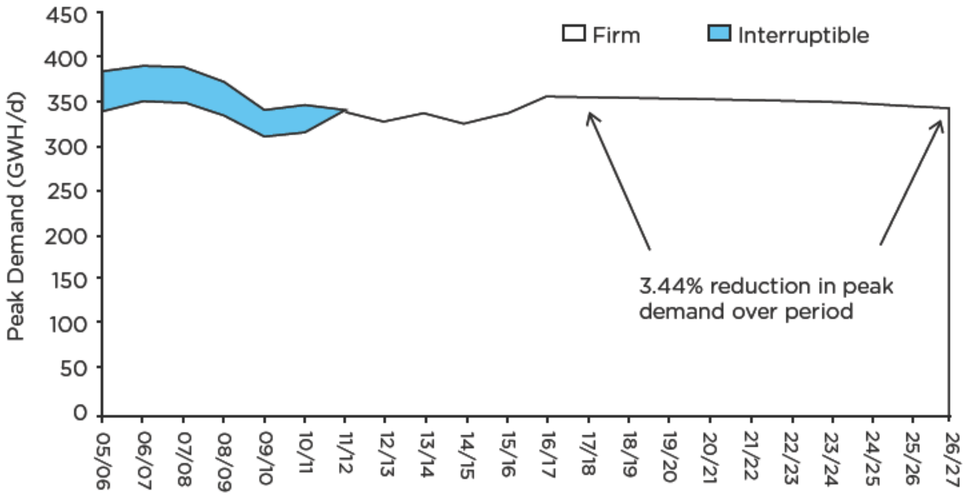


Figure 11: Historic demand and forecast change of peak gas demand – Scotland

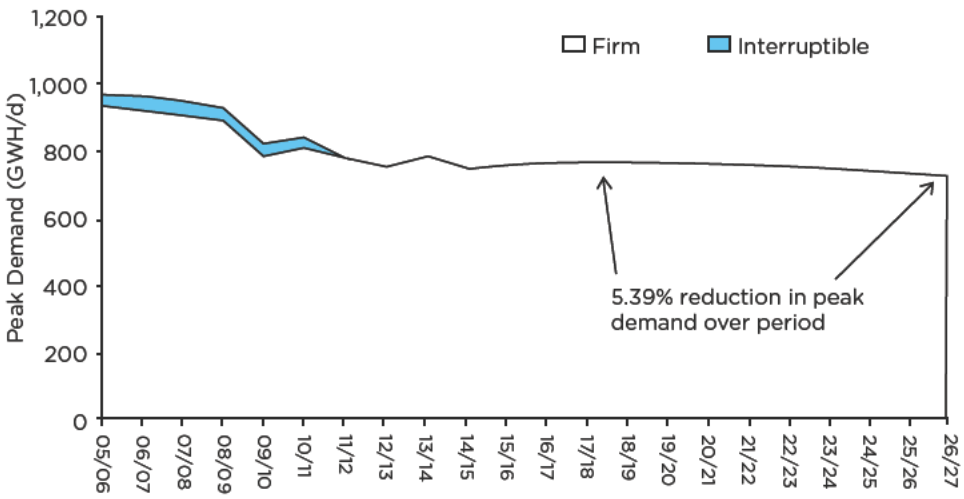


Figure 12: Historic demand and forecast change of peak gas demand – South & South east

Change in Peak Day demand (2016/17 – 2026/27)			
	SGN	Scotland	Southern
Peak Demand	-4.54%	-3.44%	-5.39%

Table 6: Change in Peak Day demand (2016/17 – 2026/27)

Forecast comparisons

The following figures provide a comparison of the current forecasts with those that were produced in 2016.

The latest annual demand forecasts for Scotland, southern and SGN in total are higher over the period of the plan than last year. The driver for the difference in the forecasts is primarily due to the fact that the 2017 forecasts have taken account of the difference between the forecast for 2016 and the actual demand in 2016.

There is some increase in the domestic and small commercial sector due to lower retail gas price forecasts and higher long term economic forecasts. The increase in demand driven by these factors is counteracted by marginally lower levels of housing growth forecasts in Scotland and southern than the previous year. There is forecast a modest decline in demands throughout the forthcoming forecast period.

Greater consumer awareness on environmental issues and their 'carbon footprint' will also have an effect on the annual gas demands during the forecast period. Typical measures for domestic consumers include double glazing, loft insulation, cavity wall insulation and energy efficient boilers. These are administered in the UK government domestic energy efficiency programme, CERT (Carbon Emissions Reductions Target) and community programme, CESP (Community Energy Saving Programme). The drop in gas price as a result of a combination of the reduction in the environmental levy and lower wholesale prices will affect all markets along with national and local government initiatives. Also of importance is the effect of UK and EU renewable energy targets such as '20 - 20 - 20 Targets'. This European Directive is to reduce the European Union's greenhouse gas emission by 20% below 1990 levels, ensure 20% of energy is generated from renewable sources and reduce primary energy use by 20% by improving energy efficiency. These initiatives should continue to have an impact on non-domestic and domestic demand as gas is used more efficiently and have a positive impact as new types of business are created to cope with emerging industrial opportunities.

This could have a substantial impact on consumption year to year or may not materialise in the near or possibly even mid-term future if gas prices remain low. The sustainability of lower gas prices in the long term may be dependent on the success of shale gas development, which is supported by the current government.

Back to 'The next ten years' - Demand forecasting

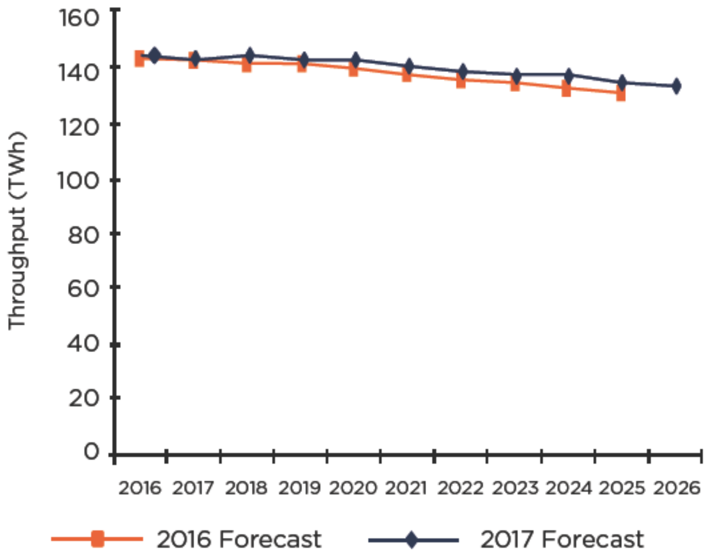


Figure 13: Comparison of total annual demand forecasts – SGN overall

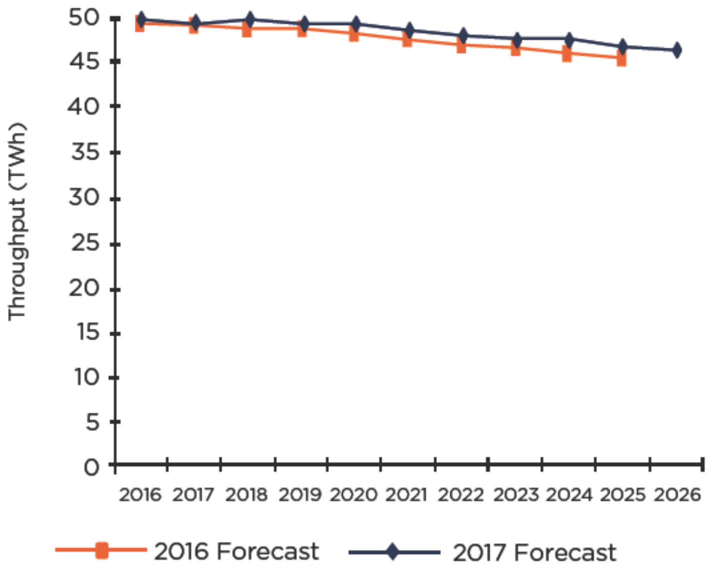


Figure 14: Comparison of annual demand forecasts – Scotland

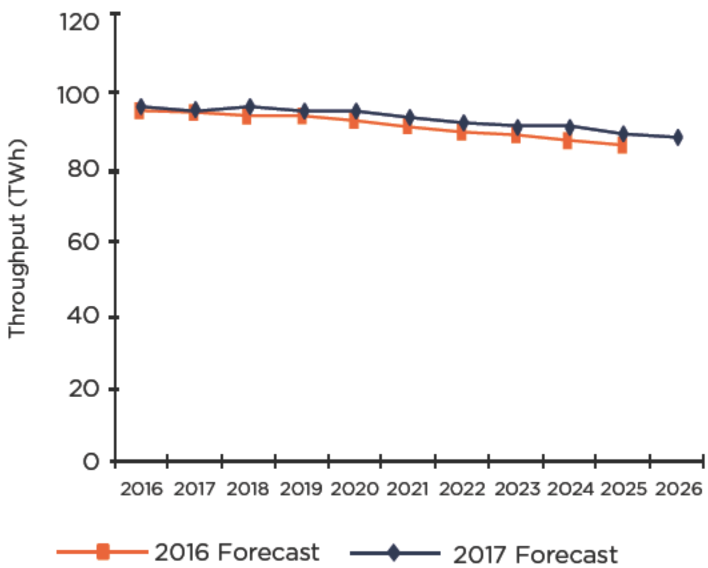


Figure 15: Comparison of annual demand forecasts – Southern

Appendix 1

Demand forecasts tables

Annual demand forecast by load category – SGN overall											
Calendar year	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
0 - 73.2 MWh	89.2	89.1	89.0	88.8	88.9	88.1	87.6	87.2	87.2	86.4	86.0
73.2 - 732 MWh	13.6	13.9	14.0	13.9	13.9	13.7	13.6	13.5	13.4	13.3	13.2
732 - 2196 MWh	6.6	6.4	6.3	6.1	5.9	5.6	5.4	5.1	4.9	4.7	4.5
2196 - 5860 MWh	4.1	4.1	4.0	3.8	3.7	3.5	3.4	3.2	3.1	2.9	2.8
Total Small User	113.4	113.5	113.3	112.7	112.3	110.9	109.9	109.0	108.7	107.3	106.4
Firm >5860 MWh	7.3	7.2	7.0	6.8	6.5	6.2	6.0	5.7	5.5	5.2	5.0
DM Firm Consumption	24.0	23.0	23.5	23.1	22.9	22.6	22.3	22.1	21.9	21.6	21.3
DM Interruptible Consumption	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Large User	31.2	30.1	30.5	29.9	29.4	28.8	28.3	27.8	27.4	26.8	26.3
Total LDZ	144.7	143.7	143.8	142.5	141.7	139.7	138.2	136.8	136.0	134.1	132.8
Firm Shrinkage	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Interruptible Shrinkage	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Shrinkage	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Total Throughput	145.4	144.4	144.5	143.3	142.4	140.4	138.9	137.5	136.8	134.8	133.5
Gas Supply Year	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27
Total Throughput	145.2	144.6	143.7	142.9	140.9	139.3	137.9	137.1	135.3	133.9	132.6
Total Firm Demand	145.4	144.4	144.5	143.3	142.4	140.4	138.9	137.5	136.8	134.8	133.5
Total Interruptible Demand	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 7: Forecast annual demand – SGN load categories (TWh)

Annual demand forecast by load category – Scotland LDZ											
Calendar year	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**
0 - 73.2 MWh	29.0	29.1	29.2	29.2	29.2	29.0	28.9	28.8	28.9	28.7	28.6
73.2 - 732 MWh	4.6	4.7	4.7	4.7	4.7	4.7	4.6	4.6	4.6	4.5	4.5
732 - 2196 MWh	2.7	2.6	2.6	2.5	2.4	2.3	2.2	2.2	2.1	2.0	1.9
2196 - 5860 MWh	1.9	1.8	1.8	1.7	1.7	1.6	1.6	1.5	1.4	1.4	1.3
Total Small User	38.2	38.3	38.3	38.1	38.0	37.6	37.3	37.1	37.0	36.6	36.3
> 5860 MWh	3.2	3.2	3.1	3.0	2.9	2.8	2.7	2.6	2.5	2.4	2.3
DM Firm Consumption	7.9	7.8	7.7	7.6	7.5	7.4	7.3	7.2	7.1	7.0	6.9
DM Interruptible Consumption	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Large User	11.1	11.0	10.8	10.6	10.5	10.2	10.0	9.8	9.7	9.4	9.3
Total LDZ	49.3	49.3	49.1	48.8	48.5	47.8	47.3	46.9	46.7	46.0	45.6
Firm Shrinkage	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Interruptible Shrinkage	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Shrinkage	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Total Throughput	49.5	49.5	49.3	49.0	48.7	48.0	47.5	47.1	46.9	46.2	45.8
Gas Supply Year	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27
Total Throughput	49.5	49.4	49.1	48.9	48.2	47.7	47.2	47.0	46.4	45.9	45.5

Table 8: Forecast annual demand – Scotland LDZ load categories (TWh)

Annual demand forecast by load category – South East LDZ											
Calendar year	**2016**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2023**	**2024**	**2025**	**2026**
0 - 73.2 MWh	36.4	36.3	36.2	36.1	36.1	35.7	35.5	35.3	35.3	34.9	34.7
73.2 - 732 MWh	5.2	5.3	5.4	5.3	5.3	5.2	5.2	5.1	5.1	5.0	4.9
732 - 2196 MWh	2.1	2.0	2.0	1.9	1.8	1.7	1.6	1.5	1.5	1.4	1.3
2196 - 5860 MWh	1.3	1.2	1.2	1.2	1.1	1.0	1.0	0.9	0.9	0.8	0.8
Total Small User	44.9	44.9	44.8	44.5	44.3	43.7	43.3	42.9	42.7	42.2	41.8
Firm >5860 MWh	1.8	1.8	1.7	1.7	1.6	1.5	1.4	1.3	1.3	1.2	1.1
DM Firm Consumption	10.4	9.8	10.3	10.1	10.0	9.9	9.8	9.7	9.7	9.6	9.5
DM Interruptible Consumption	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Large User	12.2	11.6	12.0	11.7	11.6	11.4	11.2	11.0	10.9	10.7	10.6
Total LDZ	57.1	56.5	56.8	56.2	55.9	55.1	54.5	54.0	53.7	52.9	52.4
Firm Shrinkage	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Interruptible Shrinkage	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Shrinkage	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Total Throughput	57.4	56.8	57.1	56.5	56.2	55.4	54.8	54.3	54.0	53.2	52.7
Gas Supply Year	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27
Total Throughput	57.3	57.1	56.7	56.4	55.6	55.0	54.4	54.1	53.4	52.8	52.3

Table 9: Forecast annual demand – South East LDZ load categories (TWh)

Annual demand forecast by load category – South LDZ											
Calendar year	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**
0 - 73.2 MWh	23.7	23.7	23.6	23.5	23.5	23.3	23.2	23.0	23.0	22.8	22.7
73.2 - 732 MWh	3.8	3.9	3.9	3.9	3.9	3.8	3.8	3.8	3.8	3.8	3.8
732 - 2196 MWh	1.8	1.8	1.7	1.7	1.6	1.5	1.5	1.4	1.4	1.3	1.2
2196 - 5860 MWh	1.0	1.0	1.0	0.9	0.9	0.9	0.8	0.8	0.8	0.7	0.7
Total Small User	30.4	30.3	30.2	30.0	29.9	29.6	29.3	29.0	29.0	28.6	28.4
Firm >5860 MWh	2.3	2.2	2.2	2.1	2.0	1.9	1.8	1.8	1.7	1.6	1.5
DM Firm Consumption	5.7	5.3	5.5	5.4	5.3	5.3	5.2	5.1	5.1	5.0	4.9
DM Interruptible Consumption	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Large User	7.9	7.5	7.7	7.5	7.4	7.2	7.0	6.9	6.8	6.6	6.5
Total LDZ	38.3	37.8	37.9	37.5	37.3	36.7	36.3	35.9	35.7	35.2	34.8
Firm Shrinkage	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Interruptible Shrinkage	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Shrinkage	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Total Throughput	38.5	38.0	38.1	37.7	37.5	37.0	36.5	36.1	35.9	35.4	35.0
Gas Supply Year	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27
Total Throughput	38.3	38.1	37.9	37.6	37.1	36.7	36.3	36.0	35.5	35.2	34.8

Table 10: Forecast annual demand – South LDZ load categories (TWh)

1 in 20 Peak Day firm demand forecast – by LDZ											
Financial year	**2016/17**	**2017/18**	**2018/19**	**2019/20**	**2020/21**	**2021/22**	**2022/23**	**2023/24**	**2024/25**	**2025/26**	**2026/27**
Scotland	354	355	355	354	352	351	349	347	346	344	342
South East	467	466	465	463	461	458	455	452	450	447	445
South	330	329	328	326	324	322	320	318	316	314	312
SGN	1,151	1,151	1,147	1,143	1,137	1,131	1,123	1,117	1,112	1,106	1,099

Table 11: Forecast 1 in 20 Peak Day firm demand (GWh per day)

1 in 20 Peak Day firm demand forecast – SGN overall by load category											
Financial year	**2016/17**	**2017/18**	**2018/19**	**2019/20**	**2020/21**	**2021/22**	**2022/23**	**2023/24**	**2024/25**	**2025/26**	**2026/27**
0 - 73.2 MWh	813.3	812.9	812.9	812.0	810.5	808.6	805.5	803.7	802.0	799.6	796.7
73.2 - 732 MWh	118.2	121.8	121.6	121.7	121.4	121.0	120.6	120.0	119.7	119.5	119.1
732 - 2196 MWh	45.5	44.7	44.1	43.2	42.1	41.0	40.0	39.0	38.1	37.2	36.3
2196 - 5860 MWh	28.4	27.9	27.5	27.0	26.3	25.6	25.0	24.4	23.8	23.2	22.7
> 5860 MWh	50.4	49.5	48.8	47.8	46.6	45.4	44.3	43.2	42.2	41.2	40.2
Total NDM Consumption	1055.7	1056.9	1054.9	1051.7	1046.9	1041.8	1035.3	1030.3	1025.8	1020.7	1014.9
DM Firm Consumption	93.5	91.7	90.5	89.4	88.3	87.2	86.1	85.1	84.1	83.1	82.2
Total Firm Consumption	1149.2	1148.6	1145.4	1141.1	1135.2	1129.0	1121.5	1115.4	1109.9	1103.8	1097.1
Firm Shrinkage	2.0	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
Total Firm Demand	1151.2	1150.5	1147.3	1143.0	1137.1	1130.9	1123.4	1117.4	1111.9	1105.7	1099.0
DM Interruptible Consumption	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Interruptible Shrinkage	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Interruptible Demand	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total DM Consumption	93.5	91.7	90.5	89.4	88.3	87.2	86.1	85.1	84.1	83.1	82.2
Total Shrinkage	2.0	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
Total LDZ Demand	1151.2	1150.5	1147.3	1143.0	1137.1	1130.9	1123.4	1117.4	1111.9	1105.7	1099.0

Table 12: Forecast 1 in 20 Peak Day demand – SGN by load categories (GWh)

1 in 20 Peak Day demand forecast – Scotland LDZ by load category											
Financial year	**2016/17**	**2017/18**	**2018/19**	**2019/20**	**2020/21**	**2021/22**	**2022/23**	**2023/24**	**2024/25**	**2025/26**	**2026/27**
0 - 73.2 MWh	238.1	239.1	239.7	239.9	240.0	239.8	239.4	239.3	239.3	239.0	238.5
73.2 - 732 MWh	37.3	38.4	38.4	38.4	38.3	38.2	38.2	38.0	37.9	37.9	37.8
732 - 2196 MWh	17.1	16.9	16.6	16.3	15.9	15.6	15.2	14.8	14.5	14.2	13.8
2196 - 5860 MWh	11.9	11.7	11.6	11.3	11.1	10.8	10.5	10.3	10.1	9.8	9.6
> 5860 MWh	20.8	20.5	20.2	19.8	19.3	18.8	18.4	18.0	17.6	17.2	16.8
Total NDM Consumption	325.2	326.6	326.4	325.8	324.6	323.3	321.7	320.4	319.4	318.0	316.5
DM Firm Consumption	28.7	28.3	27.9	27.6	27.2	26.9	26.5	26.2	25.8	25.5	25.2
Total Firm Consumption	353.9	355.0	354.3	353.4	351.8	350.1	348.2	346.6	345.2	343.5	341.7
Firm Shrinkage	0.6	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Total Firm Demand	354.4	355.5	354.9	353.9	352.3	350.7	348.7	347.1	345.7	344.0	342.2
DM Interruptible Consumption	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Interruptible Shrinkage	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Interruptible Demand	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total DM Consumption	28.7	28.3	27.9	27.6	27.2	26.9	26.5	26.2	25.8	25.5	25.2
Total Shrinkage	0.6	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Total LDZ Demand	354.4	355.5	354.9	353.9	352.3	350.7	348.7	347.1	345.7	344.0	342.2

Table 13: Forecast 1 in 20 Peak Day demand – Scotland LDZ by load categories (GWh)

1 in 20 Peak Day demand forecast – South East LDZ by load category											
Financial year	**2016/17**	**2017/18**	**2018/19**	**2019/20**	**2020/21**	**2021/22**	**2022/23**	**2023/24**	**2024/25**	**2025/26**	**2026/27**
0 - 73.2 MWh	344.3	343.2	342.8	342.0	341.1	340.0	338.4	337.3	336.3	335.0	333.6
73.2 - 732 MWh	45.1	47.2	47.0	46.9	46.6	46.4	46.1	45.7	45.4	45.2	44.9
732 - 2196 MWh	14.5	14.3	14.1	13.8	13.5	13.1	12.7	12.4	12.1	11.8	11.5
2196 - 5860 MWh	8.8	8.7	8.6	8.4	8.2	7.9	7.7	7.5	7.3	7.2	7.0
> 5860 MWh	12.5	12.3	12.2	11.9	11.6	11.3	11.0	10.7	10.4	10.2	9.9
Total NDM Consumption	425.3	425.6	424.6	423.1	421.0	418.7	415.9	413.7	411.6	409.4	406.9
DM Firm Consumption	40.7	39.8	39.4	39.1	38.8	38.4	38.1	37.8	37.5	37.2	36.9
Total Firm Consumption	466.0	465.4	464.0	462.2	459.7	457.2	454.0	451.5	449.1	446.6	443.8
Firm Shrinkage	0.9	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Total Firm Demand	466.8	466.2	464.9	463.0	460.6	458.0	454.9	452.3	450.0	447.4	444.6
DM Interruptible Consumption	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Interruptible Shrinkage	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Interruptible Demand	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total DM Consumption	40.7	39.8	39.4	39.1	38.8	38.4	38.1	37.8	37.5	37.2	36.9
Total Shrinkage	0.9	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Total LDZ Demand	466.8	466.2	464.9	463.0	460.6	458.0	454.9	452.3	450.0	447.4	444.6

Table 14: Forecast 1 in 20 Peak Day demand – South East by load categories (GWh)

1 in 20 Peak Day demand forecast – South LDZ by load category											
Financial year	**2016/17**	**2017/18**	**2018/19**	**2019/20**	**2020/21**	**2021/22**	**2022/23**	**2023/24**	**2024/25**	**2025/26**	**2026/27**
0 - 73.2 MWh	230.9	230.7	230.5	230.1	229.5	228.8	227.7	227.1	226.4	225.6	224.7
73.2 - 732 MWh	35.8	36.2	36.2	36.4	36.4	36.4	36.4	36.3	36.3	36.4	36.4
732 - 2196 MWh	13.8	13.5	13.3	13.0	12.7	12.4	12.0	11.8	11.5	11.2	10.9
2196 - 5860 MWh	7.7	7.5	7.4	7.2	7.1	6.9	6.7	6.5	6.4	6.2	6.1
> 5860 MWh	17.1	16.8	16.5	16.1	15.7	15.3	14.9	14.6	14.2	13.9	13.5
Total NDM Consumption	305.3	304.7	303.9	302.8	301.3	299.8	297.8	296.2	294.8	293.3	291.6
DM Firm Consumption	24.1	23.6	23.1	22.7	22.3	21.9	21.5	21.2	20.8	20.4	20.1
Total Firm Consumption	329.4	328.2	327.0	325.6	323.7	321.7	319.3	317.4	315.6	313.7	311.6
Firm Shrinkage	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Total Firm Demand	330.0	328.8	327.6	326.1	324.2	322.2	319.9	317.9	316.2	314.3	312.2
DM Interruptible Consumption	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Interruptible Shrinkage	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Interruptible Demand	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total DM Consumption	24.1	23.6	23.1	22.7	22.3	21.9	21.5	21.2	20.8	20.4	20.1
Total Shrinkage	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Total LDZ Demand	330.0	328.8	327.6	326.1	324.2	322.2	319.9	317.9	316.2	314.3	312.2

Table 15: Forecast 1 in 20 Peak Day demand – South LDZ by load categories GWh)

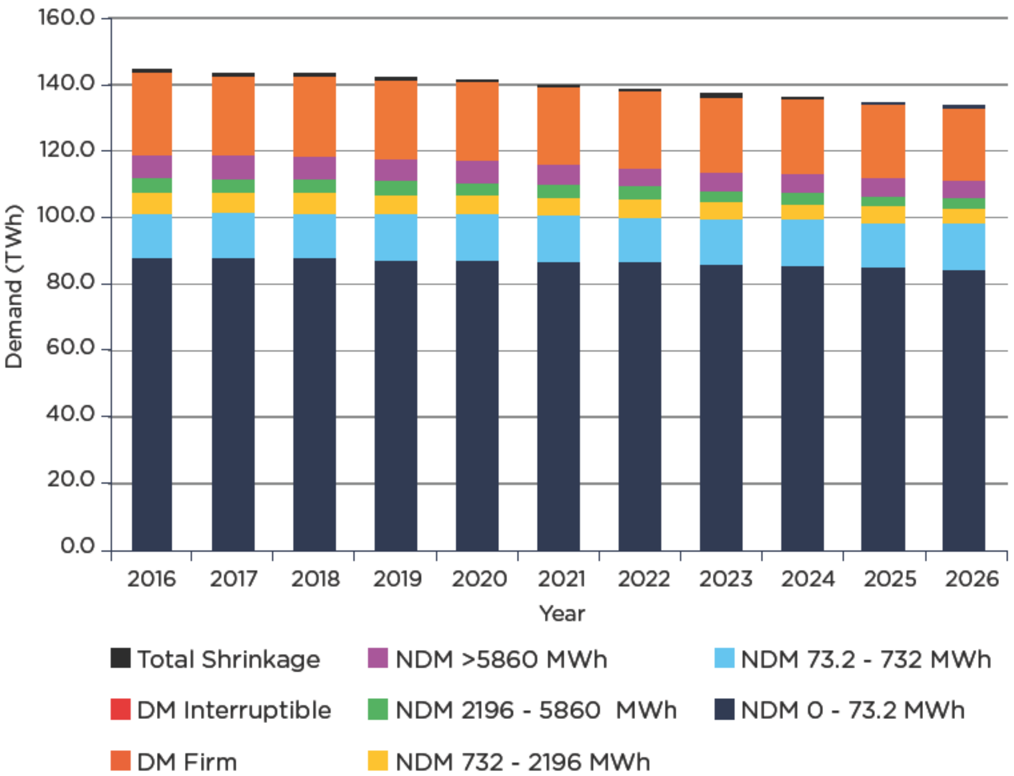


Figure 16: Annual forecast demand SGN overall

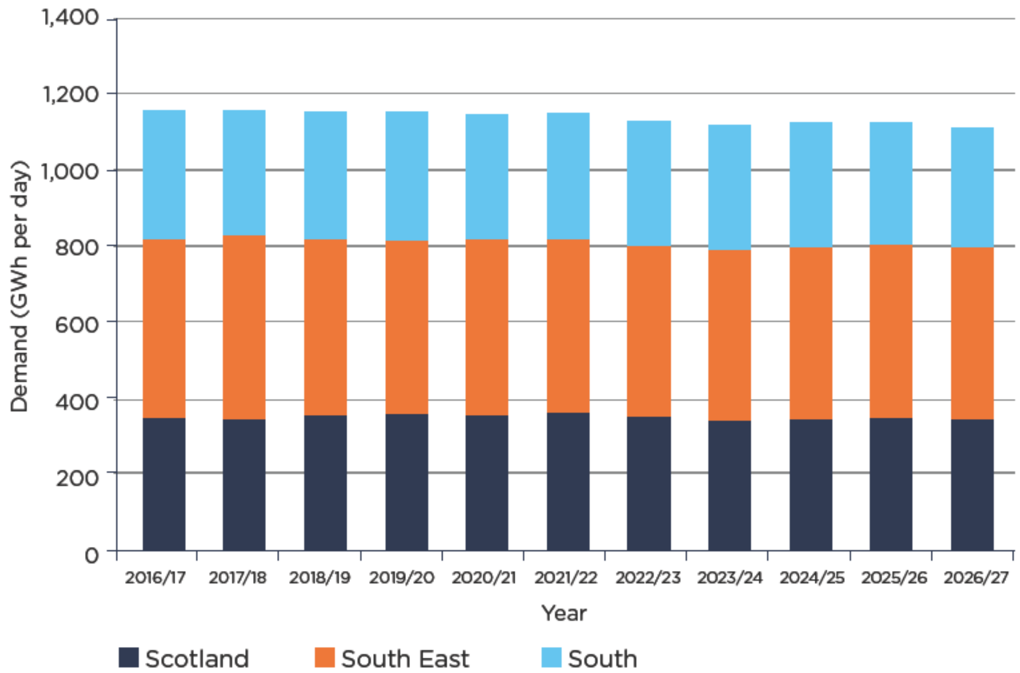


Figure 17: Forecast 1 in 20 Peak Day firm demand SGN overall

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Appendix 2

2016 flows

This appendix describes annual flows during the calendar year 2016.

Annual flows

Forecasts of annual demand are based on average weather conditions. Therefore, when comparing actual demand with forecasts, demand must be adjusted to take account of the difference between actual weather conditions and seasonal normal weather. The result of this adjustment is the weather corrected demand.

Recent winters have included some of the warmest of any in the weather data history employed for demand modelling, dating back to 1960-61. Consequently, the basis of the average weather condition used for demand forecasting purposes has been adjusted to better reflect these conditions. Anecdotal evidence to the contrary is based on specific days or weeks and not the entire winter period. As a result of this, the 2016 weather corrected annual demands and forecasts are based on the industry's current view based on research in cooperation with the Hadley Centre, which is part of the Met Office.

Tables 16 to 18 provide a comparison of actual and weather corrected demands during the 2016 calendar year with the forecasts presented in the 2016 LTDS. Annual demands are presented in the format of LDZ load bands/ categories, consistent with the basis of system design and operation.

Note: Figures may not sum exactly due to rounding.

Annual demand for 2016 (TWh) – Scotland LDZ			
	Actual demand	Weather corrected demand	2016 LTDS forecast demand
0 - 73.2MWh	30.1	28.7	29.6
73 - 5860MWh	9.1	8.8	8.5
>5860MWh Firm	12.7	12.6	12.6
Total LDZs	51.9	50.1	50.7
Shrinkage	0.2	0.2	0.2
Total Throughput	52.1	50.3	50.9

Table 16: Annual demand for 2016 (TWh) – Scotland LDZ

Annual demand for 2016 (TWh) – South East LDZ			
	Actual demand	Weather corrected demand	2016 LTDS forecast demand
0 - 73.2MWh	38.7	36.7	36.1
73 - 5860MWh	8.8	8.4	8.3
>5860MWh Firm	9.3	9.2	11.5
Total LDZs	56.8	54.4	55.9
Shrinkage	0.4	0.4	0.3
Total Throughput	57.2	54.8	56.2

Table 17: Annual demand for 2016 (TWh) – South East LDZ

Annual demand for 2016 (TWh) – South LDZ			
	Actual demand	Weather corrected demand	2016 LTDS forecast demand
0 - 73.2MWh	24.5	23.2	22.7
73 - 5860MWh	6.8	6.5	6.2
>5860MWh Firm	8.5	8.4	8.7
Total LDZs	39.8	38.0	37.6
Shrinkage	0.2	0.2	0.2
Total Throughput	40.0	38.2	37.8

Table 18: Annual demand for 2016 (TWh) – South LDZ

LDZ winter severity statistics

Sourced from the May 2017 National Grid report on winter severity statistics 2016/2017. These statistics cover the gas industry interpretation of winter lasting from October to March inclusively.

By way of explanation a winter can be either warm, cold or average. The 1 in "X" is a measure of how far away from average it is and if it is either cold or warm. The most severe cold winter is the one that has happened once in the last 56 years. This would be a 1 in 56, cold winter and this occurred in 1962/63.

Winter 2016/17 was the ninth warmest winter recorded in the last 56 years.

1 in X winter severities per LDZ	
LDZ	1 in "X"
Scotland	1 in 9, warm
South East	1 in 5, warm
South	1 in 4, warm
National	1 in 6, warm

Table 19: 1 in X winter severities per LDZ

Maximum and minimum flows

Table 20 indicates the highest and lowest daily demands seen between October 2016 and September 2017 and when they occurred.

Actual flows on the maximum and minimum demand day of gas year 2016/17		
LDZ	Maximum Day 2016/2017	Minimum Day 2016/17
Scotland	23.30 mscmd (24 November 2016)	4.69 mscmd (27 May 2017)
South East	33.09 mscmd (26 January 2017)	4.57 mscmd (21 June 2016)
South	20.97 mscmd (10 February 2017)	3.44 mscmd (18 June 2017)

Table 20: Actual flows on the maximum and minimum demand day of gas year 2016/17

Percentage flows

Table 21 shows the forecast Peak Day flow. It then converts the maximum and minimum values from table 20 above to percentages of the peak flow. Demand in the South varied from 20.97mscm or 67% of Peak Day down to 3.44mscm or 1% of Peak Day.

Maximum and minimum percentage flows of gas year 2016/17			
LDZ	Forecast Peak Day for 2016/17 (% of peak)	Maximum Day 2016/17 as %age	Minimum Day 2016/17 as %age
Scotland	31.71 mscmd	73.5%	14.8%
South East	43.64 mscmd	75.8%	10.5%
South	31.28 mscmd	67%	11%

Table 21: Maximum and minimum percentage flows of gas year 2016/17

Appendix 3

Glossary

Annual Quantity (AQ)
The AQ of a supply point is its annual consumption over a 365 or 366-day year, under conditions of average weather.

Bar
The unit of pressure that is approximately equal to atmospheric pressure (0.987 standard atmospheres). Where bar is suffixed with the letter g, such as in Barg or mbarg, the pressure being referred to is gauge pressure, ie relative to atmospheric pressure. One-millibar (mbar) equals 0.001 Bar.

Biomethane
Biogas that has been cleaned in order to meet GSMR requirements.

Calorific Value (CV)
The ratio of energy to volume measured in Mega joules per cubic meter (MJ/m3), which for a gas is measured and expressed under standard conditions of temperature and pressure.

Cubic Metre (m^3)
The unit of volume, expressed under standard conditions of temperature and pressure, approximately equal to 35.37 cubic feet. One million cubic metres (mcm) are equal to 106 cubic metres, one billion cubic metres (bcm) equals 109 cubic metres.

Daily Metered Supply Point
A supply point fitted with equipment, for example, a data-logger, which enables meter readings to be taken daily.

Distribution Network (DN)
An administrative unit responsible for the operation and maintenance of the local transmission system (LTS) and < 7Barg distribution network's within a defined geographical boundary, supported by a national emergency services organisation.

Distribution System
A network of mains operating at three pressure tiers: intermediate (7 to 2Barg), medium (2Barg to 75mbarg) and low (less than 75mbarg).

Diurnal Storage
Gas stored for the purpose of meeting within day variations in demand. Gas can be stored in special installations, such as storage facilities, or in the form of linepack within transmission, ie > 7Barg pipeline systems.

DECC
Department of Energy and Climate Change. In 2016 absorbed into Department for Business, Energy & Industrial Strategy.

Embedded Entry Points
Entry point which is not an offtake from NTS. Can be a biomethane or other unconventional source of gas.

Exit Zone
A geographical area within a LDZ, which consists of a group of supply points, which on a Peak Day, receive gas from the same NTS Offtake.

Formula Year
A twelve-month period commencing 1 April predominantly used for regulatory and financial purposes.

Future Energy Scenarios (FES)
National Grid's annual industry-wide consultation process encompassing the Ten Year Statement, targeted questionnaires, individual company and industry meetings, feedback on responses and investment scenarios. Previously called Transporting Britain's Energy.

Gas Day
Used by gas industry for buying and selling gas on open market. Defined as running from 05:00 on one day to 05:00 on the following day.

Gas Transporter (GT)
Formerly Public Gas Transporter (PGT). GTs such as SGN, are licensed by the Gas and Electricity Markets Authority to transport gas to consumers.

Gas Supply Year
A twelve-month period commencing 1 October also referred to as a Gas Year.

GS(M)R
Gas Safety (Management) Regulations 1996.

HMG
Her Majesty's Government.

Interconnector
This is a pipeline transporting gas from or to another country.

Kilowatt hour (kWh)
A unit of energy used by the gas industry. Approximately equal to 0.0341 therms. One Megawatt hour (MWh) equals 103 kWh, one Gigawatt hour (GWh) equals 106 kWh and one Terawatt hour (TWh) equals 109 kWh.

Linepack
The usable volume of compressed gas within the national or local transmission system at any time.

Liquefied Natural Gas (LNG)
Gas stored in liquid form. Can be firm or constrained (CLNG). Shippers who book a constrained service agree to allow us to use some of their gas to balance the system.

Local Distribution Zone (LDZ)
A geographic area supplied by one or more NTS offtakes. Consists of high pressure (> 7Barg) and lower pressure distribution system pipelines.

Local Transmission System (LTS)
A pipeline system operating at > 7Barg, that transports gas from NTS offtakes to distribution systems. Some large users may take their gas direct from the LTS.

National Balancing Point (NBP)
An imaginary point on the UK gas supply system through which all gas passes for accounting and balancing purposes.

National Transmission System (NTS)
A high-pressure system consisting of terminals, compressor stations, pipeline systems and offtakes. Designed to operate at pressures up to 85Barg. NTS pipelines transport gas from terminals to NTS offtakes.

National Transmission System Offtake
An installation defining the boundary between NTS and LTS or a very large consumer. The offtake installation includes equipment for metering, pressure regulation, etc.

Odorisation
The process by which the distinctive odour is added to gas supplies to make it easier to detect leaks. Odorisation is provided at all Network Entry points.

Office of Gas and Electricity Markets (Ofgem)
The regulatory agency responsible for regulating the UK's gas and electricity markets.

Offtake
An installation defining the boundary between NTS and LTS or a very large consumer. The offtake installation includes equipment for metering, pressure regulation, etc.

ONS
Office for National Statistics.

Peak Day Demand (1 in 20 Peak Demand)
The 1 in 20 Peak Day demand is the level of demand that, in a long series of winters, with connected load held at the levels appropriate to the winter in question, would be exceeded in one out of 20 winters, with each winter counted only once.

Price Control Review
Ofgem's periodic review of Transporter allowed returns. The current period has been called RIIO and will cover April 2013 to March 2021.

PRI - Pressure Regulating Installation
The replacement term for PRS, district governor and all other local terms (such as STRS or TRS) when IGEM standard TD13 was introduced.

Seasonal Normal Temperature (SNT)
Seasonal Normal Temperature is the average temperature that might be expected on any given day, based on historical data.

Shipper or Network Code Registered User (System User)
A company with a shipper licence able to buy gas from a producer, sell it to a supplier and employ a GT to transport gas to consumers.

Shrinkage
Gas that is input to the system but is not delivered to consumers or injected into storage. It is either Own Use Gas or Unaccounted for Gas.

Supplier
A company with a supplier's licence contracts with a shipper to buy gas, which is then sold to consumers. A supplier may also be licensed as a shipper.

Supply Hourly Quantity (SHQ)
The maximum hourly consumption at a supply point.

Supply Offtake Quantity (SOQ)
The maximum daily consumption at a supply point.

Therm
An imperial unit of energy. Largely replaced by the metric equivalent: the kilowatt hour (kWh). One therm equals 29.3071 kWh.

Unaccounted for Gas (UAG)
Gas lost during transportation. Includes leakage, theft and losses due to the method of calculating the Calorific Value.

Uniform Network Code (UNC)
The Uniform Network Code covers the arrangements between National Grid, shippers and the DNs following the selling of four of the networks.

UK-Link
A suite of computer systems that supports Uniform Network Code operations. Includes Supply Point Administration; Invoicing, and the Sites and Meters database.

VLDMC
Very Large Daily Metered Customer. A site which uses greater than 50,000,000 therms per annum.

Appendix 4

Links and contacts

SGN contacts

sgn.co.uk
You can apply for a new gas connection online through our website and learn more about our Help to Heat scheme. You can also find further information about our planned and emergency works in your area.

network.capacity@sgn.co.uk
Our dedicated email address for any questions regards the Long Term Development Statement.

GT1.GT2@sgn.co.uk
Mailbox for requests for increased loads at existing sites where meter capacity may be an issue.

linesearchbeforeudig.co.uk
Safety is our number one priority, before you dig always request details of our pipework's location via this online service.

customer@sgn.co.uk
Our 24-hour Customer Service team can be reached by email or by calling 0800 912 1700.
You can also find us on Facebook or follow us on Twitter at @SGNgas.

lets.chat@sgn.co.uk
We are always interested in engaging with our stakeholders This is how we look to improve the way we do things by listening to your feedback.

paul.denniff@sgn.co.uk
Network & Safety Director

joel.martin@sgn.co.uk
Regulatory Finance Manager – point of contact for storage and biomethane enquiries.

External contacts

ofgem.gov.uk
Office of Gas and Electricity Markets. Regulating authority for gas industry and markets.

Joint Office of Gas Transporters
The Joint Office is where the UNC can be found. There are also details of live modifications to the document and the various working bodies relating to the gas industry.

BEIS - Department for Business Energy & Industrial Strategy
BEIS brings together responsibilities for business, industrial strategy, science, innovation, energy, and climate change. Formerly the department of Energy and Climate Change (DECC).

www.xoserve.com
One of several service providers supporting the UK Gas Industry.

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October 2009

Southern Water

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GLOSSARY OF TERMS

Term	***Meaning / Definition***
AA	Annual Average
ADO	Average Deployable Output
AISC	Average Incremental Social Cost
AMP4	Asset Management Plan 4 (for the period 2005-10)
AMP5	Asset Management Plan 5 (for the period 2010-15)
ASR	Aquifer Storage and Recovery
BAG	Benefits Assessment Guideline
BSWE	Base Service Water Efficiency target
BWHW	Bournemouth and West Hampshire Water, a neighbouring water company
Capex	Capital expenditure
CC	Climate Change
CDD	Cistern Displacement Device
CP	Critical Period
CWA	Commercial Water Audit
Defra	Department for Food and Rural Affairs
DI	Distribution Input
DO	Deployable Output
DWRMP	Draft Water Resources Management Plan, submitted for consultation in March 2008
DYAA	Dry Year Annual Average planning scenario
DYCP/PDO	Dry Year Critical Period planning scenario
DYMDO/MDO	Dry Year Minimum Deployable Output planning scenario
EA	Environment Agency
ELL	Economic Level of Leakage
EU	European Union
FDWS	Folkestone and Dover Water Services, a neighbouring water company
HA	Hampshire Andover Water Resource Zone
HHA	Household Water Audit
HK	Hampshire Kingsclere Water Resource Zone
HS	Hampshire South Water Resource Zone
IOW	Isle of Wight Water Resource Zone
JR07	June Return 2007
KM	Kent Medway Water Resource Zone
KT	Kent Thanet Water Resource Zone
l/h/d	Litres per head per day

LoS	Levels of Service
MDO	Minimum Deployable Output
Ml	Megalitres
Ml/d	Megalitres per day
MLE	Maximum Likelihood Estimation
NYAA	Normal Year Annual Average planning scenario
Ofwat	Office of Water Services; the water industry's financial regulator
Opex	Operational expenditure
PCC	Per Capita Consumption
PDO	Peak Deployable Output
PET	Potential Evapo-transpiration
PR	Periodic Review
PR04	Periodic Review conducted in 2004
PR09	Periodic Review 2009
PWC	Portsmouth Water, a neighbouring water company
RSA	The Environment Agency's Restoring Sustainable Abstraction programme
SAC	Special Area of Conservation
SB	Sussex Brighton Water Resource Zone
SDB	Supply Demand Balance
SDS	Strategic Direction Statement – outlining strategic priorities for water and wastewater services
SEA	Strategic Environmental Assessment
SELWE	Sustainable Economic Level of Water Efficiency
SEW	South East Water, a neighbouring water company, which, as of December 2007, incorporates the former Mid Kent Water
SESW	Sutton and East Surrey Water, a neighbouring water company
SH	Sussex Hastings Water Resource Zone
SN	Sussex North Water Resource Zone
SW	Sussex Worthing Water Resource Zone
SWS	Southern Water Services Ltd; also called 'the company' in this WRMP
TWUL	Thames Water, a neighbouring water company
WAFU	Water Available For Use
WFD	The EU's Water Framework Directive
WRMP	Water Resources Management Plan – as required for PR09
WRP	Water Resources Plan – as formulated for PR04
WRPG	Water Resources Planning Guidelines, produced by the Environment Agency
WRSE	Water Resources in the South East Group; a group chaired by the EA and comprising representatives from water companies, Ofwat, SEERA and Natural England

WRZ	Water Resource Zone
WSW	Water Supply Works
WTP	Willingness To Pay
WTW	Water Treatment Works

Executive Summary

This Water Resources Management Plan sets out in detail how Southern Water proposes to ensure that there is sufficient security of water supplies to meet the anticipated demands of all its customers over the 25-year planning period from 2010 to 2035.

There are many challenges over the next 25 years to be faced by the water industry in general, and the South East of England in particular. These challenges include: Increased demand from housing growth; the effects of climate change and the need to reduce energy use; and maintaining high levels of environmental protection. Our plan has to be robust enough in the light of these challenges to maintain security of supplies and provide the best value for customers.

Southern Water also faces a number of specific challenges including constraints on the development of new resources; the complexity of its own separated areas of supply; and the need to reach the best regional solution with the other companies within the region.

This plan shows how Southern Water has responded positively to these challenges by taking a robust approach to planning a resilient system for the future. The plan is consistent with the views expressed in the company's Strategic Direction Statement which was published in December 2007.

All water company Water Resources Management Plans have for the first time been subject to full public statutory consultation with regulators, stakeholders, customers and other interested parties. This has come at a critical time for water resources planning and Southern Water welcomes the opportunity to receive the views of all parties as it plans for the future.

The final version of this Water Resources Management Plan has taken into account the views expressed in the 125 representations received during the consultation process on the draft Water Resources Management Plan (draft WRMP) and reinforces the statements made in the company's Statement of Response to the representations received.

A draft Environmental Report was produced at the time of the draft WRMP as part of the Strategic Environmental Assessment (SEA) process. Since then the Environmental Report has been revised and an SEA Statement produced. A high-level appropriate assessment has also been undertaken of the plan.

The plan is firmly "demand management-led" and assumes: The completion of a programme of universal metering by 2015; further reductions in leakage; and the continued promotion of water efficiency initiatives to meet both the Ofwat baseline water efficiency target and as part of a least cost strategy. There will also need to be some new resource developments. We have been an active member of the Water Resources in the South East (WRSE) group whose results have informed this plan. This means that the strategy also firmly incorporates the requirement for a regional solution and therefore takes the needs of other water companies into account.

The strategy for our Western Area takes account of discussions with Ofwat and the Environment Agency and additional work since submission of the draft WRMP to explore options for implementation of Sustainability Reductions on the River Itchen. The Testwood schemes included in this plan for Hampshire South Water Resource Zone (WRZ) are required to allow the progressive implementation of Sustainability Reductions from 2015.

The value of the 25-year company preferred regional strategy is £283.4 million (based on NPV costs), of which the majority, £175.6 million, will be for reducing our abstraction from the environment through the introduction of demand management measures, and £107.8 million for new resource developments.

This significant water resources investment strategy demonstrates how Southern Water is committed to achieving security of supplies for the next 25 years, and represents the least-cost environmentally sustainable solution.

A summary of the 25-year strategy is as follows:

Water Resource Zone	Schemes During AMP5	Schemes beyond AMP 5 – company only solution	Schemes beyond AMP 5 – Water Resources in the South East of England
Isle of Wight	• Enhanced Metering • Asset improvement schemes for groundwater sources (1.55 Ml/d peak, 1.05 Ml/d average) • Optimisation of inter-zonal transfers (cross-Solent main)	• Water Efficiency kits • 1.1 Ml/d further leakage reduction • Refurbishment of L536 borehole • Refurbishment of K628 borehole	As previous column
Hants South	• Universal Metering • Asset improvement schemes for groundwater sources (12.00 Ml/d peak, 8.00 Ml/d average) • Increase Testwood WSW to licence limit • Development of the enabling Testwood to Otterbourne transfer • Optimisation of inter-zonal transfers (cross-Solent main)	• Candover & Alre augmentation schemes • 7.8 Ml/d of leakage reduction • R176 borehole rehabilitation And, subject to satisfactory completion of AMP5 schemes: • River Itchen Sustainability Reductions residual at end of AMP5	As previous column
Hants Kingsclere	• Universal Metering • Asset improvement schemes for groundwater sources (1.2 Ml/d peak only)		
Hants Andover	• Universal metering • Asset improvement schemes for groundwater sources (0.2 Ml/d peak & average)		
Sussex North	• Universal metering • Renewal of the existing bulk supply contract from Portsmouth Water • Asset improvement schemes for groundwater sources (0.30 Ml/d peak, 0.10 Ml/d average) • Optimisation of inter-zonal transfers (from Sussex Worthing) • River Arun Abstraction	• Renewal of the bulk supply of contract to South East Water	As previous column

Sussex Worthing	• Universal metering • Asset improvement schemes for groundwater sources (1.75 Ml/d peak, 4.25 Ml/d average) • Optimisation of inter-zonal transfers (to Sussex North and Sussex Brighton)		
Sussex Brighton	• Universal metering • Asset improvement schemes for groundwater sources (7.25 Ml/d peak & average) • Optimisation of inter-zonal transfers (from Sussex Worthing)		• Provision of a 4 Ml/d bulk supply to South East Water
Sussex Hastings	• Universal metering • Asset improvement schemes for groundwater sources (0.25 Ml/d peak only) • Optimisation of inter-zonal transfers (Bewl-Darwell transfer)	• Renewal of bulk supply to South East Water • Licence variation at Darwell reservoir • Re-introduction of the S556 source • 0.5 Ml/d leakage reductions	As previous column
Kent Medway	• Universal metering • Asset improvement schemes for groundwater sources (10.25 Ml/d peak, 8.75 Ml/d average) • Optimisation of inter-zonal transfers (to Kent Thanet)	• Renewal of the C522 scheme bulk supply to South East Water • Licence variation to the River Medway Scheme • Licence variation of S271 groundwater source • 6.5 Ml/d of further leakage reduction	As previous column, but additional schemes • Aylesford wastewater recycling scheme • Raising Bewl Water An the assumption that these will enable the following • Bu k Supply from Bewl Water to South East Water • Bu k Supply from Burham to South East Water
Kent Thanet	• Universal metering • Optimisation of inter-zonal transfers (from Kent Medway) • Renewal of the bulk Supply to Folkestone and Dover	• 0.1 Ml/d of further leakage reduction	As previous column, but additional schemes • Enhancement of the bulk Supply to Folkestone and Dover

1 Introduction

1.1 Purpose of this Water Resources Management Plan

This Water Resources Management Plan (also referred to as WRMP) sets out in detail how Southern Water proposes to ensure that there is sufficient security of water supplies to meet the anticipated demands of all its customers over the 25-year planning period from 2010 to 2035. The company currently supplies a total of 2.26 million customers across an area of some 4450 sq. kms in the South East of England, from East Kent in the east, through Sussex, to Hampshire and the Isle of Wight in the west.

This is the first time that all water company WRMPs have been subject to statutory consultation with regulators, stakeholders, customers and any other interested parties. This comes at a critical time for water resources planning in the South East. Southern Water welcomes the views expressed in the 125 representations received during the consultation process.

In looking at the next 25-year planning period, there is no doubt that major challenges face water companies in the South East region, including Southern Water in particular. Although not all are new to WRMPs, a number of factors have brought these challenges into much sharper focus since the last Water Resources Plan (WRP) which was published in 2004. These factors include:

- The need to ensure there is a robust and resilient water supply system that will not fail, even under the most severe conditions;
- The additional demands from the growth in new housing proposed by the Government and the likelihood that current projections of growth will be further increased;
- The need to deliver a regional solution with other companies that constitutes a least cost and sustainable solution;
- The need to take into account the growing impact of climate change on all aspects of forward planning (including energy use), not just drought-related impacts;
- The requirement under recent EU environmental legislation (Habitats Directive) for potentially very sizeable reductions in the water available for supply from some of the company's existing sources. These reductions are much greater than envisaged for the last WRP in 2004;
- The need to take account of the lessons learnt from the severe drought of 2004-06;
- The company's robust investigation and re-evaluation over the last three years of the reliable yield from its sources;
- The marked increase in the frequency and severity of droughts in the last two decades, and a growing acknowledgement in recent years within the industry of the need to plan for further increases in the frequency and severity of future droughts;
- The potential for further reductions in water available for supply as other related legislative provisions are implemented in the future (e.g. the Water Framework Directive, and the Restoring Sustainable Abstraction programme), although companies have been instructed not to include them in the WRMP;
- The requirement to take into account how the Strategic Environmental Assessment (SEA) has informed the WRMP; and

- The opportunity to take into consideration the various issues raised during the consultation process.

Southern Water has responded positively to these challenges in this WRMP which sets out a robust approach to planning a resilient system to ensure security of supplies for the next 25 years. The WRMP demonstrates that the company preferred regional strategy to address all these challenges comprises a combination of measures across different parts of its supply area. The balance of such measures will include: demand management measures such as increased meter installation; reduced leakage and water efficiency initiatives; as well as new resource developments and infrastructure improvements, as required. This strategy has taken into account a range of economic, environmental, and political and social considerations, including those concerning carbon footprint and energy usage, along with the results of the SEA. The certainty with which each of the particular measures will deliver the required outcomes will also be critical, as will the requirement placed on all water companies to, wherever possible, develop “least-cost” solutions in order to minimise increases in customer bills.

In summary, this WRMP shows how Southern Water proposes to ensure that it can supply the needs of its customers over the next 25 years in a manner that is: robust; resilient; flexible; and economically, politically and socially acceptable; whilst being environmentally sustainable.

1.2 Statutory Requirements for this Water Resources Management Plan

Water companies have previously prepared WRPs on a voluntary basis. Companies are now required to prepare and maintain WRMPs on a statutory basis. The process also now requires these WRMPs be subject to public consultation.

This WRMP has been prepared according to the requirements as set out by the following statutory provisions:

- Sections 37A and 37B of the Water Industry Act 1991, inserted by virtue of Section 62 of the Water Act 2003;
- The Water Resources Management Plan Regulations 2007 (SI 2007/ 727);
- The Water Resources Management Plan Direction 2007;
- The Water Resources Management Plan (No.2) Direction 2007;
- The Water Resources Management Plan (No.2) (Amendment) Direction 2007;
- The Southern Water Services Limited Water Resources Management Plan Direction 2007; and
- The Water Resources Management Plan Direction (England) 2008.

Copies of relevant statutory provisions are given in Appendix A.

Table 1.1 shows the statutory requirements as part of the above provisions, and cross-references them to the relevant sections of this WRMP.

The WRMP has to be maintained, and is therefore a live document which Southern Water will be keeping under review. Southern Water is required to send to the Secretary of State a statement of its conclusions following each review, which is to be conducted on at least an annual basis. Southern Water will prepare a revised WRMP where:

- The review indicates a “material change of circumstances”; or
- The Secretary of State directs it to; and
- In any event, not later than 5 years after this WRMP is published.

Southern Water published its Drought Plan in September 2008, which was also subject to the process of statutory consultation. The Drought Plan demonstrates how the company would manage the security of supplies in the event of impending or actual drought events, which are normally of shorter duration than the planning period for the WRMP.

It should be noted that, according to Section 37B (10) of the Water Industry Act 1991, this WRMP does not include any information that is considered commercially sensitive, nor does it include any information that is adjudged to be contrary to the interests of national security.

		Contents of a WRMP as specified by legislation	WRMP Ref.
(a)	WIA 1991 S.37A (3) (a)	Southern Water's estimate of the quantities of water required to meet its obligations.	Section 10.3.5, Section 10.4.5, Section 10.5.5
(b)	WIA 1991 S.37A (3) (b)	The measures which Southern Water intends to take or continue to take to meet its obligations.	Table 10.8, Table 10.16, Table 10.24
(c)	WIA 1991 S.37A (3) (b)	The likely sequencing and timing for implementing those measures.	
(d)	Dir 2007 S.2	Planning period means 25 years from 1st April 2010.	Section 1.1
(e)	Dir 2007 S.3 (a)	How frequently Southern Water expects that it may need to impose prohibitions or restrictions on its customers in relation to:	Section 3.3.1, Table 3.1
		(i) The provisions of a Drought Order restricting "non essential uses" under s.76 WRA 1991.	As above
		(ii) A Drought Order restricting "non essential uses" under s.74(2)(b) WRA 1991; and	Section 3.3.1
		(iii) The provisions of an Emergency Drought Order under s.75 WRA 1991.	As above
(f)	Dir 2007 S.3 (b)	The appraisal methodologies which Southern Water has used in choosing the measures it intends to take or continue for the purpose of making its WRMP.	Section 8
(g)	Dir 2007 S.3 (c)	The emissions of greenhouse gases which are likely to arise as a result of each measure which Southern Water has identified to meet its obligations.	Section 11
(h)	Dir 2007 S.3 (d)	How the supply and demand forecasts contained in the WRMP have taken into account the implications of climate change.	Section 5.7, Section 6.5.7
(i)	Dir 2007 S.3 (e)	How Southern Water has estimated future household demand in its area over the planning period.	Section 6.5
(j)	Dir 2007 (2) S.2 (a)	Its estimate of the increase in the number of domestic premises in its area, over the planning period, in respect of which it will be obliged to fix charges by way of a water meter by reason of a notice served by the consumer under s.144A WIA 1991.	Section 6.5.3
(k)	Dir 2007 (2) S.2 (b)	Where the whole or part of its area has been determined by the Secretary of State to be an area of serious water stress, Southern Water's estimate of the number of domestic premises which are in that area and in respect of which it will fix charges by way of water metering.	Section 6.5.3

		Contents of a WRMP as specified by legislation	WRMP Ref.
(l)	Dir 2007 (2) (Am) S.2 (c)	Its estimate of the increase in the number of domestic premises in its area over the planning period in respect of which Southern Water may be able to make a charges scheme[1] because the conditions for prohibiting such a charge scheme[2] are not met (excluding domestic premises which are in the estimate in (k) above).	Section 6.5.3
(m)	Dir 2007 (2) S.2 (d)	Full details of the likely effect of what is forecast pursuant to the estimates provided under paragraphs (j), (k) and (l) above.	Section 10.3.8, Section 10.4.8, Section 10.5.8
(n)	Dir 2007 (2) S.2 (e)	The estimated cost to the water undertaker in relation to the installation and operation of water meters to meet what is forecast pursuant to the estimates provided under paragraphs (j), (k) and (l) above, and a comparison of that cost with the other measures which it might take to manage demand for water, or increase supplies of water, to meet its obligations.	Section 10.3.13, Section 10.4.13, Section 10.5.13
(o)	Dir 2007 (2) S.2 (f)	A programme for the implementation of what is forecast pursuant to paragraphs (k) and (l)	Section 6.5.3
(p)	SWS Dir 2007	Submission of draft water resources management plan to Secretary of State by 15th March 2008	Appendix A
(q)	Dir (England) 2008	Revised submission date for statement of response, to 29th January 2009 for Southern Water	Appendix A

Table 1.1 References to Statutory Requirements

[1] Defined under s.143 WIA 1991 to be a scheme which fixes, over a 12 month period, the charges to be paid for any services provided by the undertaker in the course of carrying out its functions

[2] Those conditions are set out in s144B and the Water Industry (Prescribed Conditions) Regulations 1999 as amended

1.3 Consultation Requirements

There have now been three phases of the consultation process for this WRMP. Firstly, in accordance with Section 37A (8) of The Water Industry Act 1991, water companies must undertake pre-consultation with Ofwat, the Environment Agency, the Secretary of State and any licensed suppliers in its supply area. Southern Water took the opportunity to widen the scope of this pre-consultation phase to include a number of other bodies, namely, neighbouring water companies, RSPB, the Wildlife Trusts and the Consumer Council for Water (CCW). A copy of the pre-consultation letter and full list of pre-consultation parties is given in Appendix B.

In accordance with the requirement for full public consultation, the draft Water Resources Management Plan (DWRMP) was sent to those parties prescribed in Section 2(2) of The Water Resources Management Plan Regulations 2007 (SI 2007/ 727), in accordance with the requirements of Section 37B of The Water Industry Act 1991. Southern Water has again taken the opportunity to widen the basis of its consultation, and a full list of consultees is given in Appendix B.

The company published the DWRMP on 1st May 2008, and the twelve week consultation period lasted from then until 25th July 2008.

The DWRMP was published for consultation in a variety of formats to ensure that it was available for both technical review/comment and also for wider public consultation.

The DWRMP was published as:

- The main consultation document comprising the Main Report and the Appendices, and a 14-question questionnaire;
- The Non-Technical Summary, giving an overview of the DWRMP; and
- A brochure giving the high level summary of the DWRMP.

As part of the consultation process, a letter was sent to more than 900 stakeholders to advise them that the consultation period had started and that the DWRMP was available on the internet.

An Environmental Report that described the outcomes from a Strategic Environmental Assessment (SEA) of the DWRMP was published for public consultation at the same time as the DWRMP.

Southern Water received 125 representations to the consultation, all forwarded via Defra.

In accordance with Section 4 of the Water Resources Management Plan Regulations 2007, water companies had to prepare and publish a Statement of Response to the representations received during the consultation process. Southern Water published its Statement of Response to the representations received, according to the Water Resources Management Plan Direction (England) 2008, on 29th January 2009. The Statement of Response was available on its website. A link to the site was emailed to all those respondents who had provided an email address. A letter and CD were sent to all respondents who had provided an address, with the offer of a paper copy of the Statement of Response, if requested.

The actions described in the Statement of Response were taken into account in the WRMP - Revised Draft following Consultation which was issued to Defra and the Environment Agency in March 2009.

On 3rd August 2009, Defra announced that the company should publish its WRMP in its final version.

1.4 Strategic Environmental Assessment (SEA)

The requirement to undertake an SEA in the European Union (EU) came about when the EC Directive (2001/42/EC) 'on the assessment of the effects of certain plans and programmes on the environment', known as the 'SEA Directive', came into force in 2004. The Directive was transposed into UK law by the Environmental Assessment of Plans and Programmes Regulations (SI 1633/2004). The Directive and associated regulations make an SEA a mandatory requirement for certain plans and programmes which are likely to have significant effects on the environment.

The Directive's overall objective is to "provide for a high level of protection of the environment and to contribute to the integration of environmental considerations into the preparation and adoption of plans and programmes with a view to promoting sustainable development, by ensuring that, in accordance with this Directive, an environmental assessment is carried out of certain plans and programmes which are likely to have significant effects on the environment."

The previous PR04 WRP did not require an SEA because it was prepared before the SEA Regulations came into force. However, the options appraisal process conducted during the AMP4 Water Resources Investigations did take account of environmental issues and the results of these assessments were taken into account in the SEA. Southern Water considers the WRMP currently being prepared as a "water management plan", within the terms of the SEA Directive, and will set the framework for future development. An SEA is therefore required to be undertaken of the WRMP.

In compliance with the appropriate sets of guidance on the SEA process, an SEA Scoping Report was produced and was published for consultation. The responses received were addressed and included in the preparation of the Draft Environmental Report. The Report summarised the findings and results of the SEA process and presented information on the likely significant effects of the WRMP options considered.

The Environmental Report was published for information and consultation alongside the draft WRMP and the results of the SEA were taken into account in the formation of the final WRMP.

The Environmental Report has been revised to incorporate consultee comments and changes to the WRMP. An Environmental Statement will be published shortly after the final WRMP, indicating how the information and results in the final WRMP and Revised Environmental Report have been influenced and informed by each other.

A high-level strategic assessment has been undertaken of the possible impact of the proposed plan on the integrity of European and Ramsar sites under the Conservation (Natural Habitats &c) Regulations 1994 (the Habitat Regulations). A report of the assessment will be published with the final WRMP.

1.5 Content and Structure of the Plan

The sections of this WRMP aim to provide a clear and logical explanation of the development of the WRMP as follows:

- **Section 2: The Southern Water Supply Area**

  Gives a brief overview of Southern Water's Supply Area, summarises the location and nature of the Water Resource Zones (WRZ), its boundaries with other companies, the main sources of water for supply, and the inter-connections with other water companies and WRZs.

- **Section 3: The Challenges Addressed in this Plan**

  Describes the major challenges that face the industry in general and also those specific to Southern Water as it seeks to plan and manage water supplies for the next 25 years.

- **Section 4: Principles of Water Resource Planning**

  Sets out the fundamental principles for developing a WRMP to ensure security of supplies, through the use of the supply demand balance.

- **Section 5: The Supply Forecast**

  Provides the details of, and results from, the extensive work undertaken to develop a robust Supply Forecast. The results are then used to develop the baseline supply demand balances and thus the WRMP strategy.

- **Section 6: The Demand Forecast**

  Describes the means by which the Demand Forecast is developed over the same period as the Supply Forecast. Forecasting demand is a particularly complex process involving a range of assumptions for the various components of demand. Clear explanations of these assumptions are provided where relevant.

- **Section 7: Dealing With Uncertainty**

  Shows how estimation of both the baseline Supply and Demand Forecasts are subject to some uncertainty, especially over a 25-year planning period. This section shows how these uncertainties are taken into account in this WRMP.

- **Section 8: Options Appraisal**

  Summarises the options appraisal process, and how both supply and demand side options have been considered in the WRMP.

- **Section 9: Formulation of the Water Resource Strategy**

  Explains the investment modelling methodology and the investment model itself, and how the robustness of the solution can be tested using scenario modelling and sensitivity testing.

- **Section 10: The Water Resources Strategy**

Describes in detail the formulation of the company preferred regional strategy for each sub-regional areas and WRZ. Starting from the baseline supply demand balance and the options available, the company preferred regional strategy is given and justified against other potential strategies under different scenarios.

- **Section 11: Overview of the Water Resources Strategy**

Summarises the key components of the company's proposed investment strategy to ensure that it provides security of supplies, in order to meet the demands for water over the 25 years between 2010 and 2035. This forms a key component of the company's detailed Business Plan for the five-year period from 2010 to 2015, as part of the proposals for revised price limits for which the approval of Ofwat will ultimately be required.

2 The Southern Water Supply Area

2.1 Overview

The Southern Water area of supply is complex in nature due to the fragmented geographical areas of supply and the inter-connections between its own supply areas as well as those with a number of other water companies. The area supplied by Southern Water covers a total of some 4,450 sq. kms, and extends from East Kent in the east, through parts of Sussex, to Hampshire and the Isle of Wight in the west. The total number of customers served is 2.26 million, with water supplied to 619,000 unmeasured properties (households and non-households) and 388,000 measured properties. Around 334,000 (35%) of the company's domestic customers are currently metered; around 93% of the households on the Isle of Wight were metered in the late 1980s as part of the National Metering Trial areas.

2.2 Water Resource Zones and Sub-Regional Areas

The geographically separate supply areas, known as Water Resource Zones (WRZs), supplied by Southern Water, and also the geographical relationship with other water companies in the region, are shown in Figure 2.1.

Figure 2.1 Southern Water's Current Area of Supply

Water resources planning takes place at the level of the Water Resource Zone (WRZ) which is the largest area in which all customers bear the same risk of restrictions during drought. There are ten WRZs in the Southern Water area. However, some of these WRZs are, or may be, connected by means of treated or raw water transfers. Therefore, for the purposes of strategic planning, where actions in one WRZ can have an impact in connected WRZs, it is possible to amalgamate some of these WRZs into larger, sub-regional areas.

The spatial basis for water resources planning within the Southern Water supply area is as follows:

Western sub-regional area (Western area), which includes the following WRZs:

- Isle of Wight WRZ;
- Hampshire South WRZ;
- Hampshire Andover WRZ; and

- Hampshire Kingsclere WRZ.

Central sub-regional area (Central area), which includes the following WRZs:

- Sussex North WRZ;
- Sussex Worthing WRZ; and
- Sussex Brighton WRZ.

Eastern sub-regional area (Eastern area), which includes the following WRZs:

- Kent Medway WRZ;
- Kent Thanet WRZ; and
- Sussex Hastings WRZ.

The number of WRZs has been increased since the previous WRP in 2004, with the division of the previous Sussex Coast WRZ into the Sussex Worthing and Sussex Brighton WRZs. This division arose because the capacity of the only inter-connection between the two areas was identified as a constraint on the free movement of water between the areas. When this transfer capacity is increased, the two WRZs can again be treated as a single WRZ.

It should be noted that these new WRZs will be used for reporting purposes from the start of AMP5, in 2010-11, and are therefore used for the formulation of the strategy within this plan.

2.3 Boundaries with Other Water Companies

Southern Water also has boundaries with seven other water companies. These are:

- Bournemouth and West Hampshire Water;
- Wessex Water;
- Portsmouth Water;
- Thames Water;
- Sutton and East Surrey Water;
- South East Water, which includes the area of the former Mid Kent Water, and
- Veolia South East, formerly Folkestone and Dover Water Services.

There are a number of bulk supplies between the companies. The bulk supplies are described in more detail in section 5 (The Supply Forecast), and section 10, which describes the individual Area strategies. Clearly, the number of boundaries, and the existing and potential future inter-connections, with so many water companies raises a number of opportunities for optimising the strategic use of resources across the region. However, it also adds significantly to the complexity of the planning process, and the selection of a single “company preferred” strategy, within a regional context. These issues are discussed further within section 3.3.4 which addresses the challenges of planning in a regional context and also in section 10.

2.4 Licensed Suppliers and Competition

There are currently no licensed suppliers within the Southern Water area of supply.

The final report of Defra’s Cave Review of competition within the water industry was published in April 2009. This Water Resources Management Plan does not include or assume any effects from competition, given the uncertainty about its future scope or pace. However, the WRMP will be developed to reflect competition as it develops, as part of maintaining the WRMP as described in section 1.2.

2.5 Southern Water Sources of Supply

The majority (68%) of Southern Water's supplies comes from groundwater, predominantly from the Chalk aquifer which is widespread across the region. A further 28% comes from river abstractions: most notably the Eastern Yar on the Isle of Wight; the Test and Itchen in Hampshire; the Western Rother in West Sussex; the Eastern Rother in East Sussex; and the Medway and Stour in Kent.

The remaining 4% of supplies come from the surface water impounding reservoirs, all of which are owned and operated by the company. The largest of these is Bewl Water. This is a pumped storage reservoir, with water being abstracted from the River Medway, stored and subsequently released as required for re-abstraction further downstream. The reservoir is owned and operated by Southern Water, but South East Water has an entitlement to 25% of the scheme yield.

The other three reservoirs in the Southern Water supply area are Darwell, Powdermill and Weir Wood. Darwell and Powdermill are used to supply the Sussex Hastings WRZ, with Darwell also providing a bulk supply of water to South East Water. Weir Wood, in north Sussex, supplies parts of Crawley and Horsham and also provides bulk supplies to South East Water.

It is winter rainfall that determines the status of sources and hence the ability to abstract water from them. Southern Water is situated in the South East of England, one of the driest regions in the country. Total annual rainfall averages about 730 mm. a year. However, it is the rainfall during the autumn and winter periods that is critical to the availability of water resources in the region. It is only during this period that rainfall can infiltrate through the soil to recharge groundwater reserves, store river baseflow for the following year and replenish surface water storage. Rainfall during this critical period averages about 400 mm. Most of the rainfall over the rest of the year (on average about 330 mm.) is lost to the atmosphere through evaporation and transpiration from plants during the spring and summer periods, or runs off the land directly into rivers, and is thus of little value in replenishing groundwater resources.

Experience has shown that it is often not the case for customers in different sub-regional areas to endure the same degree of supply shortages in what appear to be very similar drought conditions. The primary reason for this is that different "types" of droughts, or droughts with different characteristics (e.g. dry winters; dry summers; a dry winter followed by a dry summer; successive dry winters etc.) affect various different types of sources in different ways, and the particular shortages in a given sub-regional area will be a factor of the type of drought being experienced and its affects on the mix of the types of sources in that Area. A secondary issue is that quite subtle variations in rainfall across the region can also have significant effects on the availability of water in different WRZs and thus the sub-regional areas. These issues were explored in some depth as part of the Drought Permit/Order applications made by the company during the 2004-06 drought and the recent 2008 revision of the Southern Water Drought Plan.

2.6 The "Twin-Track" Approach

Fundamental to the development of a water resources strategy is the "twin-track" approach. This comprises the parallel approach of: reducing demand through demand management; such as leakage reduction, appropriate metering policies and the promotion of water efficiency initiatives; and the associated development of new sources, inter-zonal transfers or inter-company bulk supplies, as required.

Since privatisation in 1989, Southern Water has proactively pursued the twin-track approach. The profile of investment is given in Figure 2.2 and shows that Southern Water has invested nearly £244 million on maintaining security of supplies, of which some £84 million has been invested on water resource schemes, whilst twice this amount, some £160 million, has been spent on demand management measures.

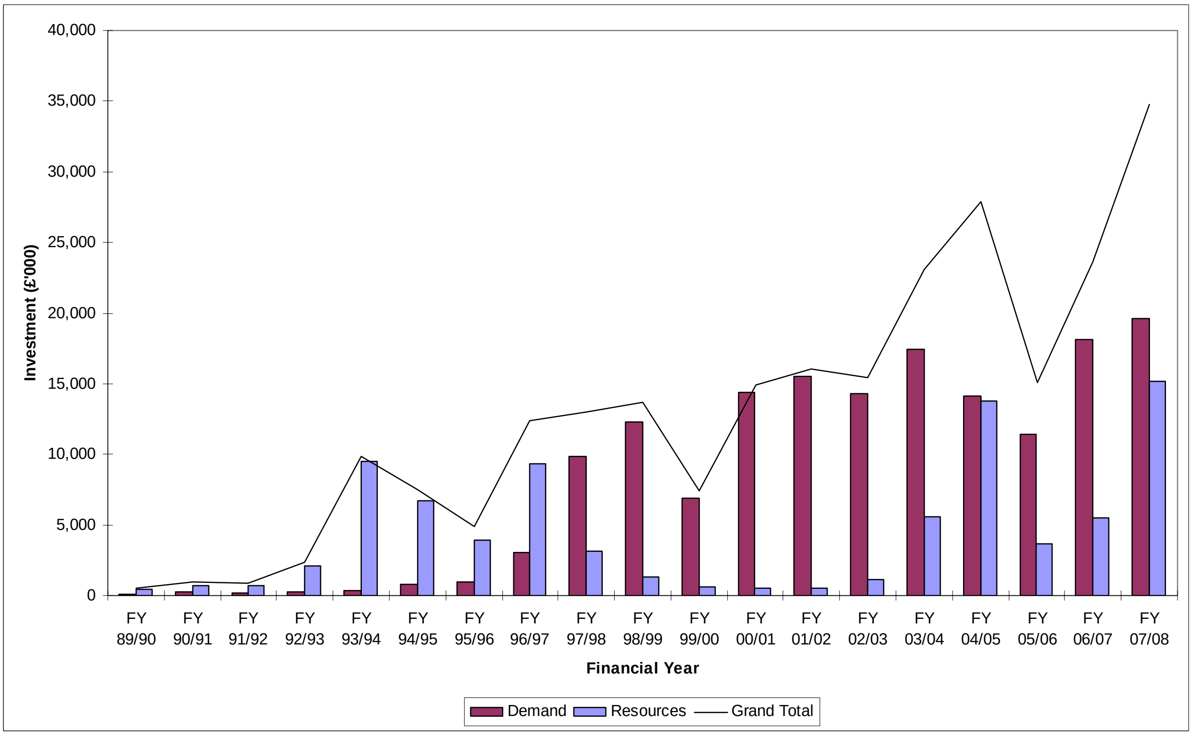

Figure 2.2 Annual Investment on Demand Management and Water Resource Schemes since 1989

3 Challenges Addressed in this Plan

3.1 Introduction

There are a number of major challenges that Southern Water needed to address in the formulation of this WRMP to develop a cost-effective and sustainable plan for maintaining the security of water supplies to its customers over the next 25 years. These challenges fall into two broad categories: the "generic" challenges which face the water industry in general; and also the specific challenges facing companies in the South East region, and Southern Water in particular.

3.2 Generic Challenges

3.2.1 Security of Supplies

A water supply system must be planned to be robust and resilient, and be able to maintain the security of supplies under the most severe conditions. Furthermore, its design must ensure the provision of essential water supplies under all foreseeable circumstances. The conclusions from the recent House of Lords Select Committee Report on Water Resources indicated that the introduction of standpipes and/or rota cuts would not be acceptable. This view was supported by Defra in its Drought Direction 2007, which instructed companies to state what measures, in the event of a severe drought, could be taken to ensure that such events would not occur. This WRMP shows how Southern Water plans to ensure that security of supplies is maintained so that such measures are not required.

3.2.2 New Housing

The number of households that will need to be supplied with water will grow significantly under the Government's plans for new houses. This issue is especially acute in the South East. Current plans, the Draft South East Plan, including the proposed amendments by the Secretary of State and published September 2008, suggest that around 30,000 new houses will be built every year for the next 25 years, of which about a quarter will be in the Southern Water supply area. This growth in housing and the associated impact on demand are taken into account in the Demand Forecast described in section 6. It is possible that the requirement for new houses will grow beyond current projections, with some planning scenarios suggesting that the effect of more than 40,000 new properties per annum in the southern region should be investigated.

3.2.3 Climate Change

The increased climatic variability, as well as a pattern of warmer drier years that would not necessarily be classified as drought years, is set within what is now acknowledged to be a period of rapid and irreversible climate change. In the light of such changes, what remains unclear is the magnitude of that future change, and WRMPs must therefore address the probability that climate change will increase the frequency, duration and magnitude of drought events.

The company's response to this fundamental concern has resulted in significant refinements in several aspects of water resources planning. It recognises that it must plan for a wider range of possible conditions than has hitherto been the case and must, in the process, significantly enhance the resilience of its supply system under this extended range of drought conditions. The need for this was highlighted during the 2004-06 drought. Given the severe conditions that were experienced, and the real possibility of them extending into a third dry winter, Southern Water undertook a very robust re-evaluation of the water available from its sources under drought conditions and a fundamental review of the principles underlying the design of its water resources supply system. It now believes that design scenarios should more explicitly take into account the fact that essential supplies must be maintained during even the most severe drought.

Accordingly, it has extended its analysis to take into account the historic records of droughts over a longer period than previously considered in order to build in the need for security of supplies. Southern Water believes that, by considering this longer historic sequence, it will enable planning for enhanced security of supplies, not only for the present, but also in the future, in view of the all the major uncertainties that are faced.

3.2.4 Energy Use

Directly related to the issue of climate change has been a sharply increased focus on energy use within the water industry. Whilst the financial cost of energy has always been a significant component of the industry's operating and planning processes, the potential environmental costs associated with greenhouse gas emissions are now an equally important consideration. The increased focus on energy use extends not only to existing operations but is now a major factor in the evaluation of potential new resource developments, as will be discussed in this WRMP.

3.2.5 Impacts of Environmental Legislation

The environmental sustainability of existing abstraction licences, many of which were granted more than 40 years ago, has been under intense review in recent years. New EU and national legislative requirements enhancing the degree of protection afforded to the water environment is likely to mean that more water will now need to be left in some rivers, particularly during dry years.

Recent, and forthcoming, decisions by the Environment Agency as a result of its interpretation of European environmental legislation including the Habitats Directive and the Water Framework Directive, and consequential UK law and regulations deriving from the European Directives are likely to affect the company's abstraction licences. This means that in dry years much less water could be available.

It is anticipated that future further reductions in abstraction licences may be made as a result of the Environment Agency's Restoring Sustainable Abstraction (RSA) Programme which will implement the legislative requirements of the EU Habitats Directive and the EU Water Framework Directive as well as recognising the objective of protecting sites of more local environmental interest. However, as will be seen later, companies have been instructed not to take into account these potential further losses in this WRMP. Also, once the relevant determinations have been made under the RSA programme, the results of such determinations on the supply forecast may constitute a "material change in circumstances" which would require Southern Water to prepare a revised WRMP.

3.2.6 Providing Best Value to Customers

Finally, it is important to explicitly state that, despite the Government's commitment to robust planning that ensures the security of water supplies under a wide range of climatic conditions, its commitment to the environmental sustainability of the water supply industry and its commitment to the provision of additional housing in the South East, it remains, through Ofwat, the economic regulator, equally committed to the principle that customer bills should not rise by more than is absolutely necessary to fulfil these foregoing requirements.

This "least-cost" challenge remains a key focus of this WRMP and, in this context, the broader consultation on the plan was extremely timely. Southern Water welcomed the responses on all aspects of its proposals for the next 25 years received as part of the consultation process.

3.3 Specific Challenges for Southern Water

The previous section considered a number of the more generic challenges faced by all water companies in the development of WRMPs, although in many respects the magnitude of these challenges is greatest for companies in the South East. However, in addition to these, there are also a number of challenges that are specific to Southern Water, as it seeks to fulfil its commitment to provide excellent service to its customers. Following consultation with customers, stakeholders and regulators, the company has set itself a wide range of equally challenging targets to achieve this commitment in its Strategic Direction Statement, published in December 2007, which are discussed in following sections. This WRMP has also been subject to public consultation and has taken any comments into account, as detailed in its Statement of Response.

3.3.1 Target Levels of Service

Southern Water has stated targets for Levels of Service that set out the design standard to which it is planning in its WRMP and that are consistent with those in the Drought Plan. There are two Target Levels of Service directly related to the WRMP. The first, customer Target Levels of Service, relates to the frequency and nature of restrictions that customers may experience, in the form of sprinkler bans, hosepipe bans and bans on "non-essential uses" under drought conditions. The second relates to the environmental Target Levels of Service, which relates to the frequency of Drought Permits/Orders, that allow increased abstraction from some of its sources. Table 3.1 shows these Target Levels of Service.

Target Levels of Service (TLoS) **Type of restriction/ measure**	**Target Levels of Service Frequency** **(% of years)** **(taken as the no. of years, irrespective of duration during the year)**
Customer TLoS	
Sprinkler/ Unattended hosepipe ban	1 in 8 years (12.5%)
Full hosepipe ban	1 in 10 years (10%)
Drought Order for non-essential use	1 in 20 years (5%)
Environmental TLoS	
Source Drought Permit/Order	1 in 20 years (5%)

Table 3.1 Target Levels of Service

It is worth noting that in 2007 the Government undertook consultation as to whether the existing powers under the hosepipe ban, and the non-essential use bans under Drought Orders, needed to be rationalised. Changes in legislation have not yet been introduced but there are provisions included in the draft Floods and Water Bill (published in April 2009) that have the potential to change the risk of bans and/or other restrictions. If enacted, such provisions may lead in turn to a change in the Target Levels of Service.

The Regulations state that each company should publish the potential frequency with which it expects to impose restrictions under Emergency Drought Orders, that is, rota cuts and/or standpipes. The company considers that the design standards that it is trying to adopt would reduce the likelihood of recourse to such measures to an absolute minimum, and, to that end, has added an additional section in its Drought Plan to cover the management of severe droughts. The current design is based on drought events within the period of over 100 years of historic record, and as such the company considers that such measures would take place at a lesser frequency than this. It also considers that, before any consideration of such events, there would likely be prior government designation of some form of national or regional emergency.

3.3.2 Actual Levels of Service

The South East of England has experienced a number of droughts within recent years, notably 1989-1992, 1995 and more recently 2004-2006. These have placed great stress on the water resources in the area. During these periods, Southern Water undertook a number of initiatives, including accelerating investment in the re-introduction of some disused sources and carrying out improvements to a number of existing sources to alleviate the effects of the drought, and reducing leakage by nearly 10%, to well below the Ofwat target. However, the situation became sufficiently serious that the company considered it necessary to introduce restrictions on the use of water during these drought events, and to apply for Drought Permits/Orders to maintain supplies from sources. The need for such measures illustrates that the company has been unable to meet its Target Levels of Service.

3.3.2.1 Customer Level of Service

Two measures can be used to demonstrate that, despite its best endeavours to alleviate the effects of the droughts, Southern Water was unable to meet its customer Target Levels of Service:

- The number of years that restrictions have been in force, irrespective of the duration within the year (expressed as a percentage). Using this measure, the company has in some of its WRZs introduced sprinkler/full hosepipe bans in eight out of the last 20 years (40%), although this varied from no restrictions (i.e. 0%) in the Hampshire WRZs to eight years (40%) in some of the Sussex WRZs; and
- The amount of time on average that customers have been subject to restrictions, calculated as the percentage of the actual (population times weeks of restriction) compared to the total (population times weeks under review). This measure could be considered to be a more accurate reflection of actual Levels of Service, as it takes into account of both the population affected, and the total time for which it was affected. Again, it would be expected that, for Target Levels of Service to be met, this measure would be a maximum of 10%. However, the company average for this measure is 15% (varying from 1% in the Western Area to 23% in the Central Area).

The potential scale of restrictions in the 2004-06 drought went beyond hosepipe bans and, for the first time since 1992, the company applied for, and was granted, Drought Orders to enable it to limit or restrict so called “non-essential uses”. In the event, the powers under these Drought Orders were not implemented, but the impact of the applications for these Drought Orders and the possible effects had they been implemented were felt very keenly by many businesses, stakeholders and customers.

Area	Target Levels of Service		Actual Levels of Service	
	1 in x years	% years	Percentage of reporting years, for most frequently affected WRZ in Area	Time expressed as % of (population x weeks)
Hosepipe ban / Sprinkler/unattended hosepipe ban				
Western	1:10	10%	10%	1%
Central	1:10	10%	40%	23%
Eastern	1:10	10%	40%	22%
Company	**1:10**	**10%**	40%	15%
Drought Orders implemented "Non essential use" ban				
Western	1:20	5%	-	-
Central	1:20	5%	-	-
Eastern	1:20	5%	5%	9%
Company	**1:20**	5%	**5%**	**3%**

Table 3.2 Summary of Restrictions in the Areas since 1989

Table 3.3 shows that the frequency of restrictions and drought authorisations in the Central and Eastern Areas does not meet the Target Levels of Service and this is of considerable concern to the company. Southern Water considers that, with increased pressure on water resources in the future, and the potential effects of climate change on the frequency and variability of drought, this past performance must be corrected as a matter of urgency through the formulation of this WRMP.

3.3.2.2 Environmental Levels of Service

A number of Drought Permits and Drought Orders have also been granted throughout the company's area in order to change licence conditions to improve security of supplies (Table 3.3). A summary of the sources subject to, and the conditions attached to, these Drought Permits/Orders, will be described in more detail in the analysis of the individual Areas in section 10.

Area	Number of Source Drought Permits/Drought Orders
Western	1
Central	4
Eastern	37
Company	**42**

Table 3.3 Number of Source Drought Permits and Drought Orders since 1989

It should be noted, however, that whilst abstraction did not always take place under the terms of the Drought Permits/Orders, it was nonetheless necessary to apply to have the powers in place should they have been required to maintain supplies. This is an important point for design of the supply system for the future, when estimates of past system performance are based in the full knowledge of the nature, severity and duration of the design event, and it is not possible to say whether applications for drought authorisations would have been made in these design events to cover the possibility that the situation deteriorated.

3.3.2.3 The impact of a Supply Demand Balance deficit

In the event that a WRZ, or Area, has a supply demand balance deficit, there is a theoretical risk that, in the event of drought conditions, the supplies will be put under more stress than would normally be the case, and it there is an increased risk that the activities associated with the Drought Plan may have to be introduced, which could involve any of the following:

- Demand side measures, such as appeals for restraint up to the introduction of restrictions;
- Supply side measures, if available, to create more deployable output; and
- Applications for Drought Permits/Orders to allow abstraction to continue beyond current licence constraints.

The likelihood of the need to resort to such measures depends on, amongst other things, the extent of the supply demand balance deficit.

At the start of, and during, AMP5, there are a number of WRZs that have supply demand balance deficits, even after taking into account the optimisation of inter-zonal transfers to reduce baseline supply demand balance deficits. The extent of AMP5 deficits in the various Areas can be summarised as follows:

- In the Western Area, there are no supply demand balance deficits in any of the WRZs, namely the Isle of Wight, Hampshire South, Hampshire Andover and Hampshire Kingsclere WRZs, in the AMP5 period;
- In the Central Area, the Sussex North WRZ has a supply demand balance deficit at the start of AMP5 of about 11 Ml/d reducing to about 6 Ml/d at the end of AMP5 for the MDO condition, and about 7 Ml/d reducing to about 3 Ml/d at the end of AMP5 for the PDO condition;
- The Sussex Worthing WRZ does not have a supply demand balance deficit during the AMP5 period;
- The Sussex Brighton WRZ has a supply demand balance deficit for the first two years of the planning period of roughly 1 and 2 Ml/d for the MDO and PDO condition respectively;
- In the Eastern Area, the Sussex Hastings WRZ does not have a supply demand balance deficit during the AMP5 period;
- The Kent Medway WRZ has a supply demand balance deficit for the first four years of the planning period for the ADO condition only, of about 7 Ml/d for the first two years, reducing to about 3 and then 0.5 Ml/d; and
- The Kent Thanet WRZ has a supply demand balance deficit for the first two years of AMP5 for the PDO condition only, of about 4 Ml/d reducing to 3 Ml/d by the end of AMP5.

3.3.2.4 Willingness to Pay

Whilst it is recognised that it would be uneconomic and environmentally unsatisfactory to plan for a supply system that has no restrictions/Drought Permits/Orders under any condition, it is nevertheless important to consider the balance between the cost to provide a resilient supply system against the potential requirement for restrictions on occasion. An indication of this balance can be made by considering the willingness to pay.

As part of the formulation of the Strategic Direction Statement, Southern Water commissioned a Willingness to Pay (WTP) survey. Further details are provided in Appendix K. The results show that customers' Willingness to Pay for a system that would achieve Target Levels of Service amounted to a Net Present Value (NPV) over the 25-year planning period of £70.2 m. with a lower and upper bound at 95% confidence limit of £52.0 m. and £102.4 m.

3.3.3 The Need for Effective Demand Management

Southern Water and its customers have made significant progress in managing the demand for water. In line with the twin track approach described in section 2.6, a number of issues have faced the company in the preparation of this WRMP, as it seeks to meet the challenge of ensuring that effective measures are implemented to optimise the efficient use of water. These issues are discussed further in the sections below under the headings of: increased household metering; enhanced leakage reduction; and water efficiency initiatives.

Demand management measures were also assessed as part of the SEA, and were found in general to have a net positive effect, though leakage and metering programmes can have some short term negative impacts.

3.3.3.1 Increasing Household Metering

Southern Water stated in its Strategic Direction Statement, issued in December 2007, that it is committed to delivering high levels of meter installation as soon as possible. Southern Water believes that metering has a number of benefits to customers, the environment, the company and many other stakeholders, and is therefore committed to achieving high levels of meter installation as soon as possible. Metering is the fairest way to pay for water; it enables customers to influence their own bills; it is consistent with sending out economic signals which will assist in the development of competition, and will enable greater focus to be given to reducing customer side supply pipe leakage. The company believes that this will not only encourage immediate reductions in demand, which will have benefits for the environment and in energy reduction, but it will also enable further reductions to be realised through the introduction of tariff structures when appropriate. The company also believes that this commitment would be supported by its customers and stakeholders, and this was confirmed in the consultation responses.

It should be noted that, at present, it is only when there is a change of occupier in the Sussex WRZs, or where a customer specifically requests the installation of a meter, that the company can install a meter at a household. Over 80,000 meters have been requested by customers in the past five years and if this rate of installation were to continue throughout the planning period, then a further 330,000 properties would become metered by 2035. At that point, around 77% of domestic customers would be receiving a metered supply.

However, the company's supply area has now been designated as an "area of serious water stress" by the Environment Agency. This designation requires Southern Water to consider universal metering, within its WRMP and, if accepted, will mean that it can introduce this metering policy throughout its supply area.

It is currently the intention to achieve a level of 100% meter installation by 2015, and this level has been included in the Demand Forecast in section 6.

3.3.3.2 Reducing Leakage

Southern Water continues to maintain its position as the best performing company for leakage levels among the water and sewerage companies in the country. This has resulted from its commitment to, and investment in, leakage reduction which has yielded savings since 1989 of more than 157 million litres of water per day (equivalent to the consumption from more than 400,000 households).

The current internal company target and 2007-08 out-turn figure for leakage is 82 Ml/d, which is the lowest level per property of all the UK water and sewerage companies. It is already significantly below the company's short-term "Sustainable Economic Level of Leakage"

(SELL) target of about 117 Ml/d and the Ofwat target for the period 2004-05 to 2009-10 of 92 Ml/d, and, under the long term SELL, which was estimated as 89.5 Ml/d. The SELL is the level at which evidence suggests that further efforts to reduce leakage are likely to be uneconomic from a purely financial viewpoint, taking into account the “external” (i.e. the environmental and social impacts) costs of leakage control activities. This approach ensures that that leakage targets are set at a level that is optimal for customers and society as a whole.

A range of surveys suggests that customers are willing to play their part in conserving water if they believe that the water company is also playing its part. It is in this context that Southern Water has determined that it will continue its extensive efforts to reduce leakage to the optimum of 60 Ml/d, which is in line with the aspirations set out in the Strategic Direction Statement.

Southern Water recognises the magnitude of the task it is setting itself, and the number of other enabling factors that will need to be in place to support this initiative, such as: mains replacement; a high level of metering; advances in meter reading technology; but believes that effective leakage control will be vital as it faces the many other challenges described in this section. The consideration of the potential ultimate level of leakage reduction is considered outside the scope of the timescale addressed in this WRMP, but will continue to be investigated.

3.3.3.3 Water Efficiency

Southern Water recognises the importance of water efficiency and will continue to encourage its customers, through a variety of initiatives, to reduce their demand for water, to both help reduce bills and to protect the environment.

The promotion and sponsorship of community events; water audits in domestic and commercial premises; publicity campaigns; provision of horticultural advice; a schools education programme; the provision of water efficient products for the home and garden are all examples of the initiatives that the company has used to promote water efficiency in the home and in the workplace.

The company is also required to meet the new Ofwat target for water efficiency, known as the Base Service Water Efficiency (BSWE) target. This is a minimum target for water saved in relation to the number of properties served. For the company to successfully meet its water efficiency target, it must ensure that 1.01 Ml/d is saved through water efficiency activity each year in AMP5 (from 2010-11 to 2014-15).

Companies are also expected to achieve a Sustainable Economic Level of Water Efficiency (SELWE) as part of their economic, sustainable approach to balancing supply and demand over the planning period. This is in addition to measures introduced to achieve the baseline Ofwat targets.

3.3.4 Planning in a Regional Context

3.3.4.1 The Nature of the Supply System

Southern Water’s current water supply system is the result of the historic development and integration of a number of local systems over more than a century. Thus, the structure of the supply system and WRZs is complex, due to the fragmented geographical areas of its own supply system, and also due to the inter-connections with a number of other water companies.

3.3.4.2 Bulk Transfer Agreements

Over the years, the company has introduced a number of schemes to increase the security of supplies by increasing the connectivity between different WRZs in order to enhance its capacity to transfer water from areas of surplus to areas of deficit, and further options in this regard have been assessed in developing this WRMP.

There are also a number of inter-company transfers of water, which take place under conditions stated in the relevant bulk supply agreements between the companies, which have been developed over the last 50 years.

One issue of inter-company importance for strategic planning is the consideration of these various bulk supply agreements to other companies in this WRMP. Nearly all inter-company agreements specify, as a minimum, such factors as quantities available, charges and duration of contract. With regard to the latter, a number of the agreements to provide exports of water from Southern Water to other companies will terminate during the planning period. Over that same period, several of the WRZs that provide these bulk supplies are forecast to develop a supply demand balance deficit. This means that, in order to maintain supplies to other companies, Southern Water will have to develop new resources, or introduce further demand management measures. The company has taken the view that it will continue to renew all existing bulk supply agreements to other companies throughout the planning period, subject to the volumes that are applicable at the time of contract renewal. This could result in Southern Water having to develop additional resources, and adopt further demand management measures, in order to maintain these inter-company bulk supplies.

The influence of these bulk supplies on the formulation of the strategy is discussed further in section 5.

The possibility of further bulk transfers is discussed in general terms in section 3.3.4.4 and section 9.5, with discussion of the individual Area strategies section 10.

3.3.4.3 Water Resources Development Constraints in South East England

A major challenge facing future planning of water resources is the range of potential constraints in the South East of England on the development of new sources. The entire region has been designated as being in an “area of serious water stress” by the Environment Agency. There has for many years been an Environment Agency policy of no increase in abstraction from groundwater for consumptive purposes. In addition, the high population density gives rise to a very high premium on space and this, combined with large areas of outstanding natural beauty that are rightly afforded a high degree of environmental protection, significantly reduces the options available for new abstraction, storage, treatment and supply infrastructure. For example, there are very few remaining sites in the South East that might be suitable for a new reservoir. Southern Water believes that, given such constraints, all the potential sites for development of new resources during the planning period, provided they are socially, economically and politically acceptable and environmental sustainable, should be identified and reserved for future development.

3.3.4.4 The Water Resources in the South East Group

Southern Water has boundaries with a number of other companies. This emphasises the importance of inter-company co-operation in strategic planning, as well as the need for consistency in the interface between companies and regulators. Southern Water, together with all of the other companies, has therefore played an active role in the Water Resources in the South East Group (WRSE). This group is chaired jointly by the Environment Agency and a company representative, and comprises members from water companies, Ofwat, SEERA and Natural England. It meets at managing director, technical and specialist sub-group levels.

The WRSE considers the shared strategic development of water resources in South East England, which has led to the development of some further bulk supplies between water companies during recent years, the majority of which have involved Southern Water. Southern Water also continues to be actively involved in the WRSE modelling work which is being undertaken by the Group to inform possible future regional solutions for optimising the use of resources.

However, whilst the work of the WRSE Group helps to facilitate appropriately integrated solutions across the region, each company remains responsible for developing its own strategy in line with the requirements of its own Board. Thus, whilst it may be quite reasonable for Southern Water's company preferred strategy to differ from that which might have arisen from work undertaken by the WRSE Group, some justification may be required if regulatory approval for the individual company preferred strategy is to be forthcoming. The water resources strategy in the WRMP presents the "company preferred regional strategy" which is consistent with the latest available results from the WRSE modelling work. This aspect is further discussed in general terms in section 9.5 with discussion of the individual Area strategies in section 10.

3.3.5 The Need for System Resilience

It is important to note that groundwater and the different types of surface water sources will react differently to differing hydrological conditions. Similarly, WRZs may incur differing degrees of stress under the same hydrological conditions due to their different mix of types of source. This has been well illustrated during recent droughts, with different, often adjacent, WRZs and companies experiencing markedly different levels of stress in the supply system.

The implications of this for Southern Water are that, in order to develop a system that is as resilient as possible to different design droughts, due consideration must be given to the optimum balance of the type of sources that it has in any given WRZ and how they will respond under a variety of design scenarios. This should be an important factor in the choice of new resources. For instance supply a forecast deficit at times of peak demand might be met through increased treatment capacity, whereas average or minimum resource period deficits may require the development of more storage or the provision of a drought resilient solution such as transfers, wastewater recycling or desalination.

4 Principles of Water Resources Planning

4.1 Introduction

This section gives a brief introduction to the water resources planning process, and introduces some of the key concepts, including the supply demand balance, which is the difference between the supplies available and the anticipated demand, the planning period and critical planning periods. These concepts will be described, and addressed, in further detail in sections 5 to 10.

4.2 Objective of Water Resources Planning

The building block for water resource planning is the Water Resource Zone (WRZ), which is defined as the largest area in which all customers bear the risk of restrictions during drought. There are ten WRZs in the Southern Water area. The over-riding objective of a water resources plan is to ensure that there are always enough supplies available to meet anticipated demands in all WRZs and for every design critical period, even under the conditions of greatest water supply stress. This is known as meeting the supply demand balance.

Such design conditions normally occur when there has been a lack of rainfall during the previous autumn and winter recharge period, coupled with high demands as a result of hot and dry summer conditions. As such, these conditions do not often occur, and therefore water resources planning normally has to consider simulating how the water supply system would have reacted during previous drought events that have been identified in the historic record. There are a number of historic droughts which are normally used to represent design events, such as 1900-03, 1920-22, 1930-33 and sometimes 1976. It is worth noting that the recent drought of 2004-06 is not included in this list, but if the lack of rainfall had continued for only a relatively short period of time then it would have moved into the design event category.

Therefore, in the water resources planning process, the aim is to ensure that there are sufficient supplies available to meet anticipated demands over the long term planning horizon for every year of the planning period under the various critical design events.

4.3 The Supply Demand Balance

The supply demand balance is, quite simply, the difference between supplies available and anticipated demands. It is determined from the Supply Forecast, which is the forecast of the supplies available, and the Demand Forecast, which is the forecast of anticipated demands. The difference between the Supply Forecast and the Demand Forecast is known as available headroom. However, as will be seen later, estimates of both supplies available and demands are subject to sources of uncertainty, which is known as headroom uncertainty. Therefore, a buffer between the Supply Forecast and the Demand Forecast is included in the supply demand balance. This buffer is known as the Target Headroom and is the amount of available headroom that is considered to be an acceptable planning allowance in the supply demand balance.

If available headroom becomes less than Target Headroom at any time, or for any critical period, during the planning period in the "baseline" supply demand balance, some form of intervention option is needed to redress the balance. A number of options may be available to meet any supply demand balance deficit. These options can be on the supply side, to increase supplies available to meet demands, or on the demand side, to reduce the supplies that are needed.

4.4 Planning Period and Critical Planning Periods

There are two conditions for which the supply demand balance has to be satisfied:

- For each year of the 25-year planning period from 2010 to 2035; and
- For each critical period during each year of the planning period.

4.4.1 Planning During the Planning Period

Figure 4.1 shows how the baseline supply demand balance over the planning period can be used to determine whether the supply demand balance is in surplus or deficit, and when this change from surplus to deficit occurs and thus when some form of supply or demand intervention is required to maintain security of supplies.

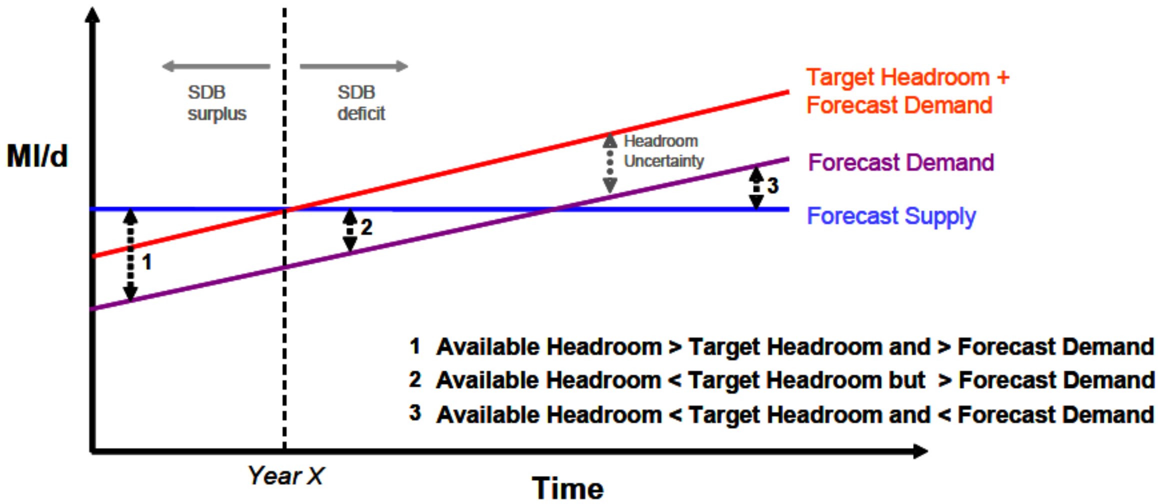

Figure 4.1 Schematic of Supply Demand Balance

4.4.2 Critical Period Planning Scenarios

The status of the supply demand balance will vary throughout the year, as both supplies available and demands vary within the year. This "within year" variability is described in detail in section 6.2, but can be summarised as leading to the definition of three "critical periods" that must be considered for each year of the planning period. These critical periods are all based on a design "Dry Year" condition, since it is in such years that the supply demand balance will be under most stress.

The three critical periods are as follows:

- The "average annual period", whereby average demand over the year is compared against the average annual supplies that are available. This is known as the average deployable output (ADO) scenario;
- The "peak demand period", whereby the demands over the period of peak demand during the year, normally defined as a week, are compared against the supplies available during that period. This is known as the peak period deployable output (PDO) scenario; and

- The “minimum resource period”, whereby demands over the period are compared with supplies when supplies available are expected to be at their minimum. This minimum resource period normally occurs during late summer/early autumn when river flows are at their minimum and groundwater levels are at their lowest prior to the onset of the winter recharge period. This is known as the minimum deployable output (MDO) scenario.

It should be noted that, for Southern Water, and this WRMP, the average annual period is not normally the most relevant in terms of the supply demand balance, and is only the driver for investment in the Eastern Area. This is due to the nature of the sources within the Southern Water supply area.

Surface water storage reservoirs, which can be most easily seasonally managed to cope with the average annual condition, only account for 4% of the supplies available to Southern Water. Groundwater sources, which can also, but to a more limited extent, be used to seasonably manage supplies over the year, account for 68% of supplies. However, they are still prone to depletion of available output at times of peak demand and at times of minimum groundwater levels late in the year. Run-of-river abstractions, with no associated storage facility, account for 28% of supplies, and are least able to be managed for the average annual condition. This is because they can only abstract from the flows available at the time of the peak demand period and the minimum flow condition. If flows are not sufficient, then abstraction cannot take place, or could be severely curtailed. Thus, the average amount of abstraction available throughout the year, defined as total annual abstraction divided by 365 days, is meaningless when designing for the annual average condition in such cases.

Therefore, the discussion and design of the supply demand balance for Southern Water throughout this WRMP, will only address the peak period (PDO) and minimum resource period (MDO) conditions for the Western and Central Areas, and the Annual Average (ADO) and PDO conditions for the Eastern Area.

4.5 The Water Resources Planning Process

The water resources planning process, to ensure the supply demand balance is maintained for each year, and for each critical period, during the planning period, is undertaken according to the following steps, for each WRZ and sub-regional area:

- Estimation of the baseline Supply Forecast (See section 5);
- Estimation of the baseline Demand Forecast (See section 6);
- Estimation of the uncertainties and Target Headroom required (See section 7);
- Calculation of the baseline supply demand balance for each year and critical period of the planning period, to determine if there are any years or critical periods where there is a supply demand balance deficit. (See section 10);
- Identification of all feasible supply and demand options which could be used to reduce or close the supply demand balance deficit (See section 8 for general discussion, and section 10 for WRZ and Area specific details);
- Undertaking investment modelling to determine the water resources strategy and further undertake scenario modelling and sensitivity testing to determine the robustness of the solution (See section 9); and
- Formulation of the final planning solution for the company-preferred regional strategy, which will specify the chosen supply and demand side options selected, their timing for implementation and the justification for their selection. (See section 10 for WRZ, and Area details and section 11 for the company preferred strategy).

5 The Supply Forecast

In order to plan effectively to ensure security of supplies, it is important to know what supplies will be available in the design event. Southern Water has developed and refined its understanding of what supplies would be available in a variety of design events through the development of a number of advanced mathematical models. Southern Water believes that, in order to provide the desired level of security of supplies in the future, it should plan for the worst historic event, including the possibility of a "third dry winter" design scenario. This scenario was close to being realised, had the drought of 2004-06 extended into the third winter. In the event, it did not extend, but the Government had asked that all companies in the South East region prepared plans for such an eventuality.

Since publication of the DWRMP, a summary report on the approach to the calculation of surface water deployable output has been prepared[1]; the report has been audited[2]. A complementary report on severe droughts and climate change impacts on groundwater deployable output has also been prepared since the DWRMP[3]. The groundwater report brings together the various elements of work undertaken for the AMP4 Water Resources Investigations and this WRMP.

The Halcrow audit report states:

> "We strongly support the overall approach of using conjunctive use DOs in an extended period simulation with the objective of enabling Southern Water to meet its stated levels of service with the defined frequencies over the long term. The company, probably in common with many others, has clearly not met its water availability LoS objective with the required frequency. The company is, therefore, to be commended on the work it is doing to address this issue."

5.1 Elements of the Supply Forecast

It has been mentioned previously that the Supply Forecast refers to the estimation of the total supplies available to meet demands in the WRZ, for each year, and for each critical period, throughout the planning period.

The value of the total supplies available is made up from a number of elements, as follows:

- Water Available for Use (WAFU), where WAFU is calculated as deployable output less outage:
  - Where, deployable output is the volume of water that can be pumped into supply from a given source (borehole, river intake, or reservoir) on a daily basis under the three *dry year* planning scenarios described in the section 4.4.2. Thus, the following different values of *deployable output* can be defined:
    - *Average deployable output (ADO)* – this is the deployable output of a source for the "average annual period";
    - *Peak deployable output (PDO)* – this is the deployable output of a source during the "peak demand period"; and
    - *Minimum deployable output (MDO)* – this is the deployable output of a source during the "minimum resource period";

[1] Southern Water WRMP Support, Technical note: Surface water Deployable Output, Atkins July 2008, (Ref: 5050675/70/DG/036)
[2] Southern Water, Deployable Output Assessment Audit, Halcrow, September 2008
[3] Assessment of impact of severe drought and climate change on groundwater DO, Atkins, March 2009 (Ref: 5050675/70/DG/092)

- o Outage, which is the deployable output that may be unavailable for supply at any given time due to unplanned events such as mechanical, electrical or treatment failures, or pollution incidents upstream of a river abstraction.

Once WAFU, which is `the water available for use from sources indigenous to the WRZ, has been calculated, there are a number of other elements which need to be taken into account in the calculation of total supplies available, as follows:

- ♦ Total supplies available equals:
  - o WAFU, from above;
  - o Less treatment works losses and operational use, which accounts for potential reductions in WAFU due to losses arising from the water treatment process or losses in the local raw water distribution system before the treated water is pumped into the supply network;
  - o Less inter-zonal or inter-company bulk exports from the WRZ;
  - o Plus inter-zonal or inter-company bulk imports to the WRZ;
  - o Less Sustainability Reductions. These are reductions in the deployable output of a source arising from the implementation of environmental legislation to protect the water environment; and
  - o Plus/less climate change effects. The scenarios for future climate change will all have varying degrees of impact on the deployable output of water supply sources. In the vast majority of cases deployable output will be reduced, but in a few cases a small increase in deployable output is possible. The calculation by water companies of the potential impacts of climate change on the deployable output of sources is based on protocols agreed the Environment Agency.

The methodologies used to describe the estimation of the above elements of the Supply Forecast are presented in sections 5.2 to 5.7.

5.2 Deployable Output

This section sets out the methods the company has used to assess the deployable output of its sources for both groundwater and surface water, together with the results of these assessments. The company has carried out a significant re-assessment of the deployable output of its sources since the last Water Resources Plan, in 2004, due to: improved collection of data; work undertaken as a result of the observed effects of the recent severe drought; and the modelling of sources that has been undertaken during the AMP4 Water Resources Investigations.

It should be noted that the following sections detail the investigations, analysis and results that will be used for the planning period, from 2010-11 to 2034-35. They will not be introduced into the baseline Supply Forecast until the start of the planning period in 2010-11. This is to ensure that there are no inconsistencies or discontinuities in the reported supply demand balance during the rest of the current AMP4 period. A full presentation of the sequencing of the introduction of various design assumptions in the build-up of the Supply Forecast over the entire planning period is given in section 5.2.3.

A prerequisite for the calculation of deployable output is the definition of the design event that is used for planning purposes. During recent droughts water use restrictions were introduced and Drought Permits/Orders were granted that modified the conditions of some abstraction licences. This experience highlighted the difference between actual and target Levels of Service. The company therefore considered it appropriate to review the design principles for the estimation of deployable output for both its surface water and groundwater sources. This resulted in a complete re-assessment of deployable output in all Areas based on detailed modelling of individual sources, drought back-casting, technical re-evaluation of source capabilities during droughts and conjunctive use modelling. Two key improvements were carried out as part of AMP4 Water Resources Investigations to enable a much better understanding of the drought capability and drought supply risk associated with Southern Water's sources:

- All surface and groundwater sources have now been assessed on a consistent basis, which allows the output of surface and groundwater sources to be assessed as a combined total during historic drought events. This is known as the 'Unified Methodology' [4]of deployable output assessment and represents a significant improvement in gaining an understanding of Southern Water's overall source capability during drought conditions. For previous deployable output assessments, outputs for surface and groundwater sources were derived from different droughts, of different severity; and
- Detailed water resource models were produced for the Western, Central and Eastern Areas using the MISER water resource modelling application. These models allow the distribution of sources, demand and strategic transfers to be spatially and temporally modelled.

These improvements in turn enabled the achievement of the following two key objectives:

- It allowed the 'conjunctive use' of sources to be modelled. For example, in the Central Area, the S466 groundwater source and Weir Wood reservoir can be used to supplement abstraction from the S648 river source during dry periods in the summer, but they can be rested following rainfall 'spate' events where river flows are temporarily higher. The MISER model allowed the significant deployable output benefit of this combined operation to be evaluated and quoted for the MDO period; and
- It provided a better understanding of the impact and significance of key strategic infrastructure constraints. This allowed additional resource development options to be identified, and meant that constraints could also be reflected in the cost and deployable output of new resource development schemes where appropriate.

In order to apply the Unified Methodology referred to above, it was first necessary to model the outputs that could have been obtained during a long record of historical droughts. Historic surface water flows were therefore reviewed and modelled as far back as the 1890s[5]. This allowed the worst historic drought for each sub-regional area to be calculated, based on the make up of its sources, the nature of demand and available storage. Realistic, pragmatic assessments of groundwater capability under the identified key surface water droughts were evaluated, and compared with the severity of the more recent drought events that formed the 'baseline' groundwater deployable output assessments. As it allowed combined deployable output under more severe, historic droughts to be evaluated, application of the Unified Methodology inevitably resulted in a reduction in the total deployable output available in a WRZ, taking into account the simultaneous impact on both surface and groundwater sources. However, Southern Water believes that the adoption of the Unified Methodology provides a much more realistic and prudent approach to developing a robust supply system that can actually provide the required levels of supplies during future drought events. Further details of the analysis of surface and groundwater deployable output are given in sections 5.2.1 and 5.2.2 respectively.

The conjunctive use modelling approach using the MISER models has reduced the deployable output impact of historic drought events by presenting a realistic assessment of the operational capability of sources. This would not have been possible if simple, separate analyses of minimum drought outputs for the different types of sources had been used for individual sources, and, thus results in an improved representation of the supply system.

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[4] Halcrow Group Ltd. / Imperial College London, 2000. A Unified Methodology for the Determination of Deployable Output from Water Sources Volumes 1 & 2. UKWIR Ref 00/WR/18/1, EA Ref W258. (UK Water Industry Research / The Environment Agency.)

[5] The impact of climate change on severe droughts, Major droughts in England and Wales from 1800 and evidence of impact, Environment Agency

It should be noted that previously only historic droughts for which operational records exist were used to calculate the deployable output of a source. Should droughts occur with a greater severity than has previously been observed, then the supplies available to the company might be less than current deployable output estimates. It is also important to recognise that in making assessments with behavioural modelling, there is perfect knowledge of the start, duration and end of droughts included in the simulation. The company does not have this prior knowledge to inform operational practice during extreme droughts. In order to maintain security of supplies it may decide on actions to conserve its resources should the duration of the drought continue beyond the length assumed for planning and until it is certain that the drought is over. During such very extreme events, the company would also be working to its Drought Plan, to ensure continued supplies of water would be available to its customers during the drought.

5.2.1 Surface Water

Since the DWRMP, a summary report that describes the approach to the assessment of surface water deployable output undertaken for the AMP4 Water Resources Investigations and then the WRMP processes has been written. As noted previously, the approach taken has been audited and endorsed[2].

Surface water sources include direct 'run-of-river' abstractions and surface water impounding reservoirs, which can be supported by pumped inflow. The potential impact of drought events on these sources will differ depending on the conditions of the abstraction licence and the nature of the source. In order to review the widest range of droughts possible, analyses were carried out to develop a flow series back to the 1890s using a rainfall-runoff model. This flow series was then used to assess the critical drought period for each surface water source.

The general approach to calculating the surface water source deployable output was as follows:

- Analysis of the available flow records within each catchment, at relevant gauging stations to assess the availability of long-term flow data, and an assessment of the catchment and factors affecting runoff;
- Derivation of the naturalised flow series at each of the assessment points, using the finalised data series for observed flow and all artificial influences (i.e. discharges and abstractions);
- Development and calibration of rainfall-runoff models;
- Derivation of a long term flow series using long term rainfall and potential evapo-transpiration (PET) records for South East England;
- De-naturalisation of the long term flow series to include all artificial influences apart from Southern Water abstractions; and
- Use of the long term flow series to calculate the deployable output of each surface water source using MISER.

Much of this work was carried out as part of the AMP4 Water Resources Investigations and additional detail about the modelling work carried out is included in Appendix D.

Following this analysis, the critical droughts within each sub-regional area as a whole were identified and used for water resource planning purposes. The worst surface water historic droughts for each Area were identified as follows:

- Western Area: 1920-1922;
- Central Area: 1920-1922; and
- Eastern Area: 1900-1903.

The range of design events result from the different responses in each Area due to the mixture of sources in the individual Areas. The critical event for the Western and Central Areas is 1920-1922, as the sources are prone to the effects of relatively short, two year, very severe droughts. Conversely, the sources in the Eastern Area are most sensitive to the effects of conditions during 1900-1903, when there was an extended three year drought which progressively eroded reservoir and groundwater storage.

5.2.2 Groundwater

Since the DWRMP, the company has undertaken more work on the assessment of groundwater deployable output. Work focussed on the impacts of severe drought conditions that occurred before the period for which operational data are available and on the impacts of climate change.

The assessment of groundwater deployable output used for the planning period follows the Unified Methodology[4]. The deployable outputs estimated for the last Water Resources Plan, in 2004, were based on the 2003 re-assessment of deployable outputs. These estimates have subsequently been updated by re-assessments of groundwater deployable outputs in both 2005 and 2006. These groundwater deployable output assessments are all based on historically observed values of water levels and outputs. Often, the drought event used to define the deployable output is from 1990-1992, 1996-1998 or the recent 2004-2006 drought, as these are the only ones for which actual observed data is generally available. However, these estimates are not consistent with the drought periods used to define the deployable output of surface water sources, which are based on either the 1900-1903 or the 1920-1922 droughts. Thus, in order to apply the Unified Methodology, it is necessary to estimate the value of groundwater deployable output which would have been available at the same time, during these earlier, more severe, drought events.

Assessment of the potential impact of historic droughts on groundwater deployable outputs is complicated when there is little or no data available from such historic events on which to base estimates of groundwater levels. In order to make an assessment of the potential reduction in deployable output during the critical 'surface water' drought, the following general approach was taken for all WRZs (but with variations to take account of the different availability of historic data and robust recharge and/or groundwater models in each WRZ), following a peer review:

- Conceptualisation of all groundwater sources to identify those at risk from extreme drought (e.g. in particular sources where adits or other hydrogeological constraints such as fissures define the deployable output);
- Groundwater recharge modelling over the long term record using either existing models or lumped recharge calculation, depending on what techniques are available for the WRZ;
- Estimation of regional groundwater levels during the critical drought, based on the extended recharge series using either the existing groundwater models or a regression analysis using observation boreholes with sufficiently long records;
- Estimation of source rest water levels at boreholes which are considered to be vulnerable; and
- Assessment of the potential impact of this change in water level on the source deployable output by downshifting the assessment diagrams.

The approach is described in more detail in the summary groundwater report[3].

This process enabled a consistent estimate of deployable output for each WRZ and Area to be made between the surface and groundwater assessments for the design event.

5.2.3 Summary of Deployable Outputs

This section sets out the values of deployable output that have been used in this WRMP for the different time periods in which the differing design standards have been applied.

For surface water deployable outputs, the following values have been used, for different time periods, as follows:

- From the baseline year 2007-08 to the end of AMP4 (2009-10), the values used will be the original PR04 values, in line with the PR04 baseline condition, together with any AMP4 improvements; and
- From the start to the end of the planning period (2010-11) to 2034-35, the values used will be as calculated from the methodology described in the section 5.2.1 above.

For groundwater, the situation is more complex, as there will be a progressive series of values used, to reflect the changing assumptions, as follows:

- The baseline year 2007-08, will use the original PR04 values, in line with the PR04 baseline condition, or 2006 re-assessments (where available);
- For 2007-08 these values will also include any AMP4 improvements in deployable output to date and will remain constant until the start of the planning period (2010-11);
- For the start of the planning period (2010-11), the values used will take into account the 2006 re-assessments, together with the results from application of the Unified Methodology;
- During the AMP5 period, up to 2014-15, these values will be modified to take into account any AMP5 planned source improvements; and
- Up to the end of the planning period in 2034-35, the values used will be those used at the end of AMP5.

The deployable output values used in the baseline supply demand balance have therefore changed from those presented in the last WRP in 2004. These changes are presented graphically in Appendix I for each Area at both MDO and PDO, showing the value of deployable output both increasing and decreasing as a result of the work carried out to re-assess the deployable output of both ground and surface water sources. Table 5.1 summarises the PR09 baseline (2010-11) deployable output for the company by WRZ and source type.

Enhancements to groundwater deployable output are planned during AMP5 and these will be included in the baseline Supply Forecast during AMP5, but these are not shown in Table 5.1 which is the PR09 baseline at 2010-11. A review of the methodologies used, and results of all surface and groundwater deployable output assessments is included in Appendix D.

Area	WRZ	Groundwater (Ml/d)		Surface Water (Ml/d)		Total (Ml/d)	
		MDO	PDO	MDO	PDO	MDO	PDO
Western	HS	96.33	114.77	149.46	149.46	245.79	264.23
	HA	22.47	28.20	0.00	0.00	22.47	28.20
	HK	8.68	9.48	0.00	0.00	8.68	9.48
	IoW	20.72	25.49	10.00	12.00	30.72	37.49
	Total	**148.20**	**177.94**	**159.46**	**161.46**	**307.66**	**339.40**
Central	SN	23.85	39.29	16.20	24.50	40.05	63.79
	SB	89.30	108.52	0.00	0.00	89.30	108.52
	SW	57.85	68.98	0.00	0.00	57.85	68.98
	Total	**171.00**	**216.79**	**16.20**	**24.50**	**187.20**	**241.29**
Eastern	SH	1.82	3.50	38.66	42.85	40.48	46.35
	KM	109.98	135.67	34.60	46.90	144.58	182.57
	KT	50.97	57.29	3.50	3.50	54.47	60.79
	Total	**162.77**	**196.46**	**76.76**	**93.25**	**239.53**	**289.71**
Company	**Total**	**481.97**	**591.19**	**252.42**	**279.21**	**734.39**	**870.40**

Table 5.1 PR09 Baseline (2010-11) Deployable Output by Source Type and WRZ

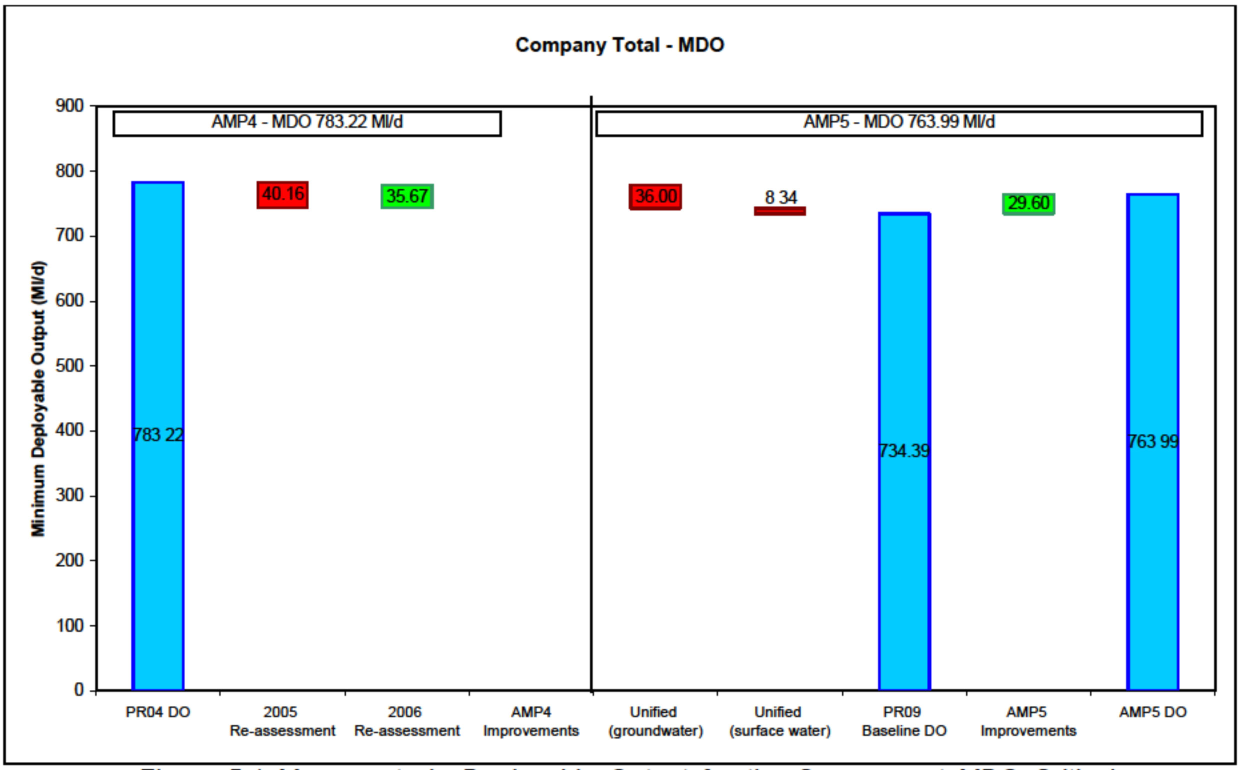

Figure 5.1 Movements in Deployable Output for the Company at MDO Critical Period (Ml/d)

For the MDO critical period condition Figure 5.1 shows the following,:

- ♦ There is a net reduction in MDO from the PR04 baseline to the start of the planning period for PR09 of 4.49 Ml/d due to;
  - o a reduction of 40.16 Ml/d as a result of the 2005 reassessments; and
  - o an increase of 35.67 Ml/d as a result of the 2006 reassessments.
- ♦ A decrease of 36.00 Ml/d from the 2006 reassessment due to the adoption of the Unified Methodology for groundwater sources;
- ♦ A decrease of 8.34 Ml/d due to the adoption of the Unified Methodology for surface water sources; however
- ♦ There will be an increase in MDO of 29.60 Ml/d during AMP5 due to assumed groundwater source improvements.

Therefore, overall in the baseline Supply Forecast there will be a net reduction in MDO from AMP4 baseline to AMP6 baseline of 19.23 Ml/d (from 783.22 Ml/d to 763.99 Ml/d) equivalent to 2.5%.

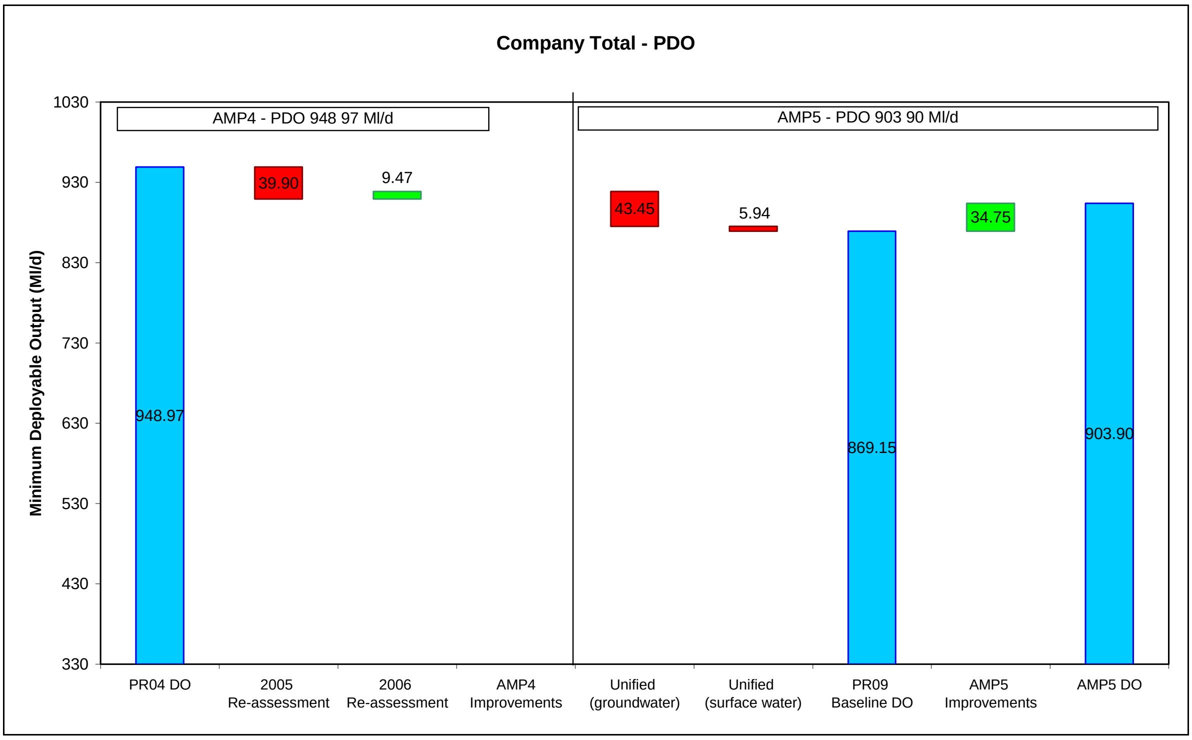

Figure 5.2 Movements in Deployable Output for the Company at PDO Critical Period (Ml/d)

Figure 5.2 for the PDO critical period condition shows the following:

- ♦ There is a net reduction in PDO from the PR04 baseline to the start of the planning period for PR09 of 30.43 Ml/d due to;
  - o a reduction of 39.90 Ml/d as a result of the 2005 reassessments; and
  - o an increase of 9.47 Ml/d as a result of the 2006 reassessments;
- ♦ A decrease of 43.45 Ml/d from the 2006 reassessments due to the adoption of the Unified Methodology for groundwater sources;
- ♦ A decrease of 5.94 Ml/d due to the adoption of the Unified Methodology for surface water sources; however

- There will be an increase in MDO of 34.75 Ml/d during AMP5 due to assumed groundwater source improvements.

Therefore, overall in the baseline supply forecast there will be a net reduction in PDO from AMP4 baseline to AMP6 baseline of 45.07 Ml/d (from 948.77 Ml/d to 903.90 Ml/d) equivalent to 4.7%.

5.3 Treatment Works Losses and Operational Use

The treatment of water from most sources will result in process and operational losses, except when treatment is in the form of simple chlorination. The following data therefore relates to the treatment process water, i.e. the net loss of water, excluding water returned to the source.

A review of the estimation of such losses has been made for all Southern Water's Water Supply Works (WSW). This shows that there are 106 sources at which there will be some form of process loss, nine are surface water sources, and 97 are groundwater sources. Estimates of the revised process losses are summarised by WRZ, sub-regional area and company level for both the MDO and PDO condition in Table 5.2.

Area	WRZ	Estimated Treatment Works Losses and Operational Use (Ml/d)	
		MDO	**PDO**
Western	IoW	0.49	0.50
	HS	1.18	1.18
	HK	0.04	0.04
	HA	0.13	0.13
	Total	**1.84**	**1.85**
Central	SN	0.44	0.39
	SW	0.60	0.60
	SB	0.50	0.50
	Total	**1.54**	**1.49**
Eastern	SH	0.34	0.38
	KM	1.20	1.20
	KT	0.61	0.61
	Total	**2.15**	**2.19**
	Company total	**5.53**	**5.53**

Table 5.2 Summary of Treatment Works Losses and Operational Use by WRZ

Although the volume of process losses will be kept under review, it is not considered that there are any opportunities for further reductions in process losses through investment with the exception of B513 which is the location of an AMP5 asset maintenance scheme. The potential scale of the reduction in process losses has been estimated and is included in Table 5.2.

5.4 Outage

Outage refers to the planning allowance made for the temporary unplanned loss of deployable output from a source. This can result from such factors as mechanical, electrical or treatment failure or any form of unplanned event which leads to the temporary loss. An allowance for outage is made in the supply demand balance, calculated at the level of the WRZ.

Estimates of outage have previously been made on the pragmatic basis of taking either the value of the average deployable output of independent groundwater sources in a WRZ, or 5 Ml/d, whichever is the smaller. However, this had the potential to give unrepresentative values, particularly in small WRZs with relatively few sources. Therefore, a risk based approach was derived to give what were considered to be more representative values.

A revised assessment of the outage allowance has been carried out for this WRMP using a risk-based approach, based on actual recorded data, which is described in more detail in Appendix D. The results of this analysis are summarised at the level of WRZ, area and company in Table 5.3.

Area	WRZ	Outage allowance (Ml/d)	
		MDO	**PDO**
Western	IoW	1.93	2.34
	HS	4.59	6.54
	HK	0.77	1.49
	HA	1.52	2.44
	Total	**8.81**	**12.80**
Central	SN	2.34	2.30
	SW	3.07	4.39
	SB	3.63	5.18
	Total	**9.04**	**11.87**
Eastern	SH	1.62	3.94
	KM	4.06	5.90
	KT	3.62	4.64
	Total	**9.29**	**14.48**
	Company total	**27.15**	**39.16**

Table 5.3 Summary of Outage Allowances by WRZ (Ml/d)

The outage allowances presented in Table 5.3 are based solely on outage at groundwater sources, with the sole exception of Sussex Hastings WRZ, where the estimates take into account known outages to surface water sources.

It is the intention to continue to monitor actual outage on a continuous basis. In particular the following aspects will be reviewed:

- Any changes as a result of ongoing data collection;
- The possible inclusion of a partial, significant loss of deployable output from surface water sources, as it is considered that this would constitute a legitimate, and experienced, form of surface water outage;

- The partial reduction in groundwater source deployable outputs given the historical occurrence of pollution events and single borehole failure at multiple borehole source sites;
- Whether an allowance should be made for flooding events; and
- The potential for reducing the outage allowance through an enhanced asset maintenance regime.

However this will require the current enhanced data collection procedures to have been in place for a longer period so that the required data are available for a more representative period of time.

5.5 Raw and Potable Water Transfers and Bulk Supplies

There are a number of bulk transfers of water, both raw and potable, within the Southern Water area of supply. These can be both from a WRZ (export), or to a WRZ (import). There are two basic types of transfer, as follows:

- Inter-zonal, whereby the transfer takes place between Southern Water WRZs (see Table 5.4); and
- Inter-company, whereby the transfer takes place between a Southern Water WRZ and another water company (see Table 5.5).

Area	From	To	Capacity (Ml/d)
			Exports
Western	HS	IoW	14.00
Central	SW	SN	15.00
	SN	SW	15.00
	SW	SB	7.00[1]
Eastern	KM	SH	35.00 (raw)
	KM	KT	22.80

Note: [1] scheme becomes available once strategic scheme completed

Table 5.4 Summary of Inter-Zonal Transfers from 2010-11 (Start of Planning Period)

Area	WRZ	Imports		Exports	
		MDO (Ml/d)	PDO (Ml/d)	MDO (Ml/d)	PDO (Ml/d)
Western	IoW	-	-	-	-
	HS	-	-	23.00	23.00
	HK	-	-	-	-
	HA	-	-	0.31	0.41
	Total	**0.00**	**0.00**	**23.31**	**23.41**
Central	SN	15.00	15.00	5.40	5.40
	SW	-	-	-	-
	SB	-	-	-	-
	Total	**15.00**	**15.00**	**5.40**	**5.40**
Eastern	SH	-	-	8.00	8.00
	KM	-	-	18.12	19.32
	KT	0.01	0.01	4.00	-
	Total	**0.01**	**0.01**	**30.12**	**27.32**
	Company total	**15.01**	**15.01**	**58.83**	**56.13**

Table 5.5 Summary of Inter-Company Bulk Transfers from 2010-11 (Start of Planning Period) (Ml/d)

Southern Water is a net exporter of water, with exports of about 60 Ml/d at both MDO and PDO, compared to imports of about 15 Ml/d at both MDO and PDO. Currently, these contractual volumes have to be taken into account in the baseline supply demand balance.

There are a number of issues to consider regarding bulk transfers within the context of the WRMP, which are briefly addressed below.

There are a number of existing inter-zonal transfers between the WRZs within Southern Water. These allow the transfer of supplies from WRZs with a surplus supply demand balance to those with a deficit. The transfers will have a given capacity, which may not need to be fully utilised at the start of the planning period for all conditions because the transfer is optimised to meet the deficit year by year. Thus, spare capacity may exist for future increases in transfers to support the recipient WRZ. This in turn allows for the possibility of increasing the capacity of the transfer if further spare supplies become available in the donor WRZ. It also has the implication that, should further supplies be required in the inter-connected WRZs, then it may be more appropriate to develop resources in either the donor, or recipient, WRZ. This gives flexibility to the choice of scheme option selection within the investment model.

There are also a number of inter-company transfers, some of which are of significant volume, although others, such as the small metered supplies, serve only a few properties. The terms and conditions of the larger inter-company transfers are set out in some form of agreement. These agreements will normally state such aspects as: volume; duration of the agreement; and financial arrangements, although no two agreements are the same. However, many of the current agreements are due to expire during the current planning period, one as early as 2012.

Furthermore, all of the donor WRZs (apart from Hampshire Andover) which provide for these bulk exports will develop a supply demand balance deficit during the planning period. It has already been stated that Southern Water has included in the baseline supply demand balance renewal until the end of the planning period of all existing bulk supplies at the volumes that are applicable at the time of contract renewal.

Southern Water has reaffirmed its commitment to the development of a regional solution within the context of the WRSE companies. A number of potential inter-company transfers have been identified as part of the work of the WRSE group modelling work. These additional bulk transfers are summarised in Table 5.6 and are included in the investment model for the WRSE scenario only. In addition, a number of resource development schemes that formed part of the WRSE regional solution are proposed to be introduced. This is likely to result in a surplus of water which will be available for bulk transfer in the Eastern Area; however, the magnitude of such a transfer or transfers has not yet been agreed.

Transfer	Peak (Ml/d)	MDO (Ml/d)
Sussex Brighton		
SB export SEW Mid-Sussex	Constant from 2028-29: 4.0	Constant from 2028-29: 4.0
Kent Thanet		
KT export Folkestone & Dover – Deal High	Additional from 2027-28: 2.0	-

Table 5.6 Summary of Additional Inter-Company Bulk Transfers for WRSE Scenario

5.6 Sustainability Reductions

5.6.1 Overview

All abstractions are subject to the terms of the existing abstraction licences. Many of these licences were issued in 1965, when the provisions of the 1963 Water Resources Act came into force. The Environment Agency considers that the terms of some of these licences are such that the abstraction could cause environmental damage, or could have an impact on sites with environmental designations. Thus, there is a possibility that some licences may be varied, or even revoked, if it is proven that they could cause environmental damage. In order to manage the requirements of recent European and national environmental legislation and initiatives, the Environment Agency has set up the over-arching Restoring Sustainable Abstraction (RSA) Programme.

During AMP4, a number of investigations have been undertaken, mostly under the Habitats Directive, to determine if the abstractions under investigation could cause environmental damage, and thus needed to be revised. Such revisions are generally known as Sustainability Reductions. Most of these investigations are ongoing and final results have only been indicated for the River Itchen SAC. It should be noted that although the investigations have been carried out during AMP4, there is no strict timetable for the implementation of any measures, although at the time of the DWRMP the Environment Agency indicated that it expected all measures to be completed by 2015. In the period since the DWRMP, the company has worked with the Environment Agency, Ofwat and Portsmouth Water to explore options for the implementation of the proposed Sustainability Reductions. A draft Memorandum of Understanding (MoU) was prepared by the company following that work to set out the roles and responsibilities of the various parties to progress the development of options that would allow the proposed Sustainability Reductions to be implemented. The MoU (reproduced in Appendix A) has now been approved by all parties, and the Environment Agency has indicated that there could be a progressive timetable for implementation of the Sustainability Reductions up to the end of AMP6.

At various times during preparation of this WRMP, the Environment Agency has provided figures for the Sustainability Reductions to be included in the supply demand balance. Southern Water received the first set of figures for Sustainability Reductions in June 2007 (letter is included in Appendix D.4). This gave an "indicative" Sustainability Reduction for only the River Itchen SAC investigation. The impact of the proposed licence revisions is extremely significant for the Hampshire South WRZ and the Western sub-regional area, as described in section 10.3. The "indicative" Sustainability Reductions advised in 2007 were confirmed by the Environment Agency in its letter dated 28th November 2008 (included in Appendix D.4) as "Certain"; the letter also included information on NEP (National Environment Programme) schemes to be included in AMP5.

Table 5.7 gives a summary of the Sustainability Reductions set out in the Environment Agency letters. Table 5.8 gives a summary of the schemes and investigations to be undertaken during AMP5 that the Environment Agency identified in the NEP letter dated November 2008.

<table>
<tr><th>Area</th><th>WRZ</th><th>Reference no.</th><th>Site name</th><th>Priority</th><th>Details</th></tr>
<tr><td rowspan="4">Western</td><td>IoW</td><td>4SO501002</td><td>Brading Marshes</td><td>Medium</td><td>No Sustainability Reductions advised by EA.</td></tr>
<tr><td>HS</td><td>3POSW5106</td><td>River Itchen SAC</td><td>High</td><td>Sustainability Reductions advised by EA comprise at S517 and Y841 totalling 107 Ml/d at MDO and 86 Ml/d at PDO due to a proposed MRF of 198 Ml/d.</td></tr>
<tr><td>HK</td><td colspan="4">None</td></tr>
<tr><td>HA</td><td colspan="4">None</td></tr>
<tr><td rowspan="2">Central</td><td>SN</td><td>4SW00301</td><td>Arun Valley SPA, Ramsar, SSSI</td><td>Medium</td><td>Potential impact on the S466 groundwater abstraction. Removed by the EA in its December 2008 letter.</td></tr>
<tr><td>SW</td><td colspan="4">None</td></tr>
<tr><td rowspan="3">Eastern</td><td>SH</td><td colspan="4">None</td></tr>
<tr><td>KM</td><td>3MK3000801</td><td>North Kent Marshes</td><td>Medium</td><td>Potential impact on groundwater sources in this WRZ.
No Sustainability Reductions advised by EA in its December 2008 letter.</td></tr>
<tr><td>KT</td><td>Little Stour
3SO3000301
Wingham River
4SO300101</td><td>Little Stour, Wingham River</td><td>-</td><td>The EA advises that it does not have sufficient information to provide details on potential Sustainability Reductions to the X868, R168 and A853 sources. Options appraisal to be undertaken in AMP5</td></tr>
</table>

Table 5.7 Summary of Sustainability Reductions to be included in the Southern Water WRMP

<table>
<tr><th>Area</th><th>WRZ</th><th>Reference no.</th><th>Site name</th><th>Priority</th><th>Details</th></tr>
<tr><td rowspan="4"></td><td rowspan="2">HS</td><td>3POSW5106</td><td>River Itchen SAC</td><td>High</td><td>Implementation</td></tr>
<tr><td>RSA-SOHA0003</td><td>River Test</td><td>Not given</td><td>Investigation
New scheme that was not identified by EA in 2007.</td></tr>
<tr><td>HK</td><td colspan="4">None</td></tr>
<tr><td>HA</td><td colspan="4">None</td></tr>
<tr><td rowspan="3">Central</td><td>SN</td><td colspan="4">None</td></tr>
<tr><td>SW</td><td colspan="4">None</td></tr>
<tr><td>SB</td><td>GB107041012450</td><td>Lewes Winterbourne</td><td>Not given</td><td>Investigation
New scheme that was not identified by EA in 2007 and not advised to the company in advance of December 2008 letter.</td></tr>
<tr><td rowspan="3">Eastern</td><td>SH</td><td colspan="4">None</td></tr>
<tr><td>KM</td><td colspan="4">None</td></tr>
<tr><td>KT</td><td>Little Stour
3SO3000301
Wingham River
4SO300101</td><td>Little Stour, Wingham River</td><td>-</td><td>Options appraisal</td></tr>
</table>

Table 5.8 NEP investigations to be undertaken during AMP5

At the time of the DWRMP, the only information provided regarding the magnitude of possible Sustainability Reductions related to the River Itchen SAC. As shown in Table 5.7, there remains the possibility that further proposals will be made that affect the remaining sites. Whereas most of the investigations to date have been associated with the Habitats Directive Review of Consents, the Table 5.8 illustrates that further reviews of abstraction licences under Restoring Sustainable Abstraction programme and the Water Framework Directive drivers may lead to further pressures on the company's resource base.

At the time of the DWRMP, and further confirmed in the NEP letter (dated November 2008), all companies were instructed by the Environment Agency in its Water Resources Planning Guideline that they would be told by the Environment Agency what Sustainability Reductions should be included in their WRMPs. Companies were instructed not to include any allowance for any other Sustainability Reduction, or any allowance for the possibility of the non-renewal of time dated licences, either as a reduction in deployable output, or as a factor in the calculation of headroom uncertainty. Southern Water is of the view that this continues to represent a major source of uncertainty in this WRMP and could adversely affect its robustness in future years.

5.7 Climate Change Effects on Supply

At the time of the DWRMP, it was expected that the results of UKCIP08 would have been released in time for them to inform the final WRMP, but the new scenarios (under the name UKCP09) were only released in July 2009. Additional work undertaken since the DWRMP has therefore been restricted mainly to the refinement of the previous analysis on groundwater sources, and to reviews of the operation of the River Medway Scheme in the context of AMP4 Water Resources Investigations. There has also been additional guidance from both Ofwat[6] and the Environment Agency[7] on how the impacts of climate change on supplies should be taken into account.

The impacts of climate change on surface water sources were assessed using three different climate change models to determine the minimum, 'most likely' and maximum expected climate change impacts. The 'most likely' model has been used as the central reduction in deployable output, with the maximum and minimum models providing the bounds for headroom uncertainty using a triangular distribution. Impacts on deployable output and Target Headroom limits were interpolated linearly, providing an incremental impact and increase in headroom over the planning period.

In the Eastern Area, the operation of Bewl Water is currently constrained by the operational need for a minimum input to P647 of 30 Ml/d. With this constraint in place, it is not possible to successfully run the MISER model over the design scenario, as there is insufficient water in the Medway to allow effective re-fill of Bewl to support the P647 abstraction. The medium and high scenarios were thus based on modelling with the minimum P647 flow constraint removed. This suggests that the operation of the system is particularly sensitive under high climate change scenarios, and will therefore need to be kept under review.

The output of the three reservoir system (Bewl, Darwell and Powdermill) has thus been considered in combination. The climate change input on the whole system was calculated for the three climate change scenarios, and this impact was apportioned equally between Kent Medway and Sussex Hastings WRZs.

One further issue associated with the Eastern Area is that due to the way in which the system operates, the 'most likely' climate change impact on the peak week is actually slightly less than the minimum climate change scenario. The impact of climate change on the company's surface water sources is shown in Table 5.9.

Analysis has been undertaken since the DWRMP to assess the impact of climate change on groundwater sources. Details of the work are given in the summary report on groundwater deployable output [3]. The results of the assessment of the impact of climate change on groundwater are shown as Table 5.10.

The assessment of the impact of climate change on both surface water and groundwater supplies will need to be kept under review, particularly following release of the UKCP09 climate change scenarios. Further guidance from UKWIR and other bodies on how to apply use the new scenarios in future planning is expected following review and interpretation of the new scenarios. Delay in the release of the new scenarios means that it has not been possible to include their impact in this WRMP. However the approaches used for this WRMP can be applied to the new scenarios.

The recent Ofwat policy[6] states:

> "Companies will need to provide robust evidence for any step changes to the estimates of existing supply capacity (for example, deployable output) and demand that they use in their investment planning for the 2010-15 period, whether those changes are related to new information on climate change or to other factors. In preparing their evidence, companies should take account of their experience during the 2005-06 drought, which tested supply capacity and demand."

[6] Water supply and demand policy, Ofwat November 2008
[7] Revision to Water resource planning guideline, Environment Agency, December 2008

Section 5.2 describes how the reassessment of source yields and assessment of climate change impacts were undertaken and refers to separate reports that provide the robust evidence required by Ofwat. The potential impacts of climate change on deployable output have not been included in the baseline values of DO during AMP5. The impact is assumed only from the start of AMP6 onwards; climate change does not therefore affect any investment decisions during AMP5.

Area	WRZ	MDO Reduction, 2025			PDO Reduction, 2025		
		Headroom			Headroom		
		Min	Most Likely	Max	Min	Most Likely	Max
Western	IoW	0.0	0.0	0.0	1.40	2.09	2.77
	HS	0.0	0.0	0.0	0.0	0.0	0.0
	HK	-	-	-	-	-	-
	HA	-	-	-	-	-	-
	Total	**0.0**	**0.0**	**0.0**	**1.40**	**2.09**	**2.77**
Central	SN	0.0	0.0	0.0	0.0	0.0	0.0
	SW	-	-	-	-	-	-
	SB	-	-	-	-	-	-
	Total	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Eastern	SH	2.71	5.02	6.90	3.41	5.68	7.83
	KM	4.57	8.46	13.16	10.61	17.68	24.51
	KT	-	-	-	-	-	-
	Total	**7.28**	**13.48**	**20.06**	**14.02**	**23.36**	**32.34**
	Company	**7.28**	**13.48**	**20.06**	**15.42**	**25.45**	**35.11**

Table 5.9 Climate Change Impacts on Surface Water Deployable Output in 2025 (Ml/d)

Area	WRZ	MDO Reduction, 2025			PDO Reduction, 2025		
		Headroom			Headroom		
		Min	Most likely	Max	Min	Most likely	Max
Western	IoW	-0.07	0.08	0.29	-0.06	0.09	0.31
	HS	-1.25	0.00	1.50	-1.10	0.05	2.05
	HK	0.00	0.00	0.00	0.00	0.00	0.00
	HA	-0.04	-0.01	0.02	-0.04	0.00	0.04
	Total	**-1.36**	**0.07**	**1.81**	**-1.20**	**0.14**	**2.40**
Central	SN	-0.05	0.03	0.05	-0.05	0.03	0.05
	SW	-0.69	0.18	0.69	-0.92	0.23	0.92
	SB	-1.54	0.39	1.54	-0.95	0.24	0.95
	Total	**-2.28**	**0.59**	**2.28**	**-1.92**	**0.50**	**1.92**
Eastern	SH	-0.10	0.20	0.40	-0.10	0.25	0.50
	KM	0.00	3.89	6.43	0.00	2.71	5.92
	KT	-1.20	2.58	6.00	-3.09	3.28	10.03
	Total	**-1.30**	**6.67**	**12.83**	**-3.19**	**6.24**	**16.45**
	Company	**-4.94**	**7.33**	**16.92**	**-6.31**	**6.88**	**20.77**

Table 5.10 Climate Change Impacts on Groundwater Deployable Output in 2025 (Ml/d)

6 Demand Forecast

6.1 Introduction

This section sets out how Southern Water's Demand Forecast has been derived. During the Reporting Year 2007-08, the company supplied 564 Ml/d on average each day. This is about 40% greater than that supplied in the early 1960s. Despite the challenges to be faced by the company during the planning period and in particular the forecast increase in population and households, demand is forecast to decrease by 2.3% as a result of the significant demand management measures included in this Plan. The headlines for the demand forecast are:

- Total population supplied is forecast to rise from 2,257,000 in 2007-08 to 2,701,000 in 2034-35;
- Total connected properties are projected to increase from 1,043,000 in 2007-08 to 1,328,000 in 2034-35;
- The normal year average daily demand is forecast to <u>decrease</u> to 551 Ml/d by 2034-35, as a result of universal metering. If only optant metering policies were adopted, the NYAA demand would still be expected to fall, but only slightly, to 560 Ml/d (a decrease of 0.6%); and
- The average PCC for the company under "normal year" conditions is forecast to decrease from 152 l/h/d in 2007-08 to 127 l/h/d in 2034-35. In 2030-31, the overall household PCC is forecast to be 128 l/h/d, which is ahead of the government's aspirational target of 130 l/h/d by 2030.

Figure 6.1 shows how the annual average daily volume of water supplied by the company and the former statutory water undertakers from which the company was formed has varied since the 1960s. The volume supplied (called Distribution Input) peaked in 1989 at around 720 Ml/d, from which it has fallen back to levels not experienced since the 1970s. This trend in declining consumption is attributed to reductions in domestic customer use in response to: changes in lifestyle; customer awareness of the environment; ongoing water efficiency campaigns; increases in domestic metering; reductions in commercial demand, and a significant decrease in leakage. The impact of the forecast increase in population on demand is described in section 6.5.

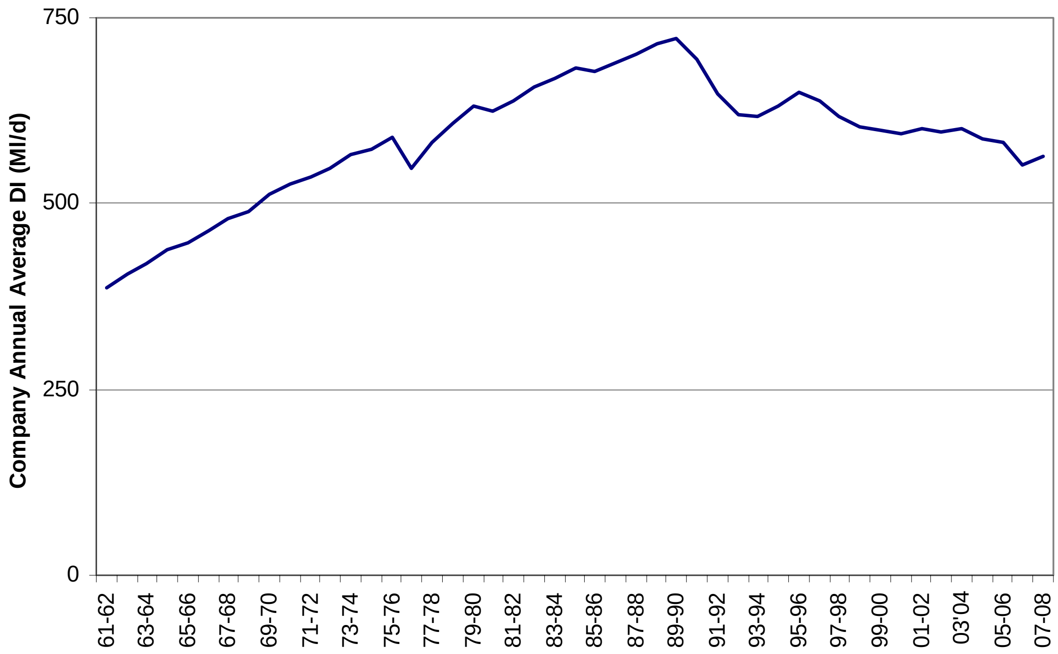

Figure 6.1 Company Annual Average Distribution Input, 1961-2007

Demand for water varies seasonally and with the prevailing weather conditions, peaking during the late spring/summer months as discretionary use increases, and then falling to a minimum during the autumn and winter. Figure 6.2 show the daily variation in demand during 2007-08 in which a peak week demand of 628 Ml/d was recorded in May, while the minimum weekly demand of 540 Ml/d was recorded during October.

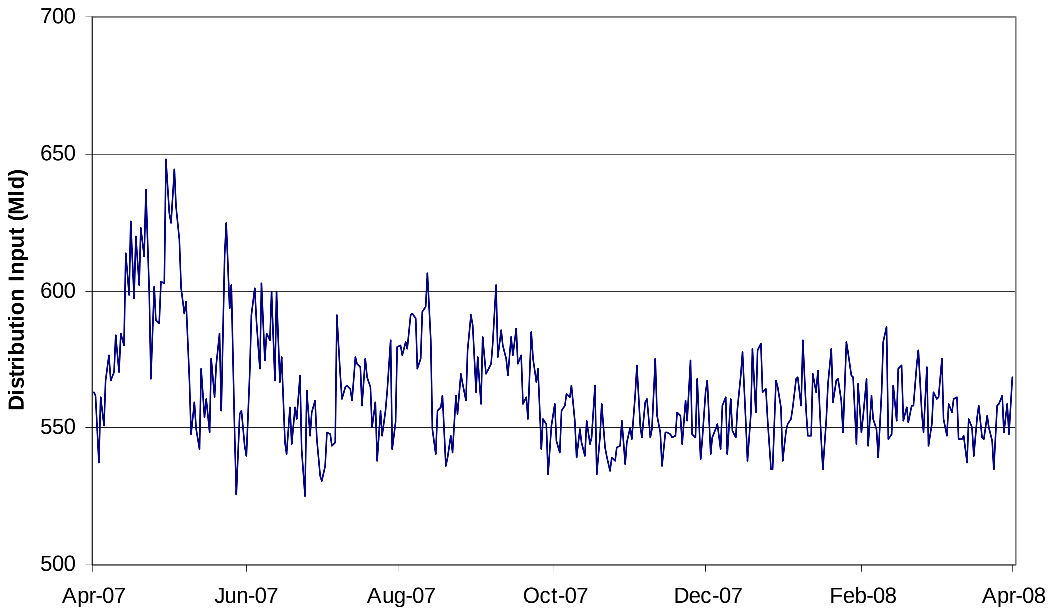

Figure 6.2 Variations in Distribution Input during 2007-08

Hot, dry summer weather, as for example in 1995, leads to significant increases in daily demand, although in times of drought, as in 1976 and 2004-05, the introduction of demand restrictions can bring about rapid reductions in customer use.

Variations in discretionary use throughout the day, particularly during the warmer summer months are generally considered the main reason behind the observed increases in summer demands. Figure 6.3, based on work carried out by WRc[8], shows the variation in recorded household demands on typical winter and summer days.

Indoor consumption is relatively constant between the two periods, but outdoor discretionary use during the summer period, due principally to garden watering, is considerably greater during the summer than the winter.

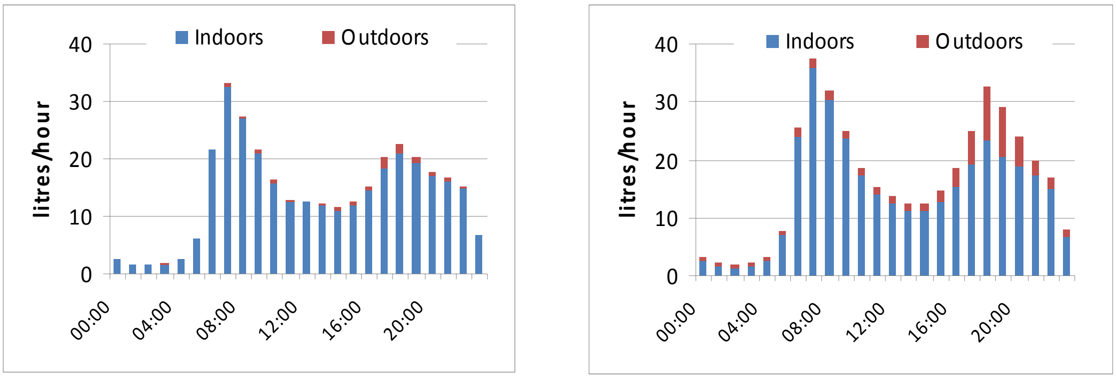

Figure 6.3 Typical Daily Household Consumption Profiles in Winter (left) and Summer (right) (After WRc 2005)

For planning purposes, the measure used for describing peak demand is the average daily consumption taken over seven consecutive days; the maximum annual figure being the so-called “average day peak week” or critical period demand, or PDO demand. In 2007-08, the peak week demand was 628 Ml/d, some 11% above the average and 15% greater than that recorded in the autumn. Demand forecasts are presented in this document for both average annual and critical period, (AA and CP) demands as required by the Water Resource Planning Guideline, and also during the autumn period, when groundwater sources are at their lowest levels – known as the minimum deployable output (MDO) period.

Historic peak week demands have been reviewed to assess the maximum that might be expected under the required forecast design scenarios during the planning period to 2034-35. In 2007-08, 35% of households supplied by the company were metered; a figure which has increased steadily since the compulsory metering of the Isle of Wight in the late 1980s, (carried out as part of the National Metering Trials). Metered domestic customers tend to use less water than unmetered customers, so the historic peak demand record has been rebased to reflect the current level of meter installation. The revised annual peak series has subsequently been used to derive the dry year demand estimates.

The base year for this new forecast is 2007-08, and demands recorded during that year are considered to be reasonably representative of what may be termed a *normal* year. The derivation of base year demands under the normal year, and for the dry year planning scenarios (DYAA, DYCP, and DYMDO) are described in section 6.3.

In 2007-08, the company supplied water to 945,000 domestic households (excluding void households), 334,000 of which were metered (35%) and to a further 61,000 commercial customers (excluding void non-households), 88% of which were metered. In addition, water was used for operational purposes by the company, water was taken but was unbilled (both by legal and illegal means), and the remainder was lost through leakage from the distribution system and from the supply pipes which connect individual properties to the distribution main. Table 6.1 lists the Components of Demand and shows the proportion of water attributed to each component.

[8] WRc (2005), *Increasing the value of domestic water use data for demand management*, Report P8832

Component of Demand	Company (Ml/d)	%DI
Unmeasured households (umHH)	244.3	43%
Measured households (mHH)	89.7	16%
Unmeasured Non-households (uNH)	5.7	1%
Measured Non-households (mNH)	131.6	23%
Distribution System Losses	65.3	12%
Customer Supply Pipe Losses	16.2	3%
Operational Use & Unbilled	10.7	2%
Total Demand	563.6	100%

Table 6.1 The Components of Demand, 2007-08

During the year, domestic household consumption accounted for around 59% of Distribution Input, while commercial customers used a further 24%. Leakage, including that lost from customers' supply pipes accounted for 15%, while the minor components accounted for the remaining 2% of supply.

Many of the assumptions on which this forecast is based are subject to uncertainty. But overall, this forecast reflects Southern Water's current view of the impact of factors such as the projected growth in population and housing numbers and changing levels of commercial activities on future demands, given existing policies and preferred options regarding metering and other demand management measures.

6.2 Demand Scenarios

This WRMP presents demand forecasts for a range of design scenarios, as specified in the Environment Agency's Water Resource Planning Guideline. The required scenarios are:

- **Normal Year Annual Average demands (NYAA)** – developed by normalising the base year (2007-08), where necessary, to compensate for the influence of weather and demand restrictions. The idea is to derive estimates of demand that would occur under 'normal' conditions;
- **Dry Year Annual Average demands (DYAA)** – the annual average demand in a year with low rainfall, but without any demand restrictions in place. This demand is used with the average deployable output (ADO) supply scenarios;
- **Dry Year Critical Period demands (DYCP)** – a scenario to look at the peak week demand during summer in a dry year. Peak week demand is the average daily value in the seven day period for which the largest demand is seen. This demand is used with the peak deployable output (PDO) supply scenarios; and
- **Dry Year MDO demand (MDO)** – the autumn demand in a dry year. Autumn is the period when ground water levels and river flows are generally at their lowest and sources are operating close to their minimum deployable outputs (MDO). Whilst demand in this period is generally not as high as in the summer, it is important to investigate this scenario because the available supplies are generally vulnerable.

Figure 6.4 illustrates the definitions of these periods in relation to the baseline demands observed in the Hampshire South WRZ during 1995-96, a period which included the very dry summer of 1995. All water companies are required to provide forecasts for the NYAA and DYAA scenarios because this allows comparison between the various companies. However, the dry year peak week demand (DYCP) or the MDO demand may be the more important investment driver in some WRZs; depending on local characteristics, for example, the volume of storage available and the composition of sources. For this reason, forecasts for these two periods are also presented.

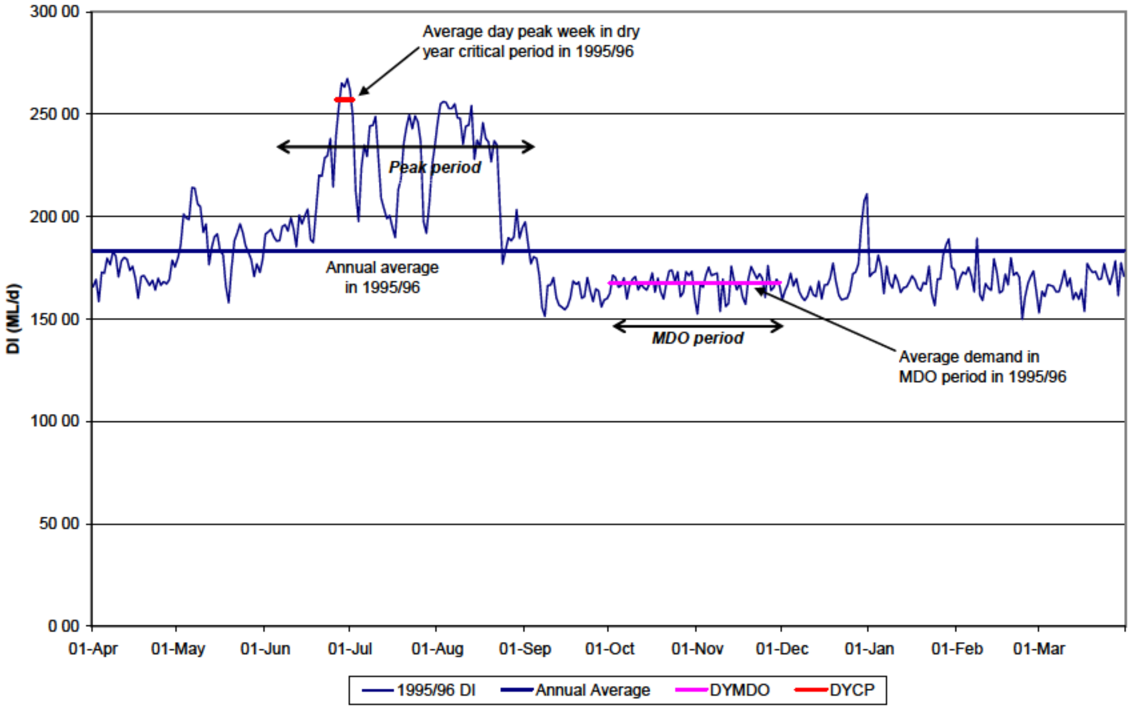

Figure 6.4 Definition of Demand Scenarios and Planning Periods

6.3 Base Year Demand

6.3.1 Normalisation of the Base Year Demand

The base year for this demand forecast is 2007-08 and component data are available at the WRZ level, based on the annual returns submitted to Ofwat and the Environment Agency.

Demand, particularly that used by households, is influenced by rainfall and temperature. During the summer months rainfall reduces the demands from garden watering and other outside activities. Conversely, drought conditions, particularly when accompanied by sustained periods of high temperature, can lead to rapid increases in demand. Long term rainfall and temperature records were used to assess the summer conditions, i.e. occurring in the period from April to September. This period was considered to be the one of most relevance to demand, as illustrated in Figure 6.5. During the summer of 2007-08 total rainfall was only slightly less than average compared with other years, although it was warmer than average. However, July was unusually wet and demands in that month were less than those observed earlier in the year with the peak week demand of 628 Ml/d being observed in May.

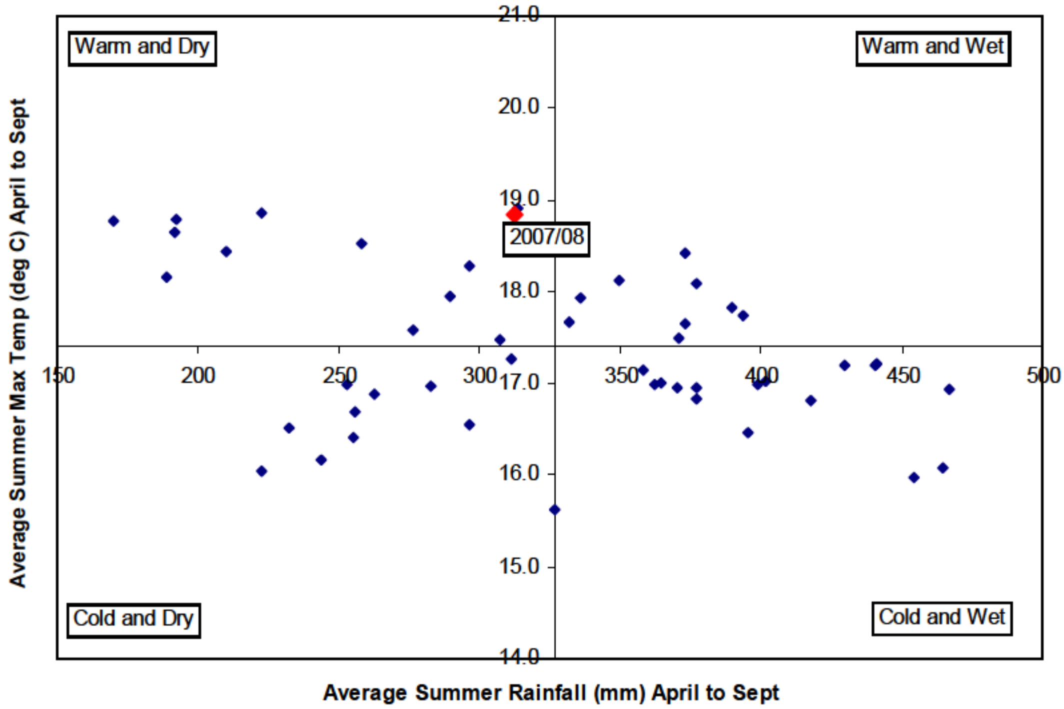

Figure 6.5 Classification of Dry/Wet and Warm/Cold Years (1959-60 to 2007-08)

On balance it is considered that in demand terms, at least, the year was not exceptional and the recorded demands have not been adjusted to compensate for unseasonal consumption. Thus we assume that 2007-08 was a normal or typical year, and the average daily demand during the year (the Normal Year Annual Average or NYAA) was 564 Ml/d.

6.3.2 Dry Year Demands

Distribution Input data for the years 1995-96 to 2007-08 were analyzed with leakage removed from Distribution Input to focus on trends in actual demand rather than on total Distribution Input. Non-household demand was also removed from Distribution Input because it is not generally subject to seasonal variation in the company supply area. Data for the early 1990s, whilst available, was considered to be less robust than current data and is also less representative of the current customer base.

The resulting series was subsequently rebased to produce estimates of the demands which would have been experienced in previous years if the base year conditions (i.e. current meter installation levels and customer numbers) had been in place. Rebasing of household demand in each WRZ over the period 1995-96 to 2007-08 was undertaken using the assumed suppression effects of metering on the actual un-metered customer base.

A dry year is one with very low summer rainfall but unconstrained demand (i.e. it is a year without demand restrictions in place). The company's published Target Levels of Service is for hosepipe restrictions to be introduced no more frequently than once in ten years.

Dry year annual average (DYAA) demand was determined from the rebased historic demand series for each WRZ as the 90th percentile of the annual average series of rebased demands. This is considered equivalent to the 1 in 10 year demand.

Historic peak and MDO household demands were rebased using the maximum peak week demand observed in each year and the maximum rolling 30-day average demand over the period October to November respectively.

The 90th percentile of the rebased historic peak and MDO demands was used to provide estimates of the dry year (unconstrained) demand for these two periods. Thus, the rebased peak week and MDO demands are also considered to represent a 1 in 10 year demand. The demands resulting from this analysis are presented in Table 6.2.

Area	WRZ	Base year Dry Year Demand (Ml/d)	Base year Peak Period Demand (Ml/d)	Base year MDO Period Demand (Ml/d)
Western	IoW	34.96	44.36	33.70
	HS	157.83	206.41	152.33
	HK	5.24	7.13	4.95
	HA	16.62	21.30	17.51
Central	SN	67.57	85.20	65.92
	SW	42.95	51.57	41.94
	SB	86.47	103.80	84.39
Eastern	SH	26.95	32.69	26.69
	KM	122.33	148.95	116.47
	KT	46.39	59.81	43.67

Table 6.2 Calculated Dry Year Demand in the Base Year (2007-08)

The dry year demand (in Ml/d) has been used as the starting point for the demand forecast presented in this report. A dry year factor has been calculated and applied to the base year household PCC to match the dry year demand (in Ml/d), assuming the normal year factor and non-household factor are both unity.

6.4 Base Year Components of Demand

The base year from which the demand forecasts are derived is 2007-08 because this is the latest complete year for which data are available.

6.4.1 Base Year Population and Property Estimates

Base year population and property estimates, and the split in these between different components of demand have been taken from the latest June Return (JR08 out-turn data). A summary of the base year estimates of total properties and population for each resource zone is given in Table 6.3.

Area	WRZ	Base year properties	Base year population
Western	IoW	67,230	135,201
	HS	257,726	589,154
	HA	28,017	63,902
	HK	6,619	14,814
	Total	**359,592**	**803,071**
Central	SN	107,079	242,607
	SW	88,046	168,384
	SB	154,942	320,824
	Total	**350,067**	**731,815**
Eastern	SH	51,795	101,033
	KM	192,115	441,309
	KT	89,729	180,186
	Total	**333,639**	**722,528**
Company Total		**1,043,298**	**2,257,414**

Table 6.3 Summary of Base Year Properties and Population (2007-08)

6.4.2 Reconciliation of the Base Year Water Balance

The components of demand comprise household and non-household customer use, operational use; losses from the company's distribution system and other non billed losses. Table 6.1 (above, in section 6.1) lists the components as reported to Ofwat in January, 2009, being a re-statement of the corresponding Table10b(1) from the JR08 returns to Ofwat, reflecting the up to date property and population forecasts described earlier and minor changes to other components.

6.4.3 Base Year Per Capita Consumption

In 2007-08, the company-wide estimate of the Per Capita Consumption of unmeasured customers (uPCC) was 159 l/h/d, while that of measured customers (mPCC) was around 13% lower, at 138 l/h/d.

The unmeasured customer PCC is currently derived from data obtained from the Southern Area Group Control Area Monitoring Programme which is a collaborative data sharing exercise involving several of the water companies in the South East. The metered customer PCC is derived from consumption data held on the Company's billing system.

Unmeasured and measured PCC varies between WRZs because of differing socio-economic, climatic and geographic factors. The 2007-08 estimates of PCC, derived for each WRZ based on the water balance, and considered representative of normal year (NYAA) consumption, are presented in Table 6.4.

Area	WRZ	Unmeasured household PCC Base year 2007-08	Measured household PCC Base year 2007-08
Western	IoW	138.5	120.1
	HS	153.6	136.9
	HA	158.2	140.1
	HK	159.2	159.6
Central	SN	151.6	148.4
	SW	168.1	145.3
	SB	168.5	139.9
Eastern	SH	168.0	138.8
	KM	157.9	146.1
	KT	158.3	142.8
Company		**158.5**	**138.1**

Table 6.4 Base Year PCC Comparisons (l/h/d)

6.5 Demand Forecast

The 2007-08 out-turn estimates of the components of demand form the base from which the forecast has been developed. The demand forecast is built up from the population and property forecasts, together with assumptions on changes in PCC and commercial activities over the planning period, plus consideration of the company policies on metering, water efficiency and leakage reduction.

6.5.1 Population and Property Forecast

Population and property estimates through the planning period have been developed for the company by Experian, using the best practice methodology published by the Environment Agency (EA 2007)[9]. This methodology produces two forecasts: the first is based on historical trends projected forward; whilst the second derives estimates based on policy as presently promulgated in draft regional plans.

Experian were commissioned by several companies, including Southern Water (Experian, 2007), to provide the most likely scenario based on a combination of the population growth from the policy based projections but constrained to the total national trend based projection. This work has now been updated to take account of recently published regional data (Experian 2008). This analysis provided a “best estimate” forecast on which the demand forecast has been developed.

In summary, the total base year population and property numbers have been derived from the June Return (JR08) data, with expected annual changes from the Experian forecasts.

The most likely scenario forecast suggests that the total population in the company’s supply area will grow by approximately 444,000 from 2,257,000 in 2007-08 to 2,701,000 in 2034-35. Over the same period, the number of properties connected to the company’s distribution system is predicted to rise by 285,000 from 1,043,000 in the base year to 1,328,000 by 2034-35. Household occupancy rates are expected to fall over the same period, from approximately 2.32 in the base year to 2.16 in 2034-35.

The split between metered and unmetered household properties through the planning period depends on the metering policy adopted. This is discussed in detail in section 6.5.3.

The total number of metered and unmetered non-household properties has been assumed to remain constant through time, which is consistent with the general trend observed in recent years, as discussed in section 6.5.4.

Void properties are those which are connected to the company’s distribution system but are temporarily not being billed. The proportion of empty properties at any one time can be expressed as a percentage of the total housing stock (taken from JR08 data) and this proportion is assumed to remain constant over the planning period.

6.5.2 Household demand – the Per Capita Consumption Forecast

Changes in Per Capita Consumption (PCC) can be forecast by:

- Extrapolating long-term historical trends; or
- Developing a model which builds PCC from forecast changes in the underlying micro-components of demand.

Both approaches have limitations, because there is uncertainty in predicting how customers’ water use may change over the long term. Extrapolation on the basis of historical trends has the benefit of providing a reasonably realistic short term forecast, but does not allow for any

[9] Environment Agency, Methods of Estimating Population and Household Projections. Report SC030238, 2007

long term changes in regulations or customer behaviour. Nor does it allow consideration of technological advances in water using appliances.

Figure 6.6 shows the annual estimates of company wide unmeasured and measured PCC from 1994-95 onwards as published in the Ofwat June Returns. The figure shows year on year variations in both unmeasured and measured PCC but there is no apparent long term trend in the unmeasured PCC series. It could therefore be plausible to assume that there will be zero change in unmeasured PCC from the baseline position over the planning period.

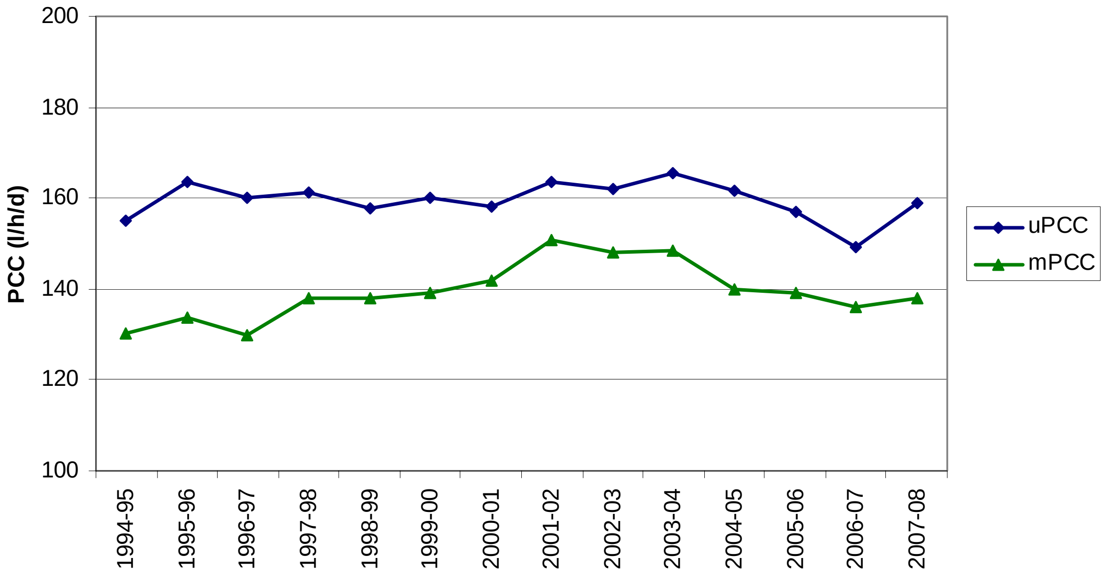

Figure 6.6 Trends in Company PCC from 1994-95

Figure 6.6 also shows the measured household PCC series. The relatively low measured PCC in the early 1990s reflects the reduced consumption of the compulsorily metered customers on the Isle of Wight and the small number of metered properties elsewhere at that time. The more recent data, however, shows no significant trends over time. For this reason it could also be plausible to assume that there will be no change in the PCC of existing metered customers from the current figure over the planning period.

Micro-component modelling, on the other hand, can be used to predict long term changes in demand, although the accuracy of this approach is highly dependent on the validity of the assumptions made about the likely impact of technological change on appliance water use, of the nature and timing of any regulatory controls and of behavioural changes in water using activities by the customer. Clearly, there will be a significant degree of uncertainty in any forecasts developed using the approach.

Nevertheless, following the requirements of the Water Resources Planning Guideline, predictions of future PCC have been based on the micro-component approach. The unmeasured NYAA PCC forecast resulted in a 7-9% decrease by the end of the planning period, depending on WRZ specific assumptions. The existing measured customer base PCC at NYAA was also forecast to decrease over the planning period by 9-11%.

A significant number of new homes are proposed for the South East over the planning period, many of which are expected to be flats or smaller dwellings, with a lower occupancy level than existing properties. In general, the lower the household occupancy rate, the higher the individual consumption. However, it has become mandatory for all new socially funded housing to meet the *Code for Sustainable Homes* code level 3 of 105 l/h/d (Defra 2008, *Future Water*). In the demand forecast it has therefore been assumed that, from the start of the planning period (2010-11) all new socially funded housing would have a PCC of 105 l/h/d.

Consumption in recently built properties, relative to that in the older housing stock, is generally unknown. However, for this demand forecast, the remainder of new houses have been assumed to meet the equivalent of a code level 0, which equates to a design standard of 125 l/h/d. However, without regulation and enforcement it is unclear how such a consumption target can be achieved or sustained over time.

The forecast for optant and selective measured PCC is based simply on an assumed saving from the unmeasured household micro-component PCC forecast. Selective PCC in this case refers to customers metered under change of occupancy, company selective (high water users), and universal metering programmes. It has been assumed, based on available literature and expert judgement, that the average saving for optants is 8% of unmeasured PCC, while the equivalent for selective is assumed to be 10%.

The consequence of these assumptions is that the average household PCC for the company under "normal year" conditions is forecast to decrease from 152 l/h/d in 2007-08 to 127 l/h/d in 2034-35. In 2030-31, the overall household PCC is forecast to be 128 l/h/d, which is lower than the government's aspirational target of 130 l/h/d by 2030. The forecast of overall household PCC is presented in Figure 6.7.

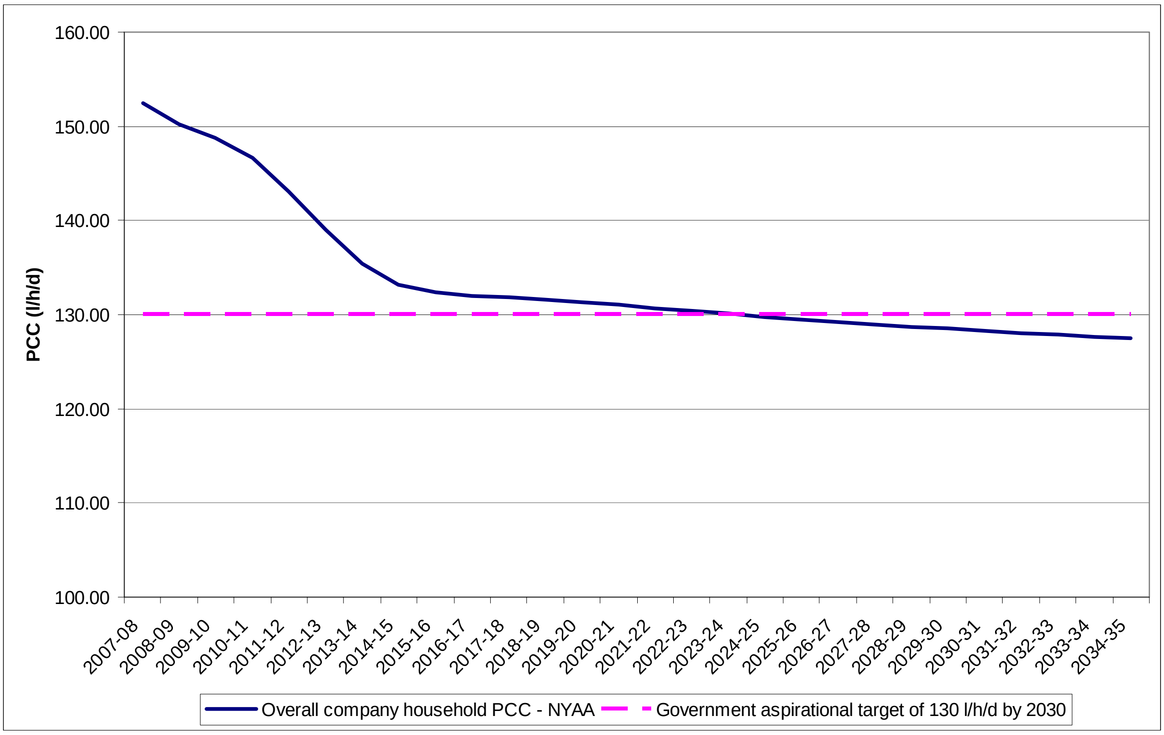

Figure 6.7 Overall Household PCC at Company Level for the Normal Year

The normal year PCC forecasts are multiplied by derived factors, in order that the base year distribution input matches the calculated demand in each WRZ under each demand forecast scenario, presented in Table 6.2. During peak periods (the DYCP design scenario), an additional 5% saving is attributed to all measured PCC forecasts, to account for documented additional reductions in demand in summer periods due to metering. However, this has not been applied to new build properties, which are assumed to already incorporate measures to reduce PCC in summer periods in their base level of PCC.

The micro-component based PCC forecast applies to all newly metered customers in the year immediately following meter installation. Assumptions regarding the baseline water efficiency target and climate change impacts are also incorporated into the calculation of measured household demand and these are discussed in sections 6.5.6 and 6.5.7 respectively.

The sensitivity of the forecast to assumptions surrounding PCC growth have been tested and included in the headroom component of the supply demand balance.

6.5.3 Meter Installation Policy

Meter installation is generally considered to be one of the best means of reducing household demand because it enables customers to monitor their consumption through their water bill. It also enables the company to develop a better understanding of demands on the distribution system which in turn helps tackle leakage. The SEA identified that although metering has the potential for disturbance to local communities in the short term during their installation, this negative effect is outweighed by the overall environmental benefits of metering.

The impact of metering on domestic demand is dependent upon a range of factors including: property type, customer demographics, the number of occupants in the property, whether the meter installation was voluntary or not, and the amount of external water use. It is also dependent on the location of the meter, which can be sited either within the property, or external to it. Installing the meter externally has the benefit of helping to alert customers to any leakage associated with their supply pipes; and timely repairs to leaking supply pipes helps to reduce overall losses from the distribution system.

It has long been Southern Water policy to require meters to be installed in new build properties, while metering on change of occupier has also been in operation in Sussex since 2005. Meters are installed externally wherever possible.

The company supply area has now been designated by the Environment Agency as an “area of serious water stress”. This has been an important consideration in the drive towards the company preferred approach of universal metering, with the installation programme proposed to be carried out between 2010 and 2015, by which time it is expected that all households will be metered. However, a range of future metering policies have also been examined for this WRMP:

- **Optant metering policy** – assumes optants, selectives (high water users), and new properties would be metered throughout the company supply area. Under this scenario the existing policy of change of occupier metering in the Sussex WRZs would cease at the end of AMP4.

  Under this policy, it is anticipated that the number of optant households will increase over the period 2010-11 to 2034-35 by 471,000. The number of selective (high water user) is expected to increase by 4,000;

- **Change of occupier metering (universal)** – extends the existing policy of metering on change of occupancy throughout the Sussex WRZs to all other WRZs. This would be in addition to the baseline policy for optant, selective, and new property metering

  Under this policy, it is anticipated that the number of change of occupier households will increase over the period 2010-11 to 2034-35 by 246,000, while the number of optants will increase by 285,000 over the same period, and selectives (high water users) by 2,000; and

- **Universal metering in AMP5** – assumes all properties in all WRZs will be metered in the period 2010-15. All new properties would continue to be metered. It is assumed that this policy would also produce associated benefits due to reduced supply pipe losses.

  Under this policy, it is anticipated that the number of universally metered households will increase over the period 2010-11 to 2034-35 by 523,000, while the number of meters installed under the optants and selective (high water users) meter programme will increase by 33,000 over the same period. Optant and selective metering will only occur ahead of the commencement of the universal metering programme in each WRZ. A likely profile of universal metering is presented in Table 6.5.

Area	WRZ	AMP5				
		2010/11	2011/12	2012/13	2013/14	2014/15
Western	IoW					✓
	HS		✓	✓	✓	
	HK	✓				
	HA	✓				
Central	SN	✓				
	SW					✓
	SB		✓			
Eastern	SH			✓		
	KM			✓	✓	✓
	KT				✓	

Table 6.5 Likely Profile of Universal Metering, 2010-15

6.5.4 Non-Household Demand

The company supplies water to some 61,000 non-household customers, 88% of which are metered. Analysis of historic non-household consumption data derived from published June Returns data (see Figure 6.8) suggests that demand in this sector is decreasing with time, albeit relatively slowly, and there is no evidence to suggest that this trend is likely to reverse, at least in the short term. Conversely, local increases in commercial demand could accompany the growth in housing construction referred to above but, as yet, there is no indication of where or if such commercial developments will take place.

For the purposes of this WRMP therefore, it has been assumed that non-household demand will continue its gradual decline until the end of AMP6, from which point it is assumed to remain at a constant level until the end of the planning period.

Furthermore, it has been assumed that non-household consumption is generally unaffected by weather. This assumption is consistent with the observation that there has been relatively little variation in this component of demand in recent years despite the variable summer weather conditions. Therefore, the dry year, MDO and peak factors for non-household demands have been taken as unity and the base year demands for these scenarios have been derived from the JR08 out-turn figures.

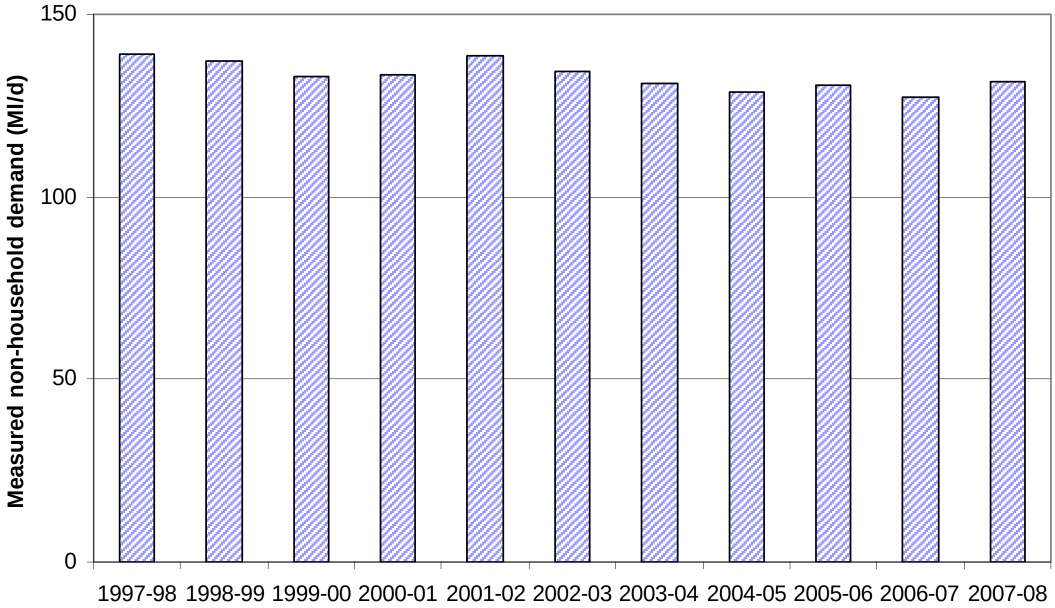

Figure 6.8 Measured Non-Household Demand at Company Level, 1997-98 to 2007-08

6.5.5 Leakage

Leakage is comprised of two components:

- Distribution losses – which includes losses from trunk mains, distribution mains, service reservoirs and communications pipes; and
- Underground supply pipe losses – which are those losses occurring between the point of delivery at the property boundary and the point of consumption.

Distribution losses are the responsibility of the company. Supply pipe losses are the responsibility of the householder, but the company has provided a free supply pipe repair service for many years in order to contain this component of leakage.

A low level of leakage is desirable because it defers the need for investment in new resources which would otherwise be required to meet increases in demand over time. However, it is not necessarily economic to reduce leakage to very low levels, because to do so could involve large incremental costs for relatively small savings in demand. In such circumstances, it may be preferable to develop other options which can achieve the same water savings but at far lower costs. Thus, a balance must be found between reducing leakage to levels that can offset investments in new resources, and the cost of a given level of leakage reduction. The concept of the Economic Level of Leakage (ELL) is used for this purpose.

The Economic Level of Leakage (ELL) is the level of leakage where the marginal cost of active leakage control equals the marginal cost of the leaking water. Active leakage control refers to those management policies and processes used to locate and repair unreported leaks from the water company supply system and from customer supply pipes. There is now also a requirement for water companies to focus on ensuring that leakage levels are set to fully reflect the preferences of society. In order to achieve this, costs and benefits included in the Economic Level of Leakage (ELL) calculations must include not only the impacts borne directly by the water companies, but also the "external" (i.e. the environmental and social impacts) of leakage control activities. This approach ensures that leakage targets are set at a level that is optimal for customers and society as a whole. In this case, ELL becomes the Sustainable Economic Level of Leakage (SELL).

In 2007-08, leakage from Southern Water's distribution system and customer supply pipes was 82 Ml/d, following MLE adjustments. This is significantly below the latest estimates[10] of the company's short-term ELL of 118.5 Ml/d, and short-term SELL of 116.5 Ml/d. The long term SELL was estimated as 89.5 Ml/d. Figure 6.9 shows the steady state relationships, as derived by WRc, between leakage rate and the 2007-08 cost of maintaining that rate. For comparison the mandatory company target level of leakage set by Ofwat[11] for the period 2004-05 to 2009-10 is 92 Ml/d.

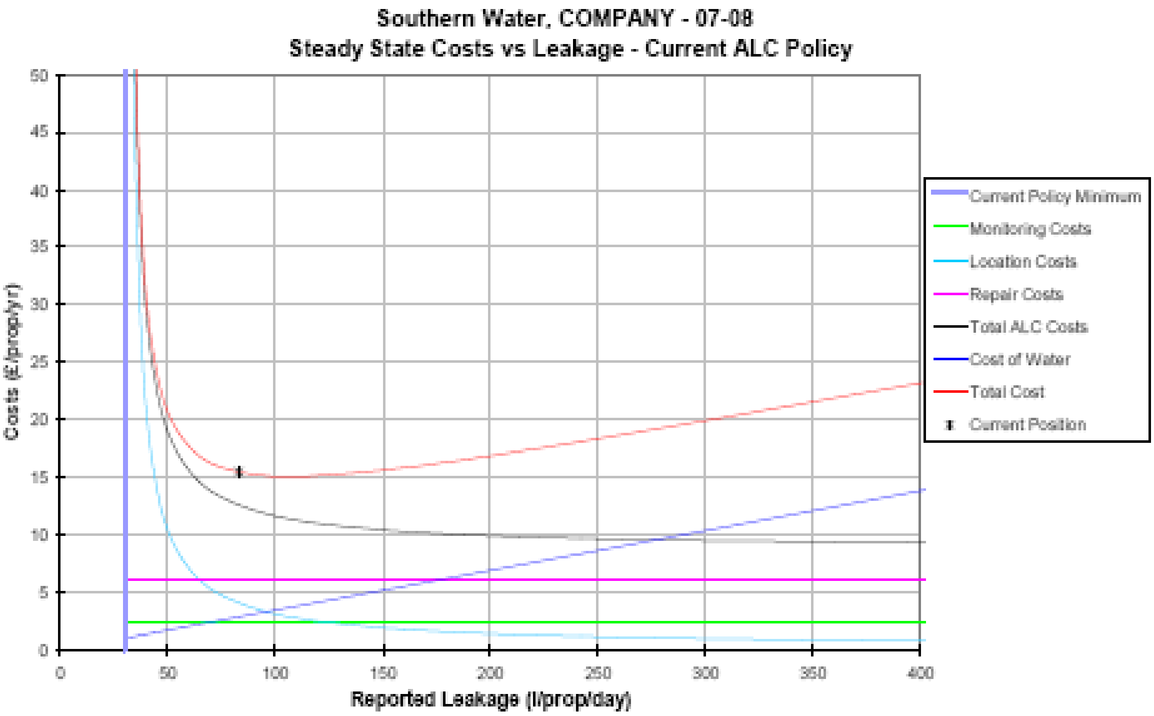

Figure 6.9 Leakage/Cost Relationship for Current Leakage Policy, (after WRc, 2008)

Both short-run and long-run SELL are above the current level of leakage. Therefore allowing leakage to rise, particularly in resource zones in which there is no supply demand balance deficit, is an option to be considered. But in general it is not economic or politically acceptable to do so because leakage would need to be reduced back down to near current levels within the short to medium term to again balance supply and demand. Due to the risks and uncertainties surrounding both the savings that could be achieved by allowing leakage to rise and the costs of bringing it back down, WRc considered it prudent for the company to maintain leakage at current levels (WRc, 2008)

Notwithstanding the comments above, the company has evaluated the following leakage policy options:

- Maintain leakage at the 2007-08 out-turn level of 82 Ml/d (post-MLE adjustment) throughout the planning period;
- Reduce leakage in conjunction with the programme of universal metering to achieve reductions in supply pipe leakage. This is expected to result in a reduction in leakage down to approximately 76 Ml/d by the start of AMP6;
- Allow leakage levels in each WRZ to rise to the Ofwat target (calculated on a WRZ basis); and

[10] WRc (Feb 2009), Sustainable Economic Level of Leakage Analysis, 2007-2008, Final report, Ref UC7893.06
[11] Ofwat, 2004, Security of Supply, leakage and the efficient use of water, 2003-04 Report

- Using one of the above leakage scenarios, allow investment modelling to select further leakage reduction schemes on a WRZ by WRZ basis, whereby, if selected, such schemes would form part of the least cost strategy to balance supply and demand, in conjunction with water efficiency and other resource development options.

This last option could lead to a reduction in leakage for the company as a whole, because in some WRZs it may be economic to undertake further leakage reductions to offset the need for additional resource developments. However in those WRZs, which do not have a supply demand balance deficit, or already operate below their own ELL, it may not be economic to further reduce leakage.

6.5.6 Water Efficiency Targets

Since the DWRMP, Ofwat have published their proposals regarding water efficiency targets (*Future Water Efficiency Targets*, 2008). These targets aim to build on water companies' existing duty to promote the efficient use of water to their customers to ensure that companies play their part in helping to meet the Government's aspirational target, set out in *Future Water* (Defra 2008) of reducing individual water usage to 130 litres per person per day by 2030.

Each company must meet a minimum target for water saved in relation to the number of properties served. Ofwat has proposed that the annual base service target of saving shall be one litre of water per billed property per day through approved water efficiency activity.

If Southern Water is to successfully meet its water efficiency target, it must ensure that 1.01 Ml/d is saved through water efficiency activity each year in AMP5 (from 2010-11 to 2014-15). This target is to be met through both household and non-household activity.

A review of potential water efficiency options was carried out using the latest literature available, including that from Ofwat and Waterwise. Those options considered feasible were ranked by their Average Incremental Social Cost (AISC) to indicate their cost effectiveness and the results of this analysis have been used to formulate the least cost strategy to achieve Ofwat's baseline water efficiency target.

In line with current best practice, the deterioration in the effectiveness of each water efficiency measure over time due to various reasons such as breakdown, lack of maintenance, removal or replacement, has been modelled using a time varying yield curve assumption, based on exponential decay and dependent on the asset life of each measure. Thus, although the proposed programme will meet the 1.01 Ml/d target in each year of AMP5 (as shown in Figure 6.10), the total water efficiency saving will not reach 5 Ml/d over the five year period from 2010-11 to 2014-15, due to decreasing yield assumptions (as presented in Figure 6.11).

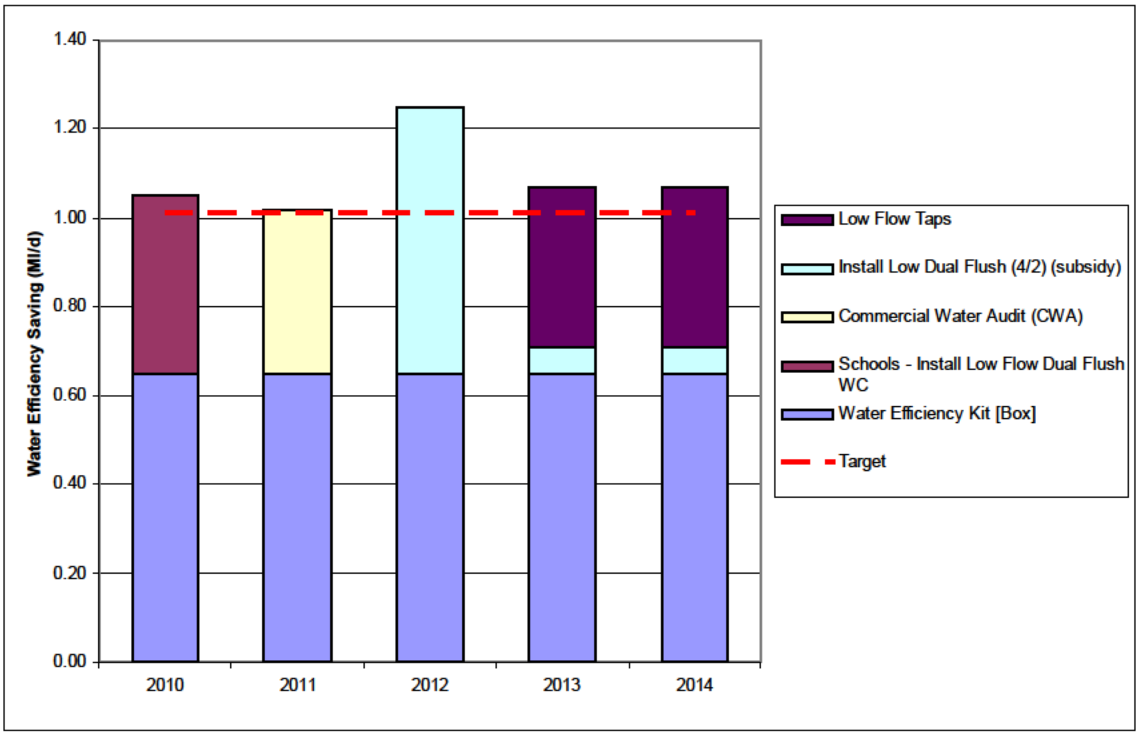

Figure 6.10 Company Level Water Efficiency Schemes to meet the Ofwat Target in Each Year of AMP5

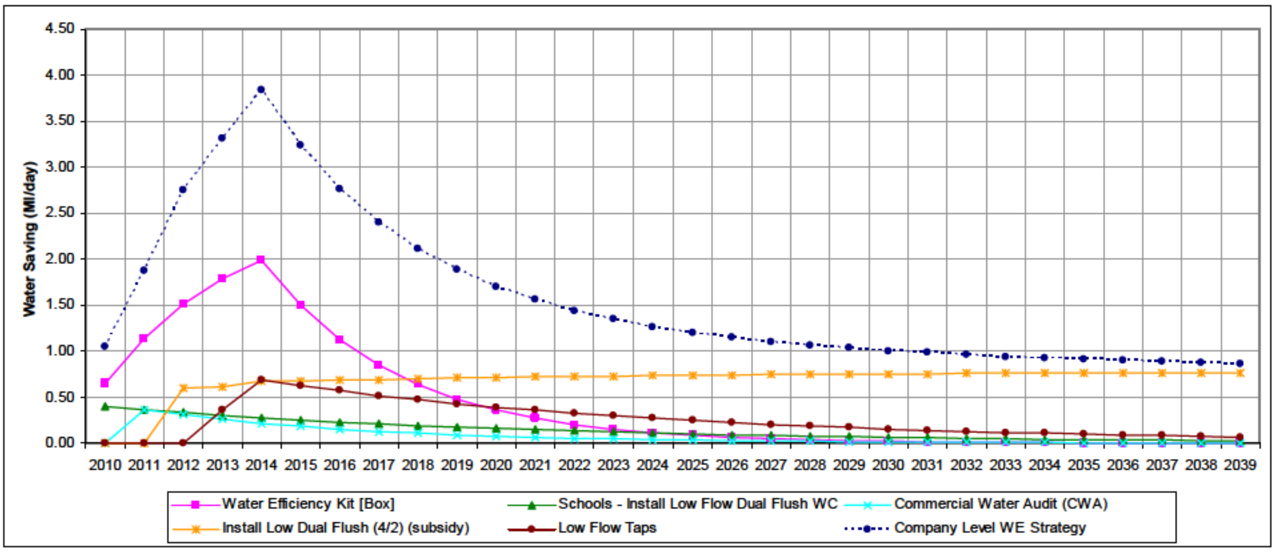

Figure 6.11 Company Level Ofwat Target Water Efficiency Activity Through the Planning Period

6.5.7 Climate Change Effects on Demand

The effects of climate change on demand have been estimated using the results from the *Climate Change and Demand for Water (CCDeW)* report[12], which was published in February 2003 as an update to a benchmark study by Herrington in 1996[13] .

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[12] SEI (2003), Climate Change and Demand for Water, Stockholm Environment Institute, Oxford.
[13] Herrington P, (1996), Climate Change and the Demand for Water. HMSO

The CCDeW study examined the impact of the UKCIP02 climate change scenarios across a number of socio-economic customer groups to provide a range of potential impacts on water demands extending from the 2020s to the 2050s.

The Beta socio-economic scenario, entitled ‘World Markets’, has been used as this is most similar to conventional development. There is little difference between the climate change scenarios for the 2020s, and so the medium-high emissions scenario has been used because most information is provided on this within CCDeW. For domestic demand, this gives a 1.45% mean increase in the 2020s, while for the 2050s factors the mean increase is 2.92%. For commercial / industrial demand, a mean of 2.7% has been used in the 2020s, while for the 2050s the mean was 5.7%.

The methodology adopted to apply the CCDeW factors is described in detail in Appendix E.

6.6 Summary of Forecast Demands

A number of different demand forecast scenarios have been use in the development of this WRMP. More details are given in section 9 and section 10. An illustration of the impact on demands of different metering assumptions is given here.

The baseline forecast assumes continuation of existing policies, namely “optant only” except in the Sussex WRZs where meters are installed on change of occupier:

- Normal year average annual demand is forecast to decrease from 564 Ml/d in the 2007-08 to 559 Ml/d at the end of the planning period;
- Dry year annual average demands are forecast to reduce from 607 Ml/d in the base year to 604 Ml/d in 2034-35; while
- Peak week dry year demands are predicted to decrease from 761 Ml/d in 2007-08 to 744 Ml/d at the end of the planning period.

Under the universal metering programme (scenario 3):

- Normal year average annual demand is forecast to decrease from 564 Ml/d in the 2007-08 to 550 Ml/d at the end of the planning period;
- Dry year annual average demands are forecast to reduce from 607 Ml/d in the base year to 595 Ml/d in 2034-35; while
- Peak week dry year demands are predicted to decrease from 761 Ml/d in 2007-08 to 732 Ml/d at the end of the planning period.

By contrast, if the “optant only” metering forecast is used (scenario 1), i.e. without universal metering or change of occupier metering, then:

- Normal year average annual demand is forecast to decrease only slightly from 564 Ml/d in the 2007-08 to 560 Ml/d at the end of the planning period;
- Dry year annual average demands are forecast to reduce slightly from 607 Ml/d in the base year to 605 Ml/d in 2034-35; while
- Peak week dry year demands are predicted to decrease from 761 Ml/d in 2007-08 to 746 Ml/d at the end of the planning period.

The figures below (Figure 6.12 to Figure 6.15) illustrate these forecasts at the company level for these three demand forecast scenarios. Each figure includes the actual and rebased historical demand compared to the three modelled demand forecasts: the baseline is for the continuation of current policies; scenario 1 is the optant scenario (i.e. optant and selective (large water users) only); scenario 3 is for universal metering and consequent reductions in supply pipe leakage.

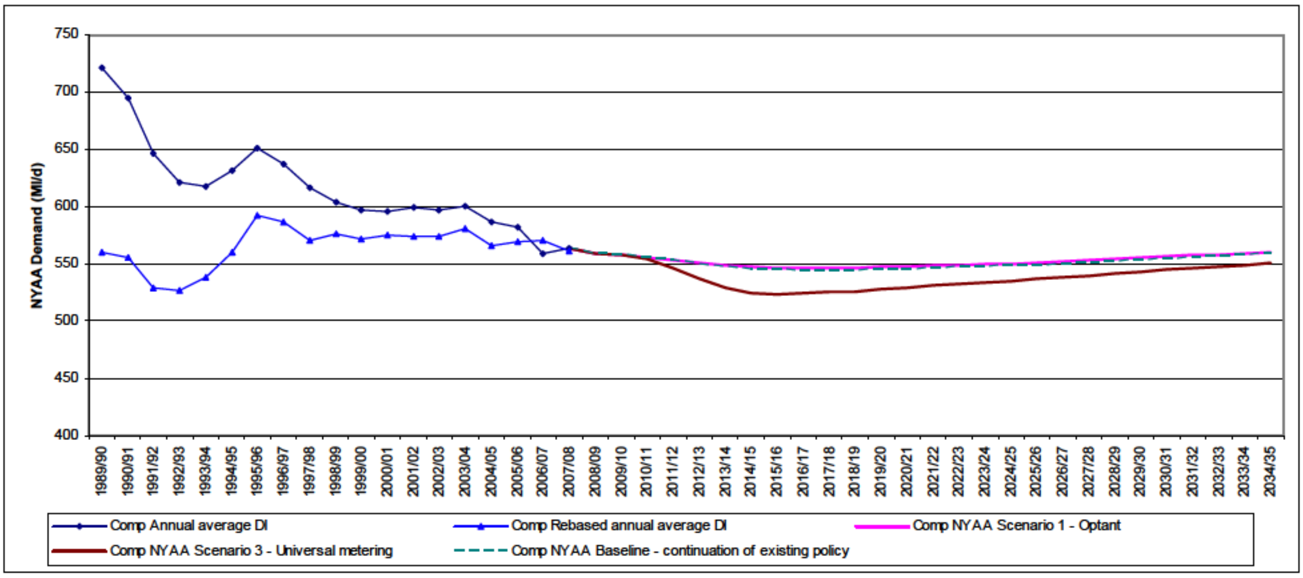


Figure 6.12 Normal Year Annual Average Company Forecast

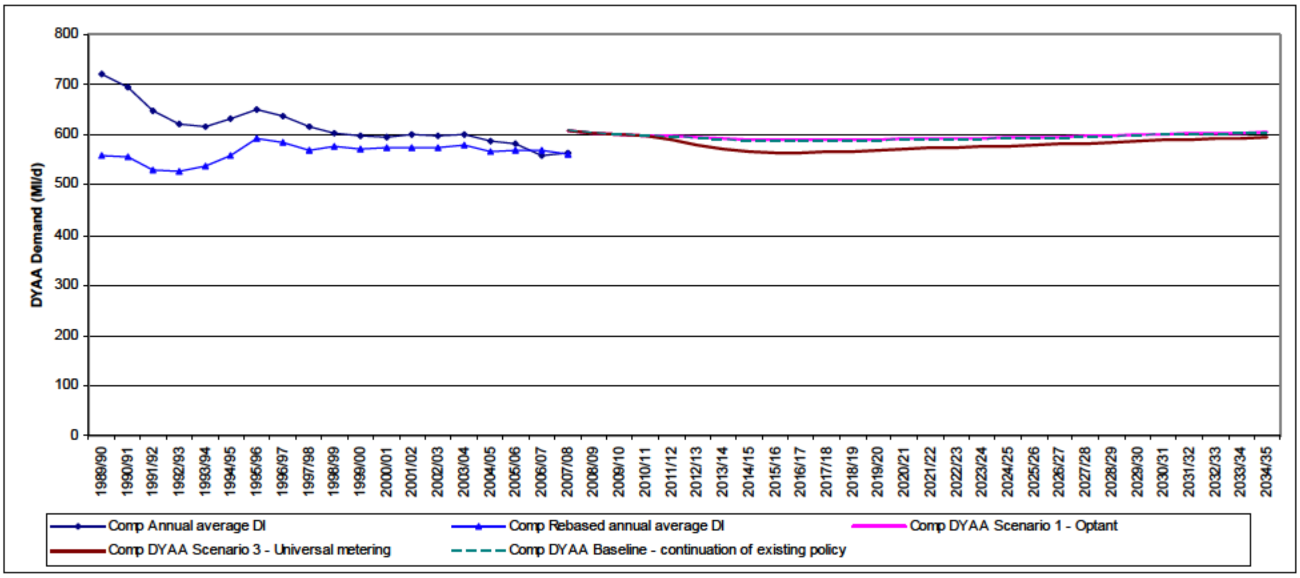


Figure 6.13 Dry Year Annual Average Company Forecast

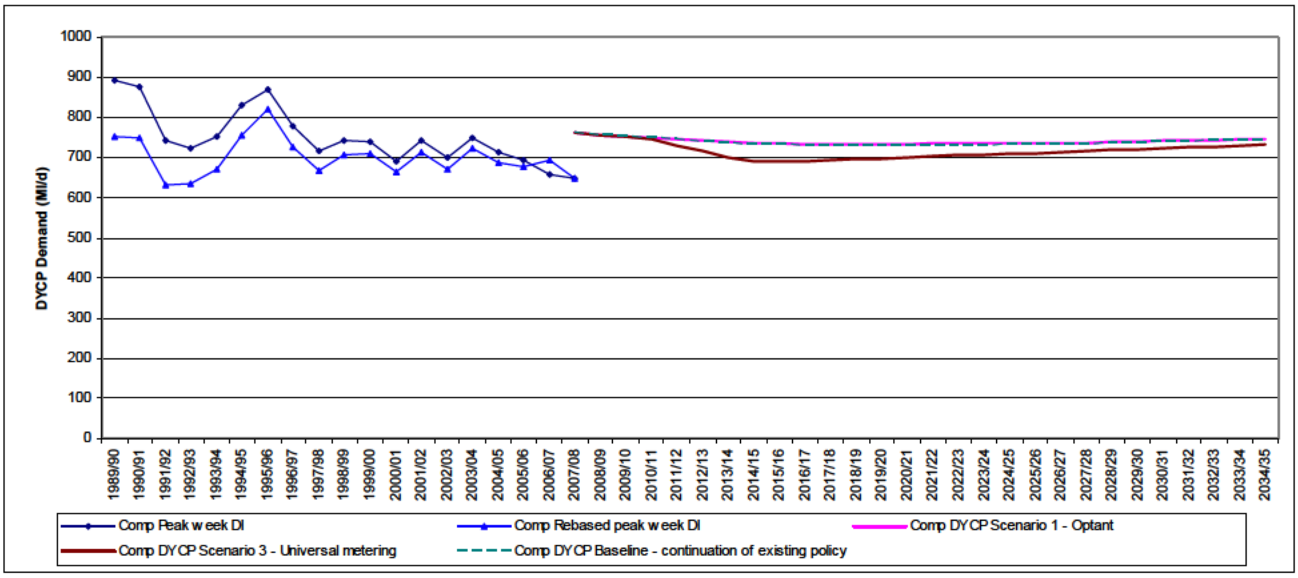


Figure 6.14 Dry Year Critical Period Company Forecast

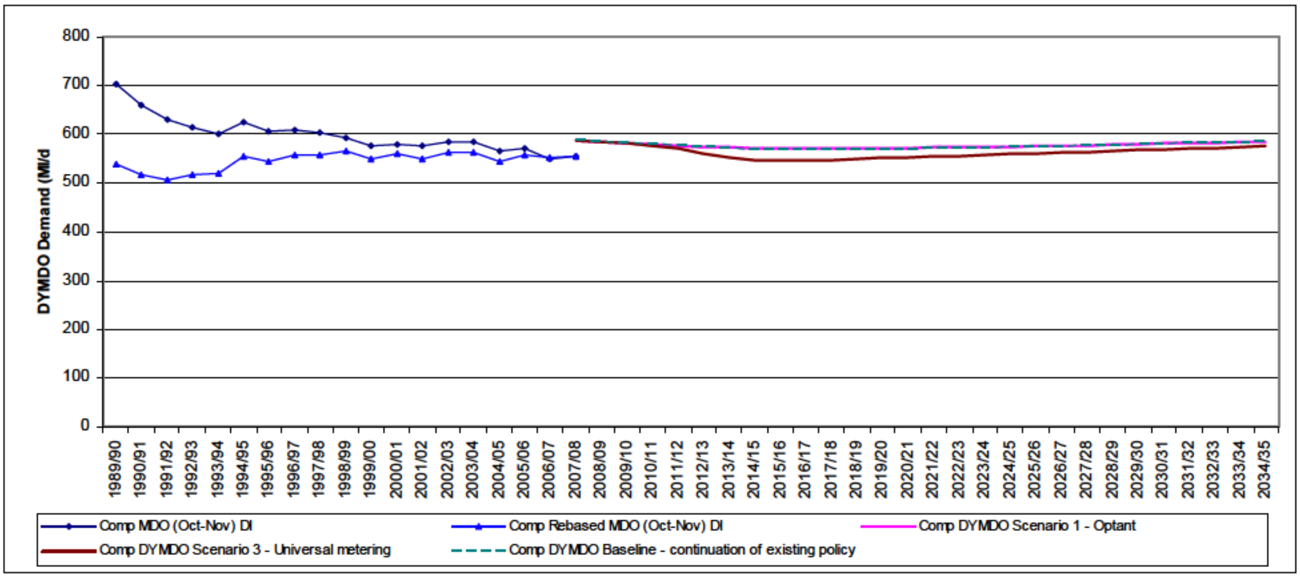


Figure 6.15 Dry Year MDO Company Forecast

The figures below (Figure 6.16 to Figure 6.19) present, at the company level, the demand forecasts for the key metering scenarios investigated during the development of this WRMP.

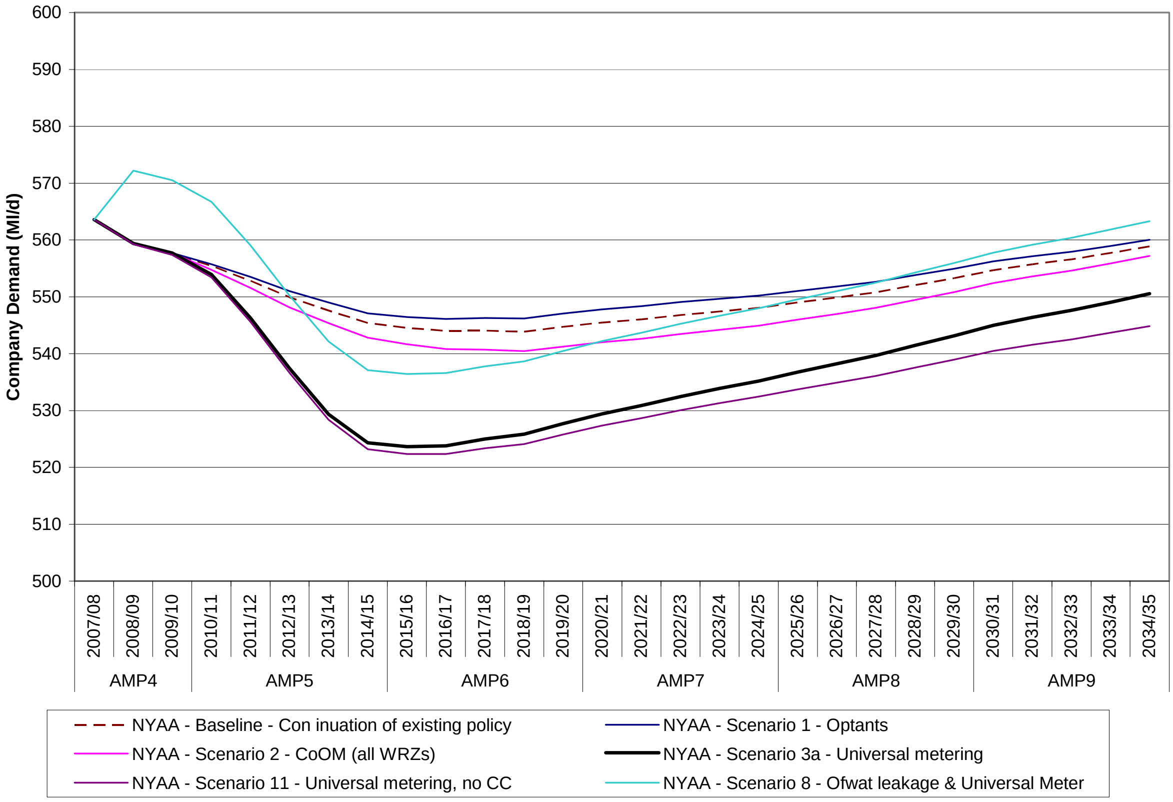


Figure 6.16 Normal Year Annual Average Company Forecasts for all Demand Scenarios

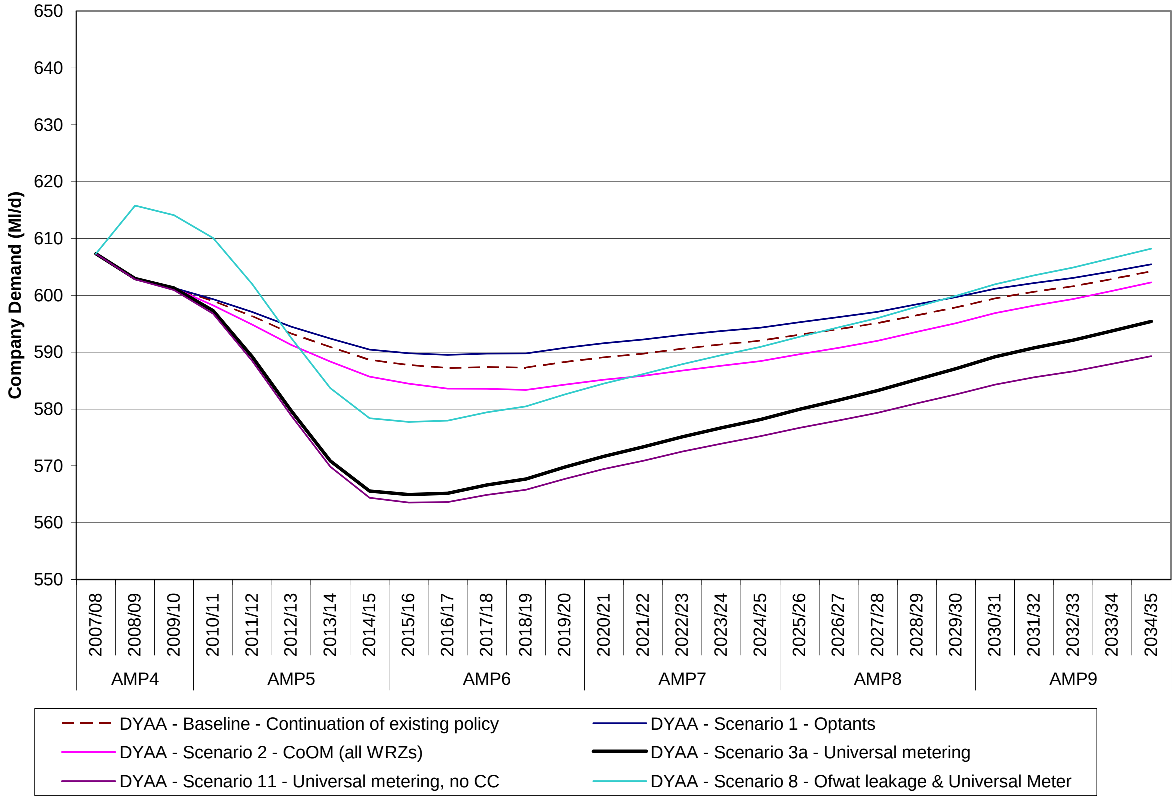


Figure 6.17 Dry Year Annual Average Company Forecasts for all Demand Scenarios

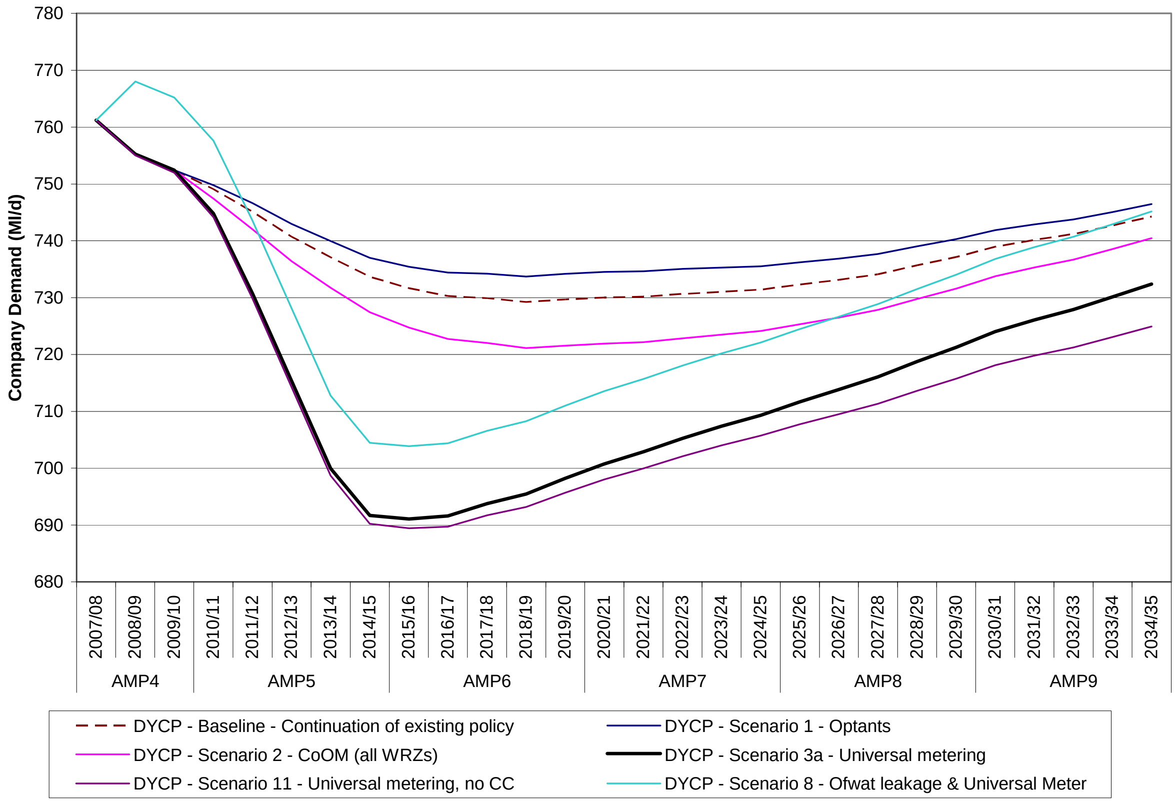


Figure 6.18 Dry Year Critical Period Company Forecasts for all Demand Scenarios

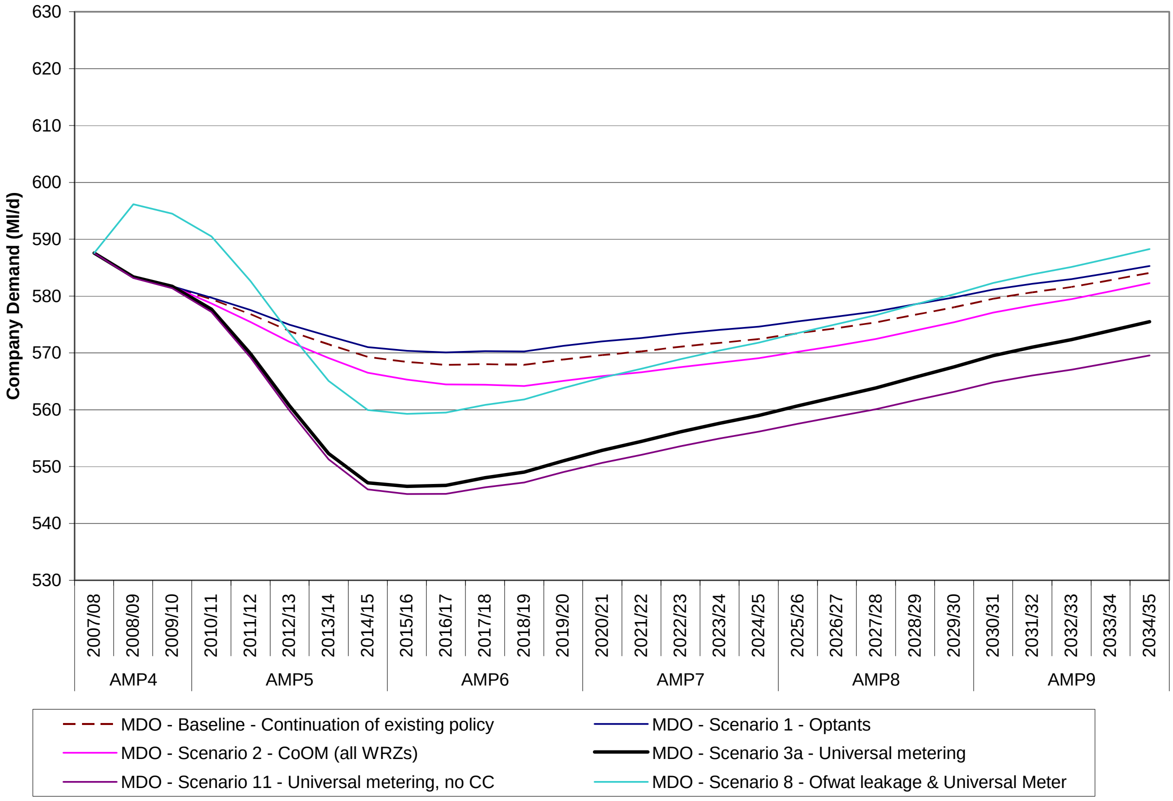


Figure 6.19 Dry Year MDO Company Forecasts for all Demand Scenarios

7 Dealing with Uncertainty

7.1 Introduction

The previous sections have outlined how the estimates for the elements of the supply demand balance have been derived. It is acknowledged that each of these estimates will, by definition, be subject to some degree of uncertainty. This section reviews how uncertainty has been included in this WRMP to ensure the supply demand balance is not put at risk, and also describes what known sources of future uncertainty the company has been advised should not be included in this WRMP.

Uncertainty in the supply demand balance falls into six broad categories:

1. Natural variability in the hydrological/hydrogeological conditions that affect the output available from sources. This uncertainty is typically taken into account when Deployable Output is calculated;
2. Uncertainty in the operational availability of supplies from sources. These are typically specified risks that are taken into account in outage allowances;
3. Variability in the magnitude of forecast demands depending on the assumptions made. This variability is usually taken into account through scenario analysis;
4. Specified uncertainties affecting the supply side and the demand side values used in the supply demand balance. These uncertainties are taken into account in the Target Headroom allowance;
5. Uncertainty in whether and/or when any given demand side or supply side option can in fact be delivered. This form of uncertainty, which includes uncertainties in obtaining planning and other consents, is generally treated deterministically by including an assumed lead time into the option selection process; and
6. Uncertainty due to outcomes from legislation/regulations not having been determined by the relevant regulatory bodies and government departments, including the RSA programme, further Habitats Directive decisions, the Water Framework Directive and other local sites of environmental interest, although some of these uncertainties may be addressed through NEP schemes.

The Tables and Figures in this section have been updated to take account of revisions to the following components of the supply demand balance:

- Deployable Output;
- Impacts of climate change on Deployable Output;
- 2007-08 as the base year for the demand forecast instead of base year of the 2006-07 used for the DWRMP;
- Revisions to forecast PCC; and
- Changes in metering policy.

The selection of the appropriate percentile of headroom uncertainty is referred to as the glidepath. Since the DWRMP, the company has also reviewed the percentile or % risk profile over time on which the selection of Target Headroom was based. Following the review and consideration of comments on the DWRMP, a gradually falling glidepath has been assumed for the first three AMP periods.

7.2 Headroom Uncertainty and Target Headroom

In all planning for future events, it is inevitable that there will be uncertainties about what might happen in the future, and so it is important that the sources of uncertainties are understood, and, wherever possible, managed. Protection against specified uncertainties can be built into the supply demand balance by including a headroom allowance. Headroom is defined as "a planning allowance that a prudent water company should take into account when developing plans to balance supplies and demands and to deliver its Target Levels of Service". This allowance is called "Target Headroom" and is designed to cater for specified uncertainties in both demand side and supply side uncertainties.

Target Headroom is the threshold of minimum acceptable headroom, which, if breached, would represent an increased risk to the company that it would not able to meet its Target Levels of Service. This would then be the trigger for options to either increase the available supplies, reduce demands or a combination of both. If options are not implemented to provide Target Headroom then the occurrence of drought conditions might trigger Drought Permits and/or Drought Orders more frequently than intended. The guidance does not prescribe what level of security of supply a company should aim for, and therefore what level of headroom allowance to use. It is left to each company to determine the Target Headroom that is used in its WRMP.

7.3 Application of the Improved Headroom Methodology

The analysis of headroom used in this WRMP is the Improved Methodology[14], which was first used for the previous PR04 WRP. This methodology requires the uncertainty for each of the headroom components to be defined as a probability distribution. All the headroom components are then combined using Monte Carlo simulation to give overall headroom uncertainty.

The full list of sources of headroom uncertainty is as follows, although it should be noted that the Environment Agency has specifically advised companies not to include some of these elements, as identified below:

Supply side sources:

- S1 Vulnerable surface water sources (included);
- S2 Vulnerable groundwater licences (included);
- S3 Time limited licences (not included);
- S4 Bulk transfers – imports from other companies (included);
- S5 Gradual pollution (included);
- S6 Accuracy of supply side data (included);
- S6/1 Uncertainty for yields constrained by source infrastructure (included);
- S6/2 Meter uncertainty for licence critical sources (included);
- S6/3 Uncertainty for aquifer constrained groundwater sources (included);
- S6/4 Uncertainty for surface water (included);
- S7 Sustainability Reductions (included as described in section 10.3);
- S8/1 Uncertainty of climate change (included); and
- S9 Uncertainty of new source yields (included).

Demand side sources:

- D1 Accuracy of sub-component data (included);

[14] UKWIR, 2002, An Improved methodology for assessing Headroom. Report 02/WR/13/2

- D2 Uncertainty in the demand forecast (included);
- D3 Uncertainty of the impact of climate change on demand (included); and
- D4 Uncertainty of demand management (included).

The headroom calculations for this WRMP have been refined and updated through the use of work undertaken as part of the AMP4 Water Resources Investigations and work specifically undertaken for this WRMP. Further details of the work undertaken and the results are given in Appendix F.

7.4 Results and Discussion

Monte Carlo analysis was undertaken using the appropriate probability distribution parameters set out in Appendix F. The analysis calculated headroom uncertainty from 1,000 iterations of the model; and the results are produced in the form of percentiles. The interpretation of the results is that if, in a given year the available headroom equals, for example, the 90th percentile of the headroom uncertainty, then this ensures that there is a 10% risk that the supply demand balance would be in deficit.

A key feature of the application of the new UKWIR methodology is the selection of the percentile of the headroom uncertainty distribution that is used to set the value of Target Headroom at key intervals over the planning period. In its Water Resources Planning Guideline, the EA notes that "In general we would expect companies to accept a higher level of risk in future than at present". The selection of the appropriate percentile of headroom uncertainty is referred to as the glidepath.

Given the severe consequences in the event of potential or actual failure of the security of supplies, and the need to improve the current actual outturn Levels of Service, Southern Water is averse to exposing itself to unnecessary risk, and is keen to take a prudent approach to setting the value of Target Headroom so that it can achieve and maintain the Target Levels of Service. However, it also acknowledges the importance of not over-planning for risks that may not become reality in the more distant future, towards the end of the planning period, which would increase the apparent need for additional resource development which in the event might not be required.

The selection of headroom uncertainty percentiles and the appropriate glidepath have been reviewed since the DWRMP to take account of the new base year, updated demand forecasts and responses received on the DWRMP.

The level of Target Headroom adopted for the WRMP is the 90th percentile from 2014, the 85th percentile from 2019, and the 80th percentile from 2024; from 2024 onwards, the Target Headroom is kept constant in terms of the absolute value in Ml/d. Values of the proposed Target headroom for the whole company supply area used for this WRMP are given in Table 7.1 and are illustrated in Figure 7.1. The results show that the adopted values of Target Headroom are prudent, in that, in terms of percentages compared to estimated Distribution Input, they are equivalent to 5.3% at the beginning of the planning period, rise to around 6 % at the end of AMP5 and then fall to around 5% by the end of the planning period.

Target Headroom for the Whole Supply Area (Ml/d) and (% of Distribution Input (DI))							
	2007	**2009**	**2014**	**2019**	**2024**	**2029**	**2034**
PDO (Ml/d)	40.38	40.39	41.67	38.55	37.75	37.75	37.75
As % of DI	5.3%	5.4%	6.0%	5.5%	5.3%	5.2%	5.2%
MDO(Ml/d)	31.11	30.85	32.17	29.15	28.63	28.63	28.63
As % of DI	5.3%	5.3%	5.9%	5.3%	5.1%	5.0%	5.0%

Table 7.1 Whole Company Supply Area – Proposed Target Headroom (Ml/d) and % DI

A summary of the percentiles for the first three AMP periods and for comparison estimates of the equivalent percentile (at MDO) for the constant value from 2024 onwards is given in Table 7.2.

Figure 7.1 Whole Company Supply Area: Proposed Target Headroom

Headroom percentiles for each Area									
	2007	2009	2014	2019	2024	2029		2034	
						MDO	PDO	MDO	PDO
Western	90%	90%	90%	85%	80%	74%	74%	69%	68%
Central	90%	90%	90%	85%	80%	75%	75%	70%	70%
Eastern	90%	90%	90%	85%	80%	76%	74%	69%	68%
Overall	90%	90%	90%	85%	80%	75%	74%	69%	69%

Table 7.2 Whole Company Supply Area – Headroom Uncertainty Percentiles

The output from the Monte Carlo simulation has been reviewed to identify main sources of headroom uncertainty in each of the WRZs and thus the main influencing factors with respect to risk. Tornado plots for the base year and 2034 are included in Appendix F.

The values of demand side headroom have changed as a result of the change in base year and other revisions to the demand forecasts in the light of company policy, reviews of the comments received on the DWRMP, and the more pessimistic economic outlook. However as shown in section 10, the magnitude of Target Headroom is not the dominant driver of the options that make up the company's preferred investment strategy. The value of Target Headroom can however have an influence on the timing of when schemes are required, although the variance is only a few years.

The main consequence of revisions since the DWRMP is that Target Headroom starts at a higher value in the base year, but then stays relatively flat before falling from 2014 onwards. One of the reasons for this is increased uncertainty following the rebasing of 2007-2008 demands (see section 6.2). The sensitivity of Distribution Input to factors outside the company's control is well illustrated by the significant rise in DI in the first part of 2009 associated with a prolonged period of extremely cold weather.

In all WRZs, and under PDO and MDO conditions the main source of headroom uncertainty is in D2 (uncertainty in the demand forecast). From 2024 in many WRZs D4 (uncertainty of demand management) begins to contribute more. S8 (supply side uncertainty associated with climate change) becomes more evident from AMP8 onwards in those WRZs where surface water storage schemes dominate.

The company will continue to work to improve the sources of information that it has available for analysis of uncertainties, and will continue to collaborate on industry-wide studies on climate change uncertainties.

7.5 Uncertainties Not Allowed for Inclusion in this WRMP

In its Water Resources Planning Guideline published in April 2007 and not changed in the November 2008 update, the Environment Agency stated that “Companies should not make allowances for the risk of non-renewal of time-limited licences in headroom” (section 9.3). Ministers have instructed the Environment Agency to ensure that time-limited licences do not present a risk to security of supply. In addition to the risk of non-renewal of licences, there are similar risks to the baseline Deployable Output from a range of environmental drivers such as the Habitats Directive, the RSA programme, the National Environment Programme (NEP) and eventually the Water Framework Directive. The Water Resources Planning Guideline states that “any notice given will provide sufficient time to restore the supply-demand balance…”, with the inference that there is no need for a headroom allowance to guard against the risk from time-limited licences reducing Deployable Output.

The Water Resources Planning Guideline also notes that “headroom uncertainty should not be significantly influenced by the headroom components accuracy of supply side data (S6) and “accuracy of sub-component data (D1)/2”. However, accuracy of supply side data attributed to uncertainty surrounding source outputs such as uncertainty about Deployable Output has been included in the WRMP headroom analysis because these are valid risks to the security of the source output available to the company. For surface water sources, this component is likely to relate to uncertainties over historic rainfall estimates, rainfall/runoff models and drought severity, whereas for groundwater this is likely to relate to drought severity (Rest Water Levels) and interpretation of the physical constraints such as location of adits, water bearing fissures, borehole screen etc., in relation to the drought bounding curves.

It is worth noting some aspects of the profile of Target Headroom over time. At the start of the planning period, total Target Headroom is 31 Ml/d (5.3% DI) and 40 Ml/d (5.3% DI) at MDO and PDO respectively. The levels of Target Headroom adopted decrease over the planning period, falling to 29Ml/d (5.0% DI) and 38 Ml/d (5.3%DI), respectively, at the end of the period.

At first sight this may appear to be counterintuitive, because uncertainty would be expected to increase over time. This is undoubtedly true, but the value of Target Headroom included in this WRMP reflects the level of risk that the company is prepared to take. This Water Resource Planning Guideline state that companies should be prepared to accept greater levels of risk later in the planning period as reflected in the choice of the percentile of headroom uncertainty used to set Target Headroom. Southern Water has adopted this approach by adopting the following profile: the 90th percentile represents a 10% risk that available supplies will be unable to meet demands plus Target Headroom; the 85th percentile represents a 15% risk; the 80th percentile represents a 20% risk.

The values Target Headroom at the start of the planning period are within the industry range, and the values are justified for the following reasons:

- Over the first AMP period there is considerable uncertainty about short-term demand forecasts arising from: the general economic downturn; the potential for rising consumption as the memory of drought restrictions and associated behavioural changes fades, and the observed and significant increase in Distribution Input following a prolonged period of wet and then very cold weather;

- These short-term uncertainties should reduce over time, as their causes are analysed and more fully understood; and
- Target Headroom then decreases over successive AMP periods as the percentile of headroom uncertainty reduces (with increased acceptance of risk).

A constant value of Target Headroom in the later AMP periods is realistic and pragmatic. If Target Headroom is allowed to increase to the end of the planning period, a supply demand balance deficit would occur earlier than would otherwise be the case, and so additional resource and/or demand side options would be triggered. However, by the time this point is reached, various components of headroom uncertainty would themselves have reduced or been removed, and so the value of Target Headroom would be closer to current values.

We consider that the chosen glidepath makes the overall strategy more realistic, in that it does not include schemes that in all probability will not be required. It also increases the certainty with which we feel the schemes identified in the strategy will actually be required at the dates identified.

7.6 Approach to Reducing Uncertainty

The company has considered the influence of climate change and demand forecast uncertainty in the derivation of Target Headroom, and ways of reducing their influence. It has concluded that the estimates that it has used are representative, and has discussed them with the EA, which accepts its view. The company has also considered the impact of these sources of uncertainty on the Water Resources Investment Strategy. It has been shown that these factors do become increasingly important from AMP8 onwards. However, any potential impact on the investment programme has been mitigated by two factors. Firstly, the selected risk profile caps Target Headroom from the end of AMP7 in absolute terms, and thus the impact of any one parameter becomes subdued. Furthermore, it is correct that any investment identified in 15 years time will again be reviewed in five years time at the time of the formulation of the next WRMP. The baseline Target Headroom in five years time will be probably very close to the current baseline, notwithstanding any revisions to baseline headroom uncertainty. Thus, the investment profile could remain relatively stable and the schemes selected in 15 years time from now, should not be delayed when the review takes place in 5 years time.

8 Options Appraisal

8.1 Introduction

Where there are forecast deficits in the baseline supply demand balance, these can be met through the introduction of supply side options to increase supplies, or demand side options to reduce demand. The effect of these two different types of options on the supply demand balance is shown in Figure 8.1.

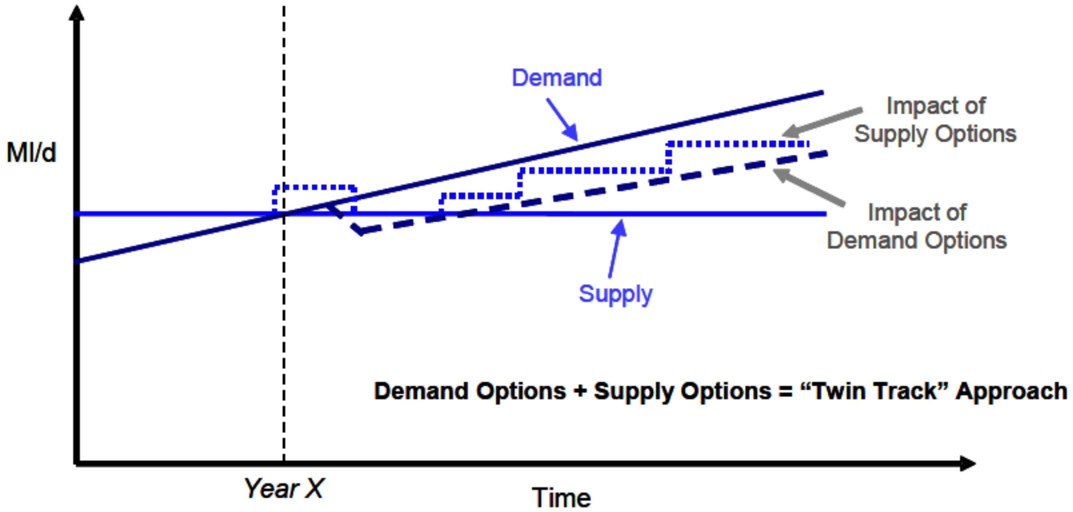


Figure 8.1 Twin Track Approach to Address the Supply Demand Balance

This section sets out an overview of the range of demand and supply side options available, and gives some generic observations on them. The demand side options considered for this WRMP are:

- Increased level of meter installation;
- Introduction of variable metering tariffs;
- Leakage reduction; and
- Water efficiency initiatives.

The supply side options considered are:

- Bulk Transfer;
- Wastewater recycling;
- Aquifer Storage and Recovery;
- Desalination; and
- Area Specific Water Resource Developments.

Details of the specific options within each WRZ and Area have been identified from a number of sources, including the following:

- Options considered as part of previous WRMPs;
- The extensive and detailed AMP4 Water Resources Investigations;

- Options identified by work carried out for the WRSE Group;
- Options from other companies;
- Options identified by respondents during the consultation of the DWRMP; and
- Other options which have been identified from miscellaneous sources during the course of the preparation of this WRMP.

A full listing of the options required for each Area to meet the supply demand balance deficit is provided in section 10, while further detailed description of each option is provided in Appendix G. The selection of options was informed by Strategic Environmental Assessment (SEA); a summary of the SEA assessments of each of the generic options is given in section 8.3. The environmental and social impacts, and possible mitigation measures for options selected in the WRMP strategy are discussed in section 10.

8.2 Demand Management Options

Demand management options can be effective in controlling what might otherwise be unrestricted growth in demand for water, which itself can trigger investment in resource developments earlier in the planning period. The implementation of demand management measures is therefore an important component of the company's approach to water resource planning.

Previous WRMPs have included demand management programmes such as: domestic metering on change of occupier; selective and optant metering programmes; aggressive leakage reduction activity; and the promotion of water efficiency initiatives. As a result, the company's level of domestic meter installation is higher than the England and Wales average, and the company is one of three water companies referred by Ofwat as reporting significant increases in free supply pipe replacements.

The demand management options under consideration in this WRMP were generically assessed for their environmental effects in the SEA Report. They were found to be broadly compatible with the majority of SEA objectives, having a net positive environmental effect due to the minimal amount of physical intervention required in implementing each measure.

Demand management describes various policy and technical initiatives that are available to a water company to manage demands, and includes the following:

- Increasing levels of meter installation;
- Introducing variable metering tariffs;
- Leakage reduction; and
- Water efficiency initiatives.

An unconstrained list of all potential demand management options was identified, based on previous work conducted as part of the AMP4 Water Resources Investigations, and from a full literature review of the current issues, costs and potential benefits associated with all possible demand management options. All options were reviewed, and those that were not applicable were discarded. Feasible options were then assessed in more detail and, where appropriate, an economic assessment was undertaken.

Whilst there may be strong political and environmental reasons for promoting demand management measures, their role of demand management measures in a long-term least-cost investment plan may depend on the characteristics of the supply demand balance, and in particular the magnitude of any deficits, when such deficits occur, and the time when new supply side options might become available. Where there are large deficits, that arise from step changes in the supply side of the supply demand balance as a result of Sustainability Reductions and/or reappraisal of deployable output using more robust and long-term hydrological and operational data, then it is unlikely that demand management measures on their own would be sufficient to reduce a deficit, but would form part of a twin-track approach.

Nevertheless, the company believes that an ambitious demand management programme should underpin the long-term strategy for its water resources. This WRMP is based on a the most cost effective and sustainable strategy , which includes a suite of significant demand management initiatives on enhanced domestic metering installation, further leakage reduction and water efficiency initiatives.

8.2.1 Metering

Metering is generally considered to be one of the most effective means of reducing demand, as it provides a financial incentive to use water more efficiently. The company currently meters all new connections in its supply area, and on change of occupier in its Sussex WRZs.

The rationale behind domestic metering as a demand management measure is that paying by volume of water used should encourage customers to use water sensibly and to restrict the discretionary use of water for activities such as garden watering and car washing. Paying by volume may also encourage efficiencies in non-discretionary use such as toilet flushing, clothes and dish washing, bathing and cooking.

Also identified is the potential for customers to modify their water using behaviour in response to paying by volume. This can be reinforced by the company through household water efficiency campaigns such as those investigated for this WRMP; e.g. subsidies for water-efficient washing machines, dishwashers and low-flush WCs, household water efficiency kits and other devices. The opportunity for introducing water efficiency initiatives on the back of increased meter installation was identified through the consultation process and taken into account in this WRMP strategy.

The SEA identified that metering has the potential for disturbance to local communities in the short term during their installation, but this negative effect is considered non-significant and is far outweighed by the overall environmental benefits of metering. The company proposes installing external meters which should minimise disruption to households, and implementing the installation programme simultaneously over a large area which will help minimise any disturbance to communities.

The impact of all these consequences from metering is reflected in Per Capita Consumption (PCC), expressed in l/head/day. In the past, PCC has remained relatively constant, however, this WRMP has been based on a micro-component forecast of PCC, taking into account potential technological and regulatory changes in future, as well as estimates of potential customer behaviour changes.

The assumptions of the savings that might be delivered through metering used in this WRMP are in line with current industry thinking. There is a risk that savings in PCC may not be sustained in the long term, but it is assumed that this risk can be managed through a combination of water efficiency campaigns, customer awareness and potentially the implementation of a variable tariff structure to limit discretionary use.

A range of different domestic metering options have been considered and the associated impact on the demand forecast taken into account in the supply demand balance and investment modelling. The scenarios investigated are:

- Baseline metering policy (optant and selective only, with current change of occupier metering in the Sussex WRZs finishing at the end of AMP4;
- Change of occupier metering policy extended to all WRZs; and
- Universal metering in all WRZs during AMP5 (2010-15), together with associated benefits of reduced supply pipe leakage losses.

Based on the results of cost benefit investigations, the company preferred policy is to undertake a programme of universal metering throughout its supply area, during AMP5. Universal metering also enables focus on leakage from customers supply pipes, and it is considered that significant further leakage savings will be achieved.

8.2.2 Tariffs

Variable tariffs based on volume usage are widely considered to be a useful mechanism for encouraging more efficient water use, particularly at peak times. However, the prerequisite for any tariff is the installation of a meter. The subsequent success of a varying tariff structures is likely to be dependent on the level of meter installation, so might not be applicable until late in the planning period if the metering policy selected does not reach the high level of meter installation rates rapidly. However, it may be a feasible option to consider if meter installation is accelerated due to universal metering.

Therefore, an additional demand management option considered in association with a universal metering programme is the use of sophisticated tariffs. A literature review was conducted in order to estimate the additional reduction in demand due to implementing variable (rising block) and seasonal tariffs. Social implications, such as the impact on customers' bills and vulnerable customers, will need be given due consideration when proposing future charging policies.

Current research suggests that, on completion of the universal metering programme, the development of appropriate tariffs could lead to further reductions in demand of up to 5% at annual and potentially up to 10% at peak, over and above the effect of metering alone[15]. These options have been included in our potential future options, but can only be considered when meters have been installed.

8.2.3 Leakage Reduction

Southern Water currently operates below their Ofwat target level of leakage, which was set in 2005. Our new leakage level is as a direct response to the drought of 2004-06. The option to allow leakage to rise back to the target level has been considered and subsequently rejected as it does not form part of a longer term economic strategy. The SEA assessed that leakage reduction had the potential for negative effects to local communities due to disruption, dependent upon the scale of the works involved, but that these effects would be short term. However, in the long term, leakage reduction was found by the SEA to be compatible with a number of the SEA objectives as it enables the best use of existing resources.

The company proposes to maintain leakage at the existing low level in the baseline supply demand balance and implement additional leakage reduction over the planning period where it is economic to do so.

As part of the sustainable economic level of leakage (SELL) assessment, costs of reducing leakage in gradual steps over the short and long term have been calculated for each WRZ. These costs and savings are compared directly with all other options in the investment model in order to determine a least cost strategy.

The proposed leakage strategy would be implemented during the next asset management plan cycle, 2010 to 2015, on the back of the proposed strategy of universal metering, which will assist in further reducing supply pipe leakage.

8.2.4 Water Efficiency

Companies are expected to achieve a Sustainable Economic Level of Water Efficiency (SELWE) as part of their economic approach to balancing supply and demand over the planning period. This is in addition to measures introduced to achieve the baseline Ofwat targets, known as the Base Service Water Efficiency (BSWE) target (see discussion of the baseline target in section 6).

Water efficiency measures are regarded as the preferred demand management measure from the SEA perspective as they have no potential conflicts with the SEA objectives.

A range of water efficiency options were individually assessed for their potential to contribute to reducing household and non-household demand, their cost and their practicality. An

[15] Herrington (2007), Waste not, want not? Water tariffs for sustainability. Report to WWF-UK.

unconstrained list of feasible options and the assessment process is detailed in Appendix G. Some options, such as grey water recycling, are considered unviable due to very low cost effectiveness. The following water efficiency options, however, were considered viable for consideration in the company's strategy:

Household options:

WCs

- Cistern displacement devices (CDD);
- Retro-fit dual flush mechanisms; and
- Low dual flush toilets (4/2 litre) (subsidy scheme).

Domestic Taps

- Tap inserts; and
- Low flow taps.

Showers

- Shower timers; and
- Low flow shower heads.

Other

- Low use washing machines (subsidy scheme);
- Low use dishwasher (subsidy scheme);
- Household water audits (HHA); and
- Household water efficiency kit, which comprised two options:
    - Household water efficiency kit with manned household audit; containing CDDs, tap inserts, low flow shower heads, shower timers, tea towel, booklet containing advice on water efficiency, and involving a manned audit to distribute devices as requested by the customer; and
    - Standard kit for distribution upon customer request; containing CDD, tap insert, shower timer, tea towel and booklet, and involving a basic self audit.

External devices

- Trigger hoses;
- Water butts

Non-household options:

- Commercial water audits (CWA);
- Schools and universities (low dual flush WC replacement).

Costs and water savings were calculated for each option and the most cost-effective were selected to meet the baseline water efficiency target. Other viable options not included in the baseline strategy were then considered in the investment model alongside all other supply and demand side options and considered available from 2010-11. Options selected in the baseline were also able to be reselected towards the end of planning period if required under a least-cost strategy. Some options were treated as mutually exclusive as appropriate.

The results of the investment modelling and company SELWE strategy are discussed in section 10.

8.3 Resource Development Options

A number of supply side options have been investigated for this WRMP. The detail of these options is considered in sections 10.2 to 10.4 for each Area. The range of options considered can be sub-divided into the following categories, each of which is described below:

- Bulk Transfer;
- Wastewater recycling;
- Aquifer Storage and Recovery;
- Desalination;
- River augmentation schemes; and
- Area Specific Water Resource Developments.

8.3.1 Option Screening Process

The screening process made use of work conducted by Atkins under the AMP4 Water Resources Investigation projects, which covered all Southern Water Areas. The objectives of the screening process were:

1. To provide a comprehensive list of 'unconstrained' options that could be considered in order to provide additional water supplies to each of Southern Water's Water Resource Zones. This included all schemes that had been previously considered by Southern Water in the AMP4 Water Resources Plan, as well as additional schemes that were identified by either Southern Water or the Environment Agency as part of the AMP4 Water Resources Investigations evaluation process.
2. To provide a summary technical evaluation of each option, to determine whether it represents a viable water resource development that should be considered in greater detail, or whether there are fundamental reasons why the scheme is unsuitable for further investigation. The following could be justifiable reasons for exclusion of schemes at the initial stages:
   - Technical feasibility;
   - Practicality, reliability and deliverability; and
   - Environmental or social impacts that mean the option is fundamentally unacceptable.

Options that address improving deployable output at existing sources through routine asset maintenance / source improvements were not included within the options appraisal work. These types of options (where feasible and practicable) are already incorporated in water resource modelling as completed options

All studies and options were the subject of review and, where appropriate, further desk based research to determine a list of "feasible" options. The constrained options were each examined in terms of:

- The practicability of the option;
- Its potential benefit in water resource terms;
- The extent of environmental impact, on both aquatic and terrestrial ecology;
- Its potential impact on other factors, such as heritage, noise and air pollution;
- Any constraints on the option in planning terms; and
- Its cost, in terms of both the capital and operational expenditure required, including an allowance for the cost of carbon.

The environmental and social costs / benefits of each option were estimated, where possible, using the Environment Agency's Assessment of benefits for water quality and water resources schemes in the PR04 Environment Programme (Environment Agency, 2003);

known as the Benefits Assessment Guidance, or BAG. However, there are inherent uncertainties associated with the calculation of these environmental costs and benefits, and not all transfer costs involved were necessarily adaptable to the wide range of options assessed.

The result of the option screening process was to produce a list of “feasible” options for each of Southern Water’s three sub-regional areas, with associated cost, that could then be used in the investment model to derive a least-cost plan over the 25-year planning period.

8.3.2 Strategic Environmental Assessment (SEA)

Those options considered as feasible following the screening process were then subject to a Strategic Environmental Assessment (SEA) as part of the WRMP process and to fulfil the requirements of the SEA Directive (see section 1.4).

This assessment expanded on the identification of environmental and social impacts by the AMP4 Water Resources Investigations for each of the water resource options considered in the DWRMP. Potential mitigation measures were also considered, particularly with reference to those options included in the proposed WRMP strategy.

A high level compatibility assessment was carried out for each of the generic resource development options outlined below, against 17 SEA objectives in order to identify conflicts between the two in the short, medium and long term. A brief summary is given of the findings of this high-level assessment for each of the generic options.

Overall, a number of potential conflicts between WRMP resource development options and SEA objectives were identified. The SEA found that the extent of these conflicts was dependent on the nature of implementation and location of the specific options. Therefore the feasible list of WRMP options was subject to further in-depth SEA investigation, the results of which informed this WRMP strategy. The environmental and social impacts and possible mitigation measures for options selected in this WRMP strategy are discussed in section 10.

8.3.2.1 Bulk Transfers

Bulk transfers are a means of supplying additional water to a WRZ with a supply demand balance deficit from a WRZ with a supply demand balance surplus. The range of possible transfer options open to Southern Water includes:

- Enabling transfers (inter-zonal transfers between Southern Water WRZs);
- Inter-company bulk transfers within the South East region;
- Termination of existing bulk supplies to other water companies; and
- Transfers from outside the South East region.

The transfer of water from areas of surplus to those of deficit has always been a fundamental part of Southern Water’s water resources strategy. However, a key consideration is the availability of surplus supplies in potential donor WRZs or other companies. Consideration also needs to be given to other factors such as the magnitude of the surplus available, the timing of availability and the duration for which it is available.

The SEA found that bulk transfers were compatible with a number of SEA objectives but depending on the requirement for construction of additional pipelines and routing, they may have potential conflicts against some SEA objectives, particularly during the construction phase.

8.3.2.2 Wastewater recycling

The recycling of wastewater, to reduce pressure on existing water abstractions and further resource development options, can be sub-divided into the following categories:

- Direct potable re-use;
- Direct non-potable re-use;
- Indirect potable use: recharge of groundwater aquifers; and
- Indirect potable use: supplementing river flows and surface water storage.

However, there are a number of other issues associated with the recycling of wastewater that need to be considered and overcome if it is to be widely adopted in the future. These relate to environmental impact of wastewater discharge, public health, public perception and cost. The only categories that will be considered as part of this WRMP process are direct non-potable re-use and indirect potable use by augmenting river flows and surface water storage. Direct potable re-use is unacceptable due to the high levels of risk and the recharge of groundwater using wastewater is not permitted under European legislation.

The advantages of wastewater recycling schemes are that they should be resilient to climate change, and offer flexibility in implementation and operation. However, there could be serious concerns raised with regards to the energy usage involved to operate such schemes, bearing in mind the possibility of multiple pumping and treatment required. There are examples of indirect wastewater recycling schemes across the company's supply area, although they may not be perceived as such in view of their size.

The SEA found that, while compatible with some SEA objectives, wastewater recycling has the potential for negative environmental impacts. These are associated with the potential infrastructure and additional pipelines required and the nature of the treated wastewater, dependent upon the nature of implementation of the scheme. The SEA concluded that the potential for negative medium/long term impacts could be reduced by appropriate mitigation measures.

8.3.2.3 Aquifer Storage and Recovery

The principle of Aquifer Storage and Recovery (ASR) is that either potable water, or raw water that could be used for potable purposes, is injected into a confined or semi-confined aquifer to create a 'bubble' of fresh water than can be re-abstracted when required.

The SEA report found that the environmental applicability of ASR relates to the impacts that such a scheme would have on parts of aquifers that either affect surface water bodies or sources that are currently used for potable water. Taking into consideration its broad compatibility with SEA objectives, subject to the nature of implementation and potential mitigation measures, the SEA concluded that ASR was the preferred resource development option.

8.3.2.4 Desalination

Desalination considers the opportunity of making use of saline groundwater, and coastal and tidal river waters which cannot be exploited by traditional treatment techniques. It has become less expensive in recent years as the cost of membrane technologies used in reverse osmosis processes has reduced. The potential sources of saline water are:

- Coastal Waters;
- Tidal Rivers;
- Offshore Waters;
- Deep Groundwater; and
- Coastal Aquifers.

The first two sources, coastal waters and tidal rivers, are the two most commonly identified sources, and are probably the easiest to design and manage from an operational viewpoint.

A number of environmental factors were taken into account when considering desalination during the AMP4 Water Resources Investigations, among which are:

- Construction and the subsequent abstraction and brine discharge may have adverse environmental impacts on coastal and marine habitats and wildlife;
- Treatment works may have significant visual impacts, especially in residential, tourist and designated areas along the coastline;
- Significant supporting infrastructure (roads, power, pipelines) is required, which may have social and environmental impacts;
- Tidal rivers in the South and South East of England are considered a valuable habitat and many of those within or near the company's supply area are subject to one or more environmental designation;
- Groundwater aquifers, given that they are likely to be non-renewable (i.e. a fossil aquifer), when subject to abstraction may have impacts on adjacent aquifers;
- Extraction from coastal aquifers may result in saline intrusion into fresh groundwater sources; and
- The potential requirements in terms of energy, although these can be reduced if the plant is only used intermittently, and modern design includes the facility for much enhanced energy recycling and the use of green energy source.

The SEA generic assessment of desalination as an option found that it has the potential for conflicts with a number of SEA objectives in both the short, medium and long term. These were dependent upon a number of factors relating to the nature of implementation of the plant and potential mitigation measures for long term impacts suggested. These are discussed in section 10.

8.3.2.5 Area Specific Water Resource Developments

These options refer to the various Area specific options that are not covered by the categories above. They all include the development of new resources in specific locations within each of the Areas. The options in this category are outlined below, and can vary widely in terms of the volumes of supplies available, from minor local source improvements to the development of major strategic options such as surface water reservoirs:

- New surface storage reservoirs;
- Increases in abstraction from either surface or groundwater;
- Enlarging existing reservoirs;
- Re-commissioning old/existing licences;
- Licence variations; and
- Upgrading Water Supply Works treatment facilities.

The availability of any of these options will vary considerably within each Area, and so each option needs to be considered on its own merits. However, it must be remembered that the development of an option in one WRZ can have an effect on all interconnected WRZs within the Area.

The SEA assessment at generic level identified a range of potential conflicts between different Area specific options and the SEA objectives, and each scheme was subject to more detailed analysis. These findings are contained within section 7 of the Environmental Report and a summary findings and discussion of potential mitigations measures for options included in this WRMP strategy is provided in section 10.

8.4 Other Considerations

There are a number of factors that influence the choice and timing of options to address a forecast supply demand balance deficit. These are as follows:

- **The Nature of the Deficit**

  In any given WRZ, a forecast supply demand balance deficit may arise under one or more of the conditions defined by the ADO, PDO or MDO scenario (see section 4.4). The deficit triggers the need for new investment in demand or supply side options and the conditions which are the drivers of the need for such investment may have a direct bearing on the appropriateness of one option over another. For instance, a deficit under a PDO scenario may be able to be solved by increased treatment capacity or higher meter installation, whereas average or minimum resource period imbalances may require the development of more storage, the provision of a more reliable supply of water such as wastewater recycling or desalination, or again, increased meter installation and further leakage reduction;

- **Magnitude of an Option**

  A key factor is obviously the potential that a given option has to reduce demand or increase deployable output such that available headroom equals or exceeds Target Headroom;

- **Cost of an Option**

  Costs take into account both the initial capital investment required and the subsequent operational costs of a given option;

- **Timing of Availability**

  Some options require a long lead time before they can contribute to the supply demand balance. Both the lead-time and the confidence in that lead-time (i.e. the likelihood that it will be available when it required) are important. Confidence in lead-times reduces sharply with an increase in the number and complexity of factors on which an option depends that are outside the control of the company;

- **Reliability of an Option**

  This addresses the confidence that a given option will “deliver” the required reduction in the supply demand balance deficit. Where an option depends heavily on assumptions about changes in customer behaviour, or may be significantly impacted by some of the climate change scenarios, they would be considered less reliable than an option which will be unaffected by such factors (e.g. large storage options; wastewater recycling; and desalination). Furthermore, most options on the supply side will require some form of consent, for example planning permission, abstraction licence or any other form of consent. The potential for being granted these consents must be a factor to be considered;

- **Energy and Carbon Costs**

  Like environmental impacts, energy and carbon costs need to be well understood. The monetary costs of energy will be automatically taken into account as part of the assessment of capital and operational costs of an option. It should also be understood that high energy costs should not automatically be equated with high carbon costs, since the company may choose to supply the energy needs of an option from renewable sources; and

- **Social and Political Acceptability**

  Some options for demand management or new water resources are subject to greater social and/or political acceptability criteria than others. An obvious example would be the direct recycling of wastewater which may not be considered a socially acceptable option despite the availability of technology to treat wastewater to the required drinking water standards.

9 Formulation of the Water Resources Strategy

9.1 The Investment Model

The objective of the water resources investment model is to ensure that sufficient supply and demand side measures are identified to maintain the supply demand balance, for each critical period scenario, throughout the entire 25-year planning period (2010 – 2035) at least cost. Therefore, if there is a supply demand balance deficit for any critical period planning scenario during the planning period, the least-cost strategy should select the option, or combination of options, which maintains the supply demand balance at least, discounted, cost, given the assumptions for the model run.

The method used to determine this least-cost solution follows the Water Resources Planning Guideline, and uses the methodology recommended in the UKWIR report[16] "Economics of Balancing Supply and Demand". This recommended the use of a mathematical optimisation model, based on the technique of integer programming. Southern Water has adopted this approach, and has used the optimisation software What'sBest! (WB!) version 9.0. A description of the model is given in Appendix H.

The modelling approach consists of a number of different elements and processes, as presented in Figure 9.1. This schematic shows how the strategy, as reported in section 10, is developed.

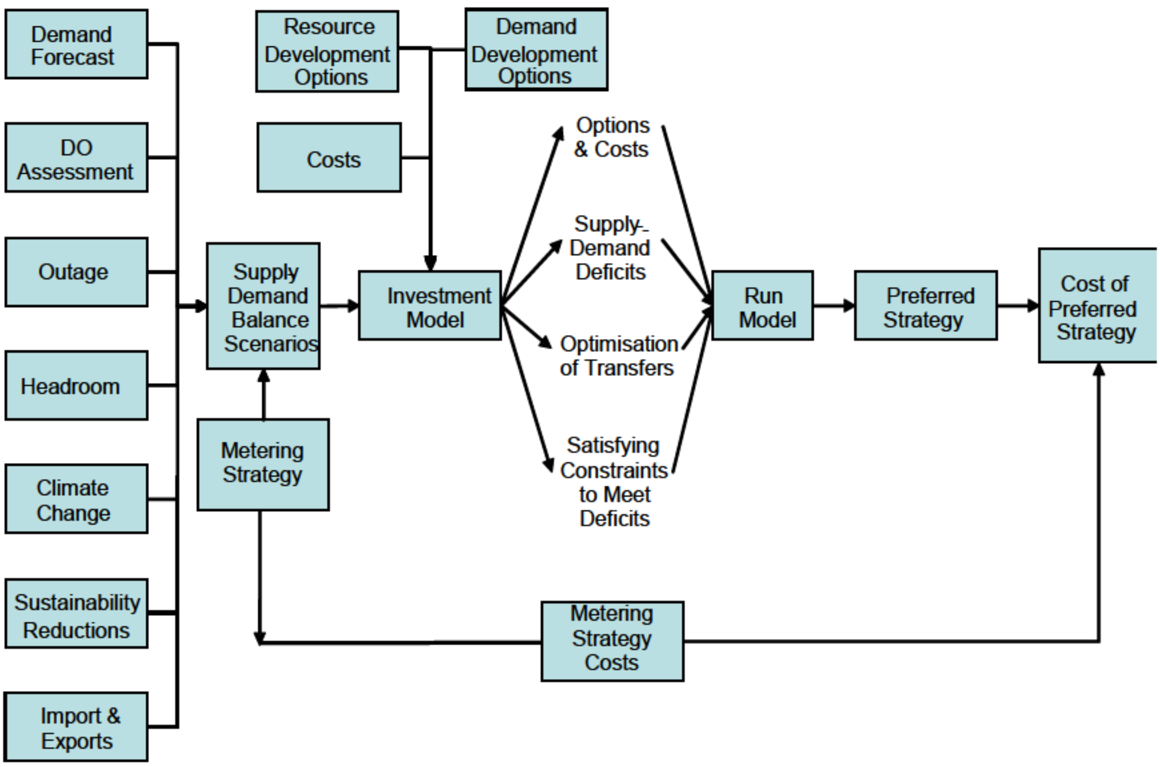


Figure 9.1 Schematic of Investment Modelling Approach

16 UKWIR, 2002, The Economics of Balancing Supply & Demand (EBSD) Guidelines. Report 02/WR/27/4

Separate investment models were developed for each of the three sub-regional areas. This was because although the building blocks for the strategy are the WRZs, there are inter-connections between WRZs, either current or potential, that make up the sub-regional areas. Thus, actions in one WRZ can have an impact on other inter-connected WRZs. As a result, the model has to take account of the supply demand balances in all the WRZs in the Area at the same time in order to develop a co-ordinated least-cost solution.

The investment modelling process considers both supply and demand side options. However, the optimisation process is computationally difficult and very time consuming, as a result of the complexity of the problem and the immense number of iterations that have to be made. Consideration of the different demand management options can make this process even more complex.

Demand management options were introduced in the investment model in the following way:

- Water efficiency options were included as individual options, available every year, each with its own capex, opex and savings;
- Leakage options were potentially more difficult and complex in that there could be a start date for every year of the planning period, and an infinite amount of leakage reduction to achieve. To assist in the modelling process a number of discrete leakage reduction volumes were calculated. Further details are given in Appendix G.
- Metering options are more difficult to introduce in to the model because there could be individual options which comprised all the combinations of a start date for every year of the planning period, and an end date of any interval between the start date of the programme and the end of the planning period. In order to overcome these difficulties it was decided to create a number of scenarios which would simplify the modelling process. It was considered that very high levels of metering would be achieved by the end of the planning period, even if this was only as a result of optants. This is because of the number of switchers now observed since the introduction of the free optant switching option. Following classification as an area of serious water stress, the company had to consider universal metering as part of the 25-year strategy. Work was undertaken (see Appendices G and H) which showed that it was more cost effective to introduce universal metering over a five year period than, for instance over the whole of the planning period. Accordingly, it was decided that the universal metering programme would be introduced as a scenario which assumed a five year programme starting at the start of AMP5, i.e. 2010. The results of this scenario, in terms of costs and benefits, was compared with three other scenarios: one based solely on optants (scenario 1); and the other based on change of occupier throughout the company's area (scenario 2), as against solely Sussex, where this policy is already in force; and the third based on a continuation of the existing metering policies in each of its' ten water resource zones.

9.2 Scenario Modelling

The model output will be the least-cost solution, given the input data and assumptions that underpin the values of this data. However, it is often useful to check the robustness of a given solution or test alternative solutions, if other underlying assumptions were used. This is known as scenario modelling.

In essence, the approach used for scenario modelling is to change the baseline input data, assuming different assumptions to derive the values of the input data. The model is then re-run, and the resulting solution checked against the baseline solution.

Details of the different scenarios and results from the investment modelling are reported in section 10, where the following scenarios have been tested:

- Baseline: continuation of current metering policies, comprising “change of occupier” (CoOM) in the Sussex WRZs and optant metering in all other WRZs;
- Scenario 1: An “optant” strategy, with metering assumed to be optant and selective (large water users) only;
- Scenario 2: CoOM in all WRZs. This was useful for comparison with the company’s preferred demand management-led strategy of universal metering;
- Scenario 3: A “universal metering” strategy for all WRZs to achieve 100% penetration by the end of AMP5, together with associated savings due to supply pipe leakage reductions;
- Scenario 4: A “regional” strategy comprising scenario 3 metering but with WRSE-preferred resource developments and bulk supplies to other water companies;
- Scenario 8: A “leakage rise to Ofwat target” strategy;
- Scenario 11: A “universal metering no climate change” ; and
- A hybrid scenario comprising “universal metering” in those WRZs that would otherwise have a supply demand balance deficit, and continuation of existing metering policies in those WRZs without a supply demand balance deficit (i.e. CoOM in the Sussex WRZs and Optant metering in the other zones).

9.3 Sensitivity Testing

The robustness of the selected strategy can be assessed by undertaking sensitivity analysis. Sensitivity analysis comprises determining the impact on the strategy from changes in the values of the input data, given the same basic assumptions. A number of potential sensitivities were identified and considered for both the Supply Forecast and the Demand Forecast.

For example, changes to the Supply Forecast could include such items as: changes to Deployable Output through the adoption of new methodologies, or in the light of new data; the introduction of further reductions in deployable output as a result of further Sustainability Reductions; and the potential loss of sources.

Sensitivities to the Demand Forecast could include such items as: differences in assumed demand savings as a result of metering; changes in demand due to the introduction of more efficient household design; and reductions in demand due to the development of more sophisticated tariff structures

9.4 The Importance of Strategic Decisions

The processes of option identification, appraisal and investment modelling have been progressively refined and improved over the last 10-15 years and, in combination, form a sophisticated and robust approach to water resources planning. However, there still remains the need for the company to make sensible strategic decisions regarding options that might not otherwise be chosen by the systematic approach described above.

This is particularly the case in the consideration of metering and in deriving this plan the costs and benefits of metering have been fully explored to ensure that it could be compared equally with resource development schemes and leakage reductions. Strategic decisions also need to be taken in the consideration of resource options. For example, if the forecast supply demand balance deficit is relatively small and unlikely to grow significantly over time a single solution, or a series of small-scale solutions will be appropriate. However, if demand is forecast to increase significantly over time, leading to a large supply demand balance deficit, the situation needs to be considered from a strategic viewpoint. While a series of smaller scale options may be appropriate, there may be some circumstances in which investment in a single, much larger option is the best way forward (see Figure 9.2). Although this may result in a significant surplus or resources in the short-term, it may prove to be the most effective long-term solution and facilitate the provision of bulk supplies to other companies in the interim should they be required.

Furthermore, the importance of environmental considerations must be recognised. There may be environmental considerations, both in support of and against, all schemes, which are often difficult to express purely in monetary terms. In this respect, the Environmental Report, undertaken as part of the Strategic Environmental Assessment, has been used to help assess such environmental considerations. The Environmental Report on the WRMP was made available as part of the consultation for the DWRMP, and an SEA Statement will be published alongside the final WRMP report, summarising how the information and results in the final WRMP and Environmental Report (revised following consultation on the draft Environmental Report and DWRMP) have been influenced and informed by each other (see section 10.1.9).

The need to make strategic decisions does not remove the need for very clear arguments to support them, but it does mean that it is always important for the company to review the outputs from its options appraisal and investment modelling to ensure that the company preferred strategy really is the optimal solution for the company, its customers and the environment.

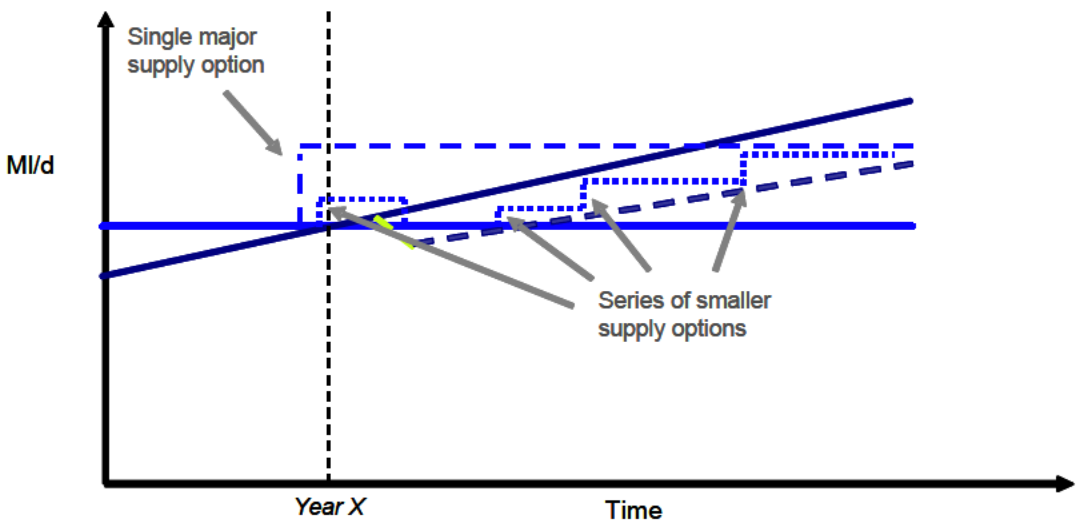


Figure 9.2 Illustration of Options to Address the Supply Demand Balance

9.5 The Importance of a Regional Solution

As mentioned in section 2, the water supply system within the South East of England is very complex, due to the nature of the individual company systems which have been developed independently for over more than a century. There are a number of water companies, each sharing boundaries with a number of other companies. It is also the area with the most pressures on it, being not only classified as an “area of serious water stress”, but also likely to be in the forefront of the effects of climate change.

Given the complexity of the situation, there are a number of benefits arising from the development of a regional strategy which is reflected through the integration of the strategies of the individual companies. The benefits of such an approach include the following:

- It demonstrates joined-up thinking between companies, and identifies synergies with the strategic plans of other companies;
- It avoids the potential for the selection of mutually incompatible or even mutually exclusive schemes to be selected;

- It creates the progression of regional developments that might avoid pursuing individual company strategies that could lead to unnecessary developments which could in turn result in the creation of excessive headroom, greater environmental impact, a solution that is not least-cost and higher customer bills than necessary; and
- It creates the opportunity to make the optimum use of limited resources, and realise any potential for economies of scale with minimum impact/cost.

9.5.1 The Work of Water Resources in South England Group (WRSE)

The WRSE Group was formed in 1999 to progress the joint strategy for the South East region. Southern Water has already adopted a number of the conclusions for the sharing of resources identified by the group, with the following schemes being successfully completed during AMP4:

- Export to South East Water from Darwell, facilitated via the upgrade of the Bewl-Darwell transfer;
- Export to Folkestone and Dover Water via a bulk supply from Deal High reservoir; and
- Import from Portsmouth Water to the Sussex North/Sussex Worthing WRZs, facilitated by a variation to the Eastergate group licence.

Central to the work of the group during AMP4 has been the development of a regional water resources investment model under the direction of the Environment Agency. The model is an optimisation model, and applies the methodology recommended in the Economics of Balancing Supply and Demand. The modelling platform uses the software package WhatsBest!, which is the package used by Southern Water and a number of other companies.

Input data has been provided by the individual companies and has been subjected to cost consistency checks. A number of different scenarios have also been investigated. It is accepted that, as the data is proved by the companies themselves, there should be some consistency with the modelling work of the companies themselves. However, it also means that there may be some difference in the design standards used by the various companies, such as: the metering policy; Target Levels of Service for the frequency of restrictions; design conditions for the estimation of Deployable Output and the adopted target headroom glidepath.

It must be recognised that it has never been the intention that the regional model will give a single, definitive solution that should override the more detailed modelling work of the individual companies. However, by investigating a number of different scenarios, for instance with different PCC estimates or differing population forecasts, in the modelling work, it should be possible to identify those schemes which are “most commonly selected”, and which therefore could be expected to be worthy of further investigation by the individual companies. As such, the results of the regional model should be used to inform the formulation of strategy at individual company level.

It is also important to recognise that the results of the model identify the most commonly selected schemes; it also identifies the most often selected ways of allocating or sharing such resource developments to create the building blocks for a regional solution. It is then the responsibility of the companies to identify, investigate and agree on the potential bulk supply and/or shared resource schemes.

It will be realised that the modelling work requires iteration between the models/data updates of the companies and the EA. The iterative process comprises:

- A bottom-up approach, whereby the companies provide updates of their data, and company preferred solutions for use in the regional model; and
- A top-down approach, whereby the Environment Agency runs the regional model, and feeds back the regional results to the companies for comparison/use within their models.

9.5.2 The Results of the WRSE Regional Model

There have been a number of major modelling phases during AMP4. There was a substantial set of runs undertaken during the latter part of 2008 that used data from DWRMPs where possible. However Southern Water, in common with some other companies, felt that the results were not sufficiently definitive, nor were they produced in time for them to be taken into consideration. Nevertheless Southern Water has included in the baseline condition renewal of all existing bulk supplies until the end of the planning period at the pre-existing volumes, in order to support the notion of a regional solution.

Since submission of the DWRMPs the draft Business Plan another major WRSE modelling exercise was undertaken. This allowed comparison of the DWRMPs company preferred strategies with what might be a more regional solution. The results of this exercise, which compared the sum of the individual company strategies with a regional strategy, allowed for shared developments/bulk supplies, and should reduce the available headroom above target headroom, and also the overall total cost of the regional strategy.

The results of the regional model were provided to the technical WRSE group and to the Managing Directors group.

The results of the regional model suggested that within a regional context for shared resources and/or bulk supplies there could be the development of other options identified by Southern Water; namely the raising of Bewl Water, the Aylesford wastewater recycling scheme and the provision of a bulk supply to South East Water from Sussex Brighton WRZ.

The results of the most recent WRSE modelling were not available at the time of this FWRMP.

9.5.3 Influence of the Regional Results on this WRMP

Southern Water has accepted the results of the WRSE regional model available to date, and has agreed to include them within its own model. These are discussed more fully in the commentary of the individual Area strategies in section 10.

The schemes that have been included within the Southern Water company preferred regional strategy as a result of the results of the WRSE regional modelling work are:

- Introduction of River Medway scheme licence variation;
- Acceleration of Aylesford wastewater recycling scheme;
- Raising Bewl Water;
- Enhancement of bulk supply to FDWS, which, although not within the WRSE results, was identified by the companies and agreed to be a more realistic than a desalination scheme that was identified in the results from the regional modelling work;
- Provision of new bulk supply to SEW from Sussex Brighton WRZ; and
- Development of a Memorandum of Understanding, with Portsmouth Water Company and the Environment Agency regarding the progression of the River Itchen Sustainability Reduction.

It was expected that a further set of regional modelling runs would be undertaken during early summer 2009 making use of data from final Business Plans and any further updates since the Statement of Response. As noted in section 9.5.2 the results have not been available to inform further update of the FWRMP and therefore the plan has used the most up to date modelling work prior to publication, to inform the plan.

9.5.4 General Principles for the Provision of Bulk Supplies

The inclusion of some regional schemes within the baseline condition of this WRMP, either for joint scheme development and/or shared resources/bulk supplies, will result lead to additional costs over and above the company-only strategy. The resulting final planning scenario will therefore not be the least-cost strategy for Southern Water on its own. It is therefore essential to state the conditions that will ensure that the customers of Southern Water are not disadvantaged by the inclusion of these schemes in the company preferred regional strategy.

The exact terms and conditions of any future agreements between Southern Water and other companies for the provision of supplies, either from bulk transfers or joint development, will be determined on a case-by-case basis. The following points set out without prejudice the general principles which will underlie any inclusion of regional strategy schemes within the company's WRMP:

- Company's own customers, and their security of water supply, are of paramount importance in the provision of bulk supplies;
- Water is a commodity for sale, and as such, can be used for the provision of bulk supplies;
- Any incremental expenditure on the company, be it from the renewal of existing bulk supplies, or the provision of new ones, should be met entirely by the recipient company; and
- The promotion of any new scheme that allows the provision of new bulk supplies would be expected to be subject to the same level of environmental scrutiny as any other scheme.

10 The Water Resources Strategy

10.1 General

10.1.1 Introduction

The previous sections have described the various elements and stages in the development of the water resources strategy that is presented in the Water Resources Management Plan. Of particular importance are:

- The need to develop a robust and resilient supply system that will not fail under the most severe conditions;
- The considerable number of challenges facing the water industry in general, and those specific to the South East region and Southern Water;
- The principles underlying the process of water resources planning;
- The derivation of the key building blocks for the formulation of a water resources strategy, namely the:
  - Supply Forecast;
  - Demand Forecast;
  - The treatment of likely uncertainties;
  - Supply and demand side options available;
  - Use of the investment model to determine a company preferred solution;
- The influence of a regional solution; and
- The outcome of the Strategic Environmental Assessment (SEA).

This section now uses all the above considerations to formulate the water resources strategy.

10.1.2 Objectives of the Water Resources Strategy

The objective of the water resources strategy is to ensure the security of supplies for the next 25 years through the development of a robust and resilient supply system that is able to:

- Reduce the risk of failure under any foreseeable scenario to an absolute minimum;
- Meet Target Levels of Service to our customers and the environment;
- Be firmly based on a demand management-led approach, supported by resource development as appropriate;
- Ensure development of a water supply system that can cope with increased housing development;
- Be fully prepared to meet the challenges of climate change, and to take into account the adverse impact of carbon emissions;
- Develop those options that are the most environmentally sustainable, whilst being economically effective, and socially and politically acceptable, from the options available;
- Select appropriate demand and supply side options that can be implemented in a timely manner as and when they are required;

- Tailor the specific area strategies to the specific individual requirements of the areas;
- Be flexible enough so that it can be adapted to changing circumstances; and
- Contribute to an integrated regional solution.

10.1.3 Development of Individual Area Water Resources Strategies

The details of the water resources strategy for each area and for each WRZ are set out in sections 10.3 to 10.5.

The strategy is presented using the following structure:

- An overview of the key features of the area and WRZs, in terms of location, sources of supply and their management, a summary of demand, recent strategic developments and performance against Target Levels of Service;
- A summary of the baseline supply demand balance for each of the WRZs in the area and a review of some of the key issues to be addressed. The assumptions for the baseline scenario are given in the area sub-sections below, and full build-up tables of the supply demand balance are given in Appendix I;
- The demand and supply side options available to meet any supply demand balances deficits;
- The influence of the WRSE work and the need to contribute to a regional solution;
- The influence of the findings of the SEA, including discussion of mitigation measures for options selected in the area strategy; and
- A presentation of the strategy for the area, with accompanying discussion and justification. The elements of the water resources strategy are set out for the following time periods:
    - AMP5, the first five years from 2010-11 to 2014-15, which will form the basis of the Final Business Plan Submission;
    - AMP6 to the end of the planning period, 2015 to 2035, based on the least-cost strategy for a company only strategy; and then
    - An explanation of how this AMP6 to the end of the planning period company only strategy is modified to take into account the recommendations of the WRSE regional modelling results. It should be noted that this comprises the current company preferred regional solution, as described in this final Water Resources Management Plan.

The baseline assumptions for supply and demand side measures are described. It is assumed that inter-zonal transfers will be managed as appropriate throughout the planning period; the transfers are mentioned here for completeness.

The company preferred regional strategy is then summarised in Section 11 which sets out the company's water resources investment strategy throughout its area of supply until the end of the planning period in a regional context.

As required the WRP Tables have been prepared for the baseline and the final planning solution only. The Tables have been compiled in a separate document.

10.1.4 The Baseline Condition

The baseline condition is used to define the starting point for the WRZ supply demand balances from which the final planning solution is developed. The baseline condition represents continuation of current management policies.

The main constituents of the baseline supply demand balances are:

- The Supply Forecast based on current values for deployable output and improvements to be made during AMP5;
- The Demand Forecast based on externally-derived population and household growth projections and most significantly the level of meter installation and reductions in supply-pipe leakage that would be achieved under continuation of current company policies; and
- The renewal of existing inter-company bulk supplies until the end of the planning period at the rates in place at the time existing agreements expire.

Using these assumptions for the baseline supply demand balances over the whole of the planning period defines all the changes in the supply demand balance that might be expected to occur, irrespective of any additional intervention by the company. The baseline represents a “no-change” condition and shows whether any deficits would occur over the planning period and what the magnitude of any deficit would be.

The different elements included in the baseline supply demand balance are described in the following sections.

10.1.5 Supply Forecast

The supply forecast section sets out the values of deployable output that have been used in this WRMP.

The following values for surface water deployable outputs have been used:

- From the base year 2007-08 to the end of AMP4 (2009-10), the values are the original PR04 values, in line with the PR04 baseline condition, together with any AMP4 improvements; and
- From the start to the end of the planning period, 2010-11 to 2034-35, the values are those derived from the analysis described in section 5.2.

The situation is more complex for groundwater. A progressive series of values has been used to reflect the changing assumptions for the different time periods as follows:

- The base year 2007-08, which will use the original PR04 values, in line with the PR04 baseline condition, or 2006 re-assessments (where available);
- For 2007-08 these values also include any AMP4 improvements in deployable output to date and will remain constant until the start of the planning period (2010-11);
- For the start of the planning period, 2010-11, the values used will take into account the 2006 re-assessments, together with the results from the Unified Methodology;
- During the AMP5 period up to 2014-15, these values will be modified to take into account any AMP5 planned source improvements; and
- Up to the end of the planning period in 2034-35, the values used will be those used at the end of AMP5.

10.1.6 Demand Forecast

Demand forecasts for a number of metering policies have been fully tested to understand the most optimal metering policy. Under a universal metering policy the installation of the meters will be completed in 5 years and the repair of the supply pipes contribute to the continued reduction of leakage.

The following four metering strategies were tested as part of the process to identify the most suitable strategy for the company in the future:

- A continuation of existing policies;
- A policy of optant metering only;
- A policy of change of occupier metering only; and
- A policy of universal metering.

Each policy has been modelled and the resultant resource strategy determined. The combination of these costs is then used to determine the overall cost effectiveness of the strategy.

10.1.7 Inter-Company Bulk Supplies

The baseline assumptions are that all existing inter-company transfers, both imports and exports, will be renewed and will continue to be renewed until the end of the planning period at the volumes at the time existing agreements expire.

10.1.8 Customer Levels of Service

Two measures can be used to demonstrate the effects of droughts on the company's Target Levels of Service:

- The number of years that restrictions have been in force (expressed as a percentage), irrespective of the duration during the year; and
- The amount of time on average that customers have been subject to restrictions, calculated as the percentage of the actual (population times weeks of restriction) compared to the total (population times weeks under review). This measure could be considered to be a more accurate reflection of actual levels of service, as it takes into account both the population affected, and the total time for which it was affected. If Target Levels of Service are being met then this measure would not exceed 10%.

A summary Table showing the frequency of restrictions compared to the Target Levels of Service is given for each area.

10.1.9 Environmental Levels of Service

A discussion of past performance against environmental Levels of Service in each area is included in the relevant section.

10.1.10 Influence of a Supply Demand Balance deficit

Section 3.3.2.3 notes that in the event that a WRZ or area has a supply demand balance deficit, there is a theoretical risk that, in the event of drought conditions, the supplies will be put under more stress than would normally be the case, and it there is an increased risk that the activities associated with the Drought Plan may have to be introduced, which could involve any of the following:

- Demand side measures such as appeals for restraint up to the introduction of restrictions;
- Supply side measures, if available, to create more deployable output; and
- Applications for Drought Permits/Orders to allow abstraction to continue beyond current licence constraints.

The likelihood of such measures being required depends on, amongst other things, the magnitude of the supply demand balance deficit.

10.1.11 Influence of Water Resources in South East (WRSE) Group

The importance of planning in a regional context has been referred to throughout this plan. The company has been an active member of the WRSE Group. WRSE preferred options have been identified from within the Southern Water option set and were discussed in section 9.

We have received a confirmed request from Folkestone and Dover Water Services for the potential inclusion of an additional bulk supply from Deal reservoir. Portsmouth Water has indicated that it will not be seeking a bulk supply, although it will consider providing one as part of the further work regarding the River Itchen Sustainability Reductions. No other confirmed requests or offers have been received.

In the absence of a complete list of potential requirements from all companies in terms of timing and volume, it was not possible to include them in the baseline supply demand balance. This means that it has not been possible to use the optimisation model that was used for the Economics of Balancing Supply and Demand (EBSD) approach to the company only solution for the development of a regional solution.

The company preferred regional strategy has therefore been derived using the following two-stage process:

- Firstly, a least-cost optimised strategy was derived, which includes renewal of existing bulk supplies; and then
- The WRSE preferred options were “forced” into the strategy to develop a regional solution, at what was considered to be the earliest start date.

This strategy will mean that a margin of headroom above the company’s target headroom becomes available over the course of the plan. This margin would then be made available as bulk supplies to other companies. Such a strategy will not be the company least-cost strategy because each of the WRSE options will have been “forced” in at the earliest start date and at the maximum capacity. It will only be possible to derive an optimised, least-cost regional strategy when a baseline regional supply demand balance has been agreed that includes all the potential volumetric and timing requirements of all the other companies. We have discussed this approach with the Environment Agency and we believe that the Agency supports our stance and approach to modelling a regional strategy.

10.1.12 Influence of SEA

10.1.12.1 SEA Process

The SEA Directive (2001/42/EC) makes a Strategic Environmental Assessment (SEA) a mandatory requirement for certain plans and programmes which are likely to have significant effects on the environment. Southern Water considers this WRMP as a “water management plan”, thus falling within the terms of the SEA Directive, so an SEA has been undertaken of the WRMP.

In compliance with the appropriate sets of guidance on the SEA process, an SEA Scoping Report was produced and was published for consultation. The responses received were addressed and included in the preparation of the Draft Environmental Report which in turn was published for consultation alongside the WRMP – “Draft for Consultation”. The Report summarised the findings and results of the SEA process and presented information on the likely significant effects of the WRMP options considered.

The Environmental Report has now been revised to reflect consultee comments and changes to the draft WRMP. An SEA Statement will be published alongside the final WRMP and will indicate how the information, analysis and modelling results presented in the final WRMP and Revised Environmental Report have been influenced and informed by each other.

10.1.12.2 Assessment of Options

All options considered in this WRMP have been subject to an SEA as part of the WRMP process and in fulfilment of the requirements of the SEA Directive. This assessment expanded on the identification of environmental and social impacts by the AMP4 Water Resources Investigations for each of the water resource options considered in the draft WRMP. Potential mitigation measures were also considered, particularly with reference to those options included in the proposed WRMP strategy.

A high level compatibility assessment was carried out for each of the generic resource development options outlined below, against 17 SEA objectives in order to identify conflicts in the short, medium and long term.

Overall, a number of potential conflicts between WRMP resource development options and SEA objectives were identified. The SEA found that the extent of these conflicts was dependent on the nature of implementation and location of the specific options. Therefore the feasible list of WRMP options was subject to further in-depth SEA investigation, the results of which informed this WRMP strategy. The environmental and social impacts and possible mitigation measures for options selected in the WRMP strategy are outlined in detail in the following sections.

The demand management measures proposed for the WRMP strategy were also assessed in the SEA. It was found that metering has the potential for disturbance to local communities in the short term during their installation, but this negative effect is considered non-significant and outweighed by the overall environmental benefits of metering.

The SEA identified that leakage reduction had the potential for negative effects to local communities due to disruption, dependent upon the scale of the works involved, but that these effects would be short term. However, in the long term, leakage reduction was found by the SEA to be compatible with a number of the SEA objectives as it enables the best use of existing resources.

Water efficiency measures are regarded as the preferred demand management measure from the SEA perspective because they have no potential conflicts with the SEA objectives.

10.1.13 Scenario Analysis

A number of scenarios have been modelled in order to check the stability of the company preferred strategy. The different scenarios were:

- The baseline condition with continuation of current metering policies;
- An “optant” strategy (scenario 1), with metering assumed to be optant and selective (large water users) only. This assumes continuation of the current policy of change of occupier (CoOM) in the Sussex WRZs until the end of AMP4 only. This is useful for comparison with the company’s preferred demand management-led strategy of universal metering;
- A “change of occupier metering” strategy (scenario 2), which is the logical extension to the existing policy of metering on change of occupier throughout the Sussex WRZs. This was useful for comparison with the company’s preferred demand management-led strategy of universal metering;
- A “universal metering” strategy (scenario 3), which assumed 100% meter installation from universal metering for all WRZs by the end of AMP5, together with associated savings due to supply pipe leakage reductions;
- A “regional” strategy (scenario 4), which uses the company preferred universal metering strategy, but with WRSE preferred resource developments

and bulk supplies to other water companies forced into the company only universal metering strategy. Note that the company is a net exporter under this scenario;

- A "leakage rise to Ofwat target" strategy (scenario 8), in which leakage in each WRZ is allowed to rise to the Ofwat target level, provided it is currently below the target level in that WRZ;
- A "universal metering no climate change" strategy (scenario 11) to investigate the impact of climate change, which uses the universal metering strategy but with no climate change impacts on either supplies or on demand; and
- A "hydrid metering scenario" which comprises of universal metering in WRZs that would be in deficit within the planning period, otherwise there would be a continuation of current metering policy.

A summary of the assumptions for each of the scenarios used for the investment model runs is given in Table 10.1.

Scenario name		Basis of scenario	Resource options		Meter policy			Leakage options			Climate change assumed
			Company selected	WRSE selected	Optants & selectives	Change of occupier	Universal	JR08 – 82Ml/d	SPL reductions	Ofwat Target	
1	Optant	Optant & selective meters only	✓	×	✓	×	×	✓	×	×	✓
2	Change of occupier	All WRZs from AMP5 (Sussex WRZs from AMP4)	✓	×	✓	✓	×	✓	×	×	✓
3	Universal metering	Universal metering in all WRZs	✓	×	AMP 4	×	✓	AMP 4	✓	×	✓
4	Regional strategy	As scenario 3, but with WRSE resource developments and bulk supplies forced in	×	✓	AMP 4	×	✓	AMP 4	✓	×	✓
8	Leakage rise to Ofwat target	Based on scenario 3, but with leakage rising to target level in each WRZ	✓	×	AMP 4	×	✓	×	×	✓	✓
11	Universal metering no climate change	Based on scenario 3 but with no climate change impacts on supply or demand	✓	×	AMP 4	×	✓	AMP 4	✓	×	×

Table 10.1 Scenario Analysis Undertaken

A discussion of the hybrid metering strategy is given in section 10.6.

10.1.14 Sensitivity analysis

Sensitivity analysis was undertaken to determine the robustness of the company only least-cost strategy. Sensitivity analysis comprises checking the stability of this strategy to changes in the input data used for the Supply and Demand Forecasts, given the same baseline assumptions.

A number of potential sensitivities in input data were identified on both the Supply Forecast and the Demand Forecast. Sensitivity analysis of different demand side assumptions could for example take account take account of the following:

- The savings associated with universal metering;

- The assumed additional savings from reductions in supply pipe leakage;
- The increased demand for housing projections higher than those envisaged in the Draft South East Plan; and
- The potential reduction in demands due to the introduction of more water efficient house design.

Similarly, sensitivity analysis of different supply side assumptions could take account of the following:

- Potential changes in deployable output due to the impact of new data or the application of new methodologies;
- Possible increases or decreases from the effect of climate change; and
- Possible reductions in deployable output due to the impact of further Sustainability Reductions, the Restoring Sustainable Abstraction programme and the Water Framework Directive.

In view of the potentially complex interaction of all these potential sensitivities which have different magnitudes it was decided to frame the analysis within two basic sensitivity “envelopes”. These comprised a “possible worst-case”, and “possible best-case” sensitivity. Using these envelope sensitivities meant that all potential combinations in the variation of the individual input data could be assessed.

10.2 Overview of Water Resources Strategy

The water resources strategy for each area is set out in detail in sections 10.3 to 10.5. For each area the strategy comprises the following elements, although the balance of the various elements will be different in each area:

During AMP5

- Introduction of universal metering by 2015;
- Asset improvement schemes at a number of groundwater sources that had been identified by the recent review of groundwater source performance;
- The optimum use of inter-zonal transfers, as identified by the investment model;
- Additional inter-zonal transfers, as identified by the investment model;
- The renewal of existing inter-company bulk supplies until the end of the planning period, at the rates at the time of contract renewal;
- New source development, if required, to either close any existing Supply demand balance deficits, and/or to restore security of supplies as a result of Sustainability Reductions; and
- Any further investigation of new resource developments that were identified as past of the WRSE regional modelling work.

From the end of AMP5 through the rest of the planning period to 2035

- It is currently envisaged that no further strategic resource developments will be required to meet Southern Water’s needs under the company only universal metering strategy;
- The strategy will deliver the objective of keeping to the target headroom line, through a delicate balance of a number of factors, including the following; source maximisation through potential licence variations; the refurbishment of a few small, currently disused groundwater sources, which may require fairly advanced treatment solutions; progressive leakage reduction up to 19% below the current outturn level to offset the need for the development of major strategic schemes; and the introduction of further water efficiency savings where it is economic to do so;

- It should be noted that we have included the effects of climate change on both supply and demand side elements. However, these have only been introduced after the end of AMP5, and thus their inclusion will not have any bill impact; however
- Southern Water has reaffirmed its commitment to the WRSE modelling work, in the form of adopting the WRSE preferred regional options in its strategy in addition to those identified in the least-cost company only strategy. Whilst the introduction of these schemes will lead to available headroom in excess of our target headroom requirements. The inclusion of these regional schemes in the company preferred regional strategy will increase the 25-year NPV by £47.4 million above the company only least-cost strategy. Further details are provided in the description of the individual area strategies. We believe that this will not contribute to any bill impact during AMP5 as the regional schemes will not be introduced until AMP6 and beyond. This approach demonstrates our continued commitment to the development of a regional solution.

10.3 The Water Resources Strategy for the Western Area

10.3.1 Location

The Western Area covers part of the county of Hampshire and the whole of the Isle of Wight. It comprises the Water Resource Zones (WRZs) of Hampshire South, Hampshire Kingsclere, Hampshire Andover and the Isle of Wight. The Hampshire South WRZ is located in the southern part of Hampshire, extending from the boundaries of the New Forest in the west towards the River Meon in the east. The Hampshire South WRZ supplies the cities of Southampton and Winchester and towns such as Romsey and Eastleigh, in addition to the surrounding rural areas. The Isle of Wight WRZ covers the whole of the Island. The Hampshire Andover WRZ is centred on the town of Andover, and includes the surrounding area, while the Hampshire Kingsclere WRZ surrounds the town of Kingsclere.

There are the following inter-zonal connections:

- From Hampshire South WRZ to the Isle of Wight WRZ, via the cross-Solent main; and
- A number of very small interconnections between the Hampshire South and Hampshire Andover WRZs.

There is one inter-company transfer:

- A very small bulk export to Wessex Water; and
- There is also a bulk supply to an industrial customer.

A schematic showing the key features of the Western Area is shown as Figure 10.1.

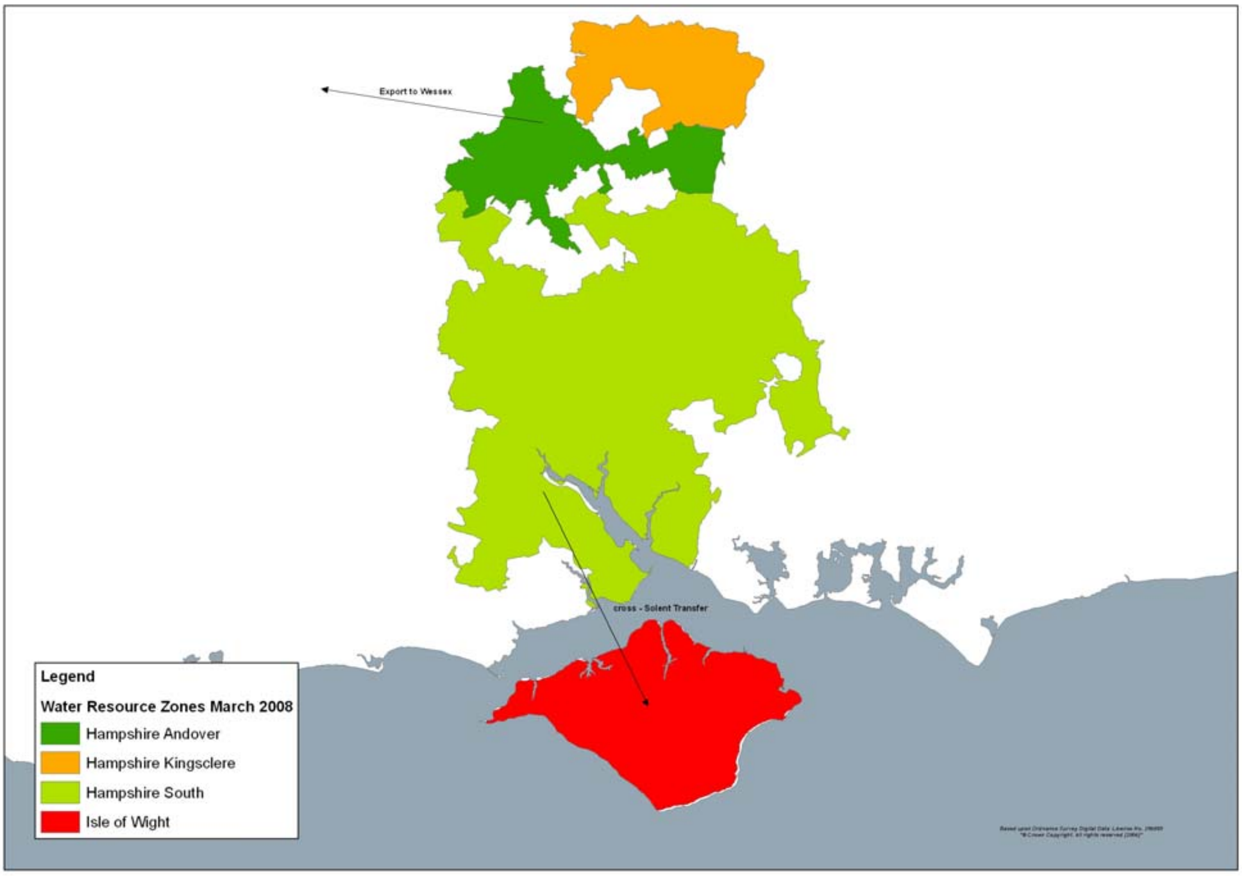


Figure 10.1 Schematic of the Western Area

10.3.2 Sources of Supply

The Western Area is supplied by both surface and groundwater sources. There are three surface water sources and over 30 groundwater sources. The groundwater sources abstract almost exclusively from the Chalk aquifer. The Deployable Output of many of these sources is constrained by the abstraction licence rather than by physical constraints. On the Isle of Wight there are also a number of smaller local groundwater and spring sources from the Greensand aquifers.

The surface water sources comprise the abstractions on the Rivers Test and Itchen in the Hampshire South WRZ, and the Eastern Yar on the Isle of Wight. A significant proportion of the supplies in Hampshire South WRZ is provided by abstractions from the River Test and the River Itchen. Both abstractions are run-of-river sources. Currently there is a Minimum Residual Flow constraint on the Test abstraction, but there are no flow-related constraints in the abstraction licences for the Lower Itchen sources. Flows in the River Itchen can be supported by the Candover and Alre groundwater augmentation schemes which are owned and operated by the Environment Agency.

To date the volume of abstraction from the company's Lower Itchen sources has been limited by the existing licensed quantities and not by hydrology. The groundwater augmentation schemes have not been required to maintain the company's ability to abstract at the licensed volumes. However as discussed in section 10.3.8.1, this situation will change in the future as a direct consequence of proposed changes to these abstraction licences following the Environment Agency Habitats Directive Stage 4 Review of Consents.

The surface water source on the Isle of Wight is located on the River Eastern Yar. It is also a run-of-river scheme. The Minimum Residual Flow condition in the licence means that in most years abstraction is less than the full licensed volume. River flow can be can be supported by a groundwater augmentation scheme which is owned and operated by the company. Typically the scheme is operated in each year.

The Hampshire Andover and Hampshire Kingsclere WRZs are supplied entirely from Chalk groundwater sources.

10.3.3 Supplies Available

The total deployable output for the area is 307.7 Ml/d at MDO and 339.4 Ml/d at PDO. Each WRZ has a different mixture of types of source, and thus a different ratio of groundwater to surface water. These proportions are shown in Table 10.2, which demonstrates that, whilst the area proportion is roughly 50% groundwater : 50% surface water (MDO), this varies from complete dominance of groundwater in the Hampshire Kingsclere and Andover WRZs, to a balance of around 40% groundwater : 60% surface water in Hampshire South WRZ and 67% groundwater : 33% surface water on the Isle of Wight.

WRZ	Groundwater			Surface Water			Total	
	No. sources	MDO Ml/d	PDO Ml/d	No. sources	MDO Ml/d	PDO Ml/d	MDO Ml/d	PDO Ml/d
HS	8	96.33	114.77	2	149.46	149.46	245.79	264.23
IOW	15	20.72	25.49	1	10.00	12.00	30.72	37.49
HA	6	22.47	28.20	0	0.00	0.00	22.47	28.20
HK	2	8.68	9.48	0	0.00	0.00	8.68	9.48
Total	**31**	**148.20**	**177.94**	**3**	**159.46**	**161.46**	**307.66**	**339.40**

Notes: Values are for indigenous sources only, and do not take transfers, either for inter-zonal or inter-company transfers into account.
Further detail is given for individual sources in Appendix D

Table 10.2 Summary of PR09 Base Year (2010-11) Deployable Outputs for the Western Area

This variation in the groundwater to surface water ratio does not have a major effect in the Hampshire South WRZ because the surface water and groundwater sources are closely inter-linked. However, it does have a significant impact on the Isle of Wight WRZ, as discussed in section 10.3.4.

The deployable output values given in Table 10.2 were used as the starting point for the baseline Supply demand balance from 2010 onwards. There will however be changes to the deployable output of the Lower Itchen sources as a result of the proposed changes to those abstraction licences following the Stage 4 Habitats Directive Review of Consents. These reductions have been included within the baseline Supply demand balance for this WRMP as required for Table WRP1a-BL. Further details and discussion regarding the progressive introduction of the proposed Sustainability Reductions is given in section 10.3.8.1.

10.3.4 Strategic Management of Sources

The Hampshire South WRZ is important for the strategic management of water resources for the Isle of Wight. The nature of the Chalk aquifer means that groundwater sources are reliable and that the aquifer provides the baseflow component of flows in the Rivers Test and Itchen which maintain the run-of river supplies.

The Isle of Wight WRZ is unique in a number of respects. It is not self-sufficient in water resources, and relies on transfers via the cross-Solent main from the Hampshire South WRZ to maintain the supply demand balance. The Island was the site of the largest pilot project of the National Metering Trials which began in 1989. More than 90% of domestic properties on the Island are metered, and so the options for additional demand savings from metering and the associated reductions in supply pipe losses are limited.

In addition to its demand management activities, the company has developed a strategy to balance supplies from the mainland through the cross-Solent main with indigenous surface water and groundwater resources. The overall aim is to rest indigenous groundwater sources for as long as possible so that there is sufficient groundwater storage to maintain supplies during long dry summer periods. The value of this policy was demonstrated during 2003 when the cross-Solent main was damaged and groundwater sources were needed to maintain supplies on the island. Because the groundwater sources had been rested there was sufficient storage to maintain supplies. The policy also proved valuable during the 2004-06 drought, when the lack of recharge resulted in low levels of groundwater storage so that groundwater source were operating at or close to deployable output.

The Hampshire Andover WRZ has adequate indigenous supplies. Although there are some points where its distribution network is connected to the Hampshire South WRZ, the capacity for transfers between the two WRZs is limited. The Hampshire Kingsclere WRZ is a self-standing WRZ that also has sufficient indigenous supplies.

10.3.5 Demand Summary

Southern Water provides drinking water to a population in the area of about 803,000. Normal year average annual demands are 195.1 Ml/d, which can rise to 214.7 Ml/d during dry years. However, during dry years, the demands at the critical MDO and PDO periods can be 208.5 Ml/d and 279.2 Ml/d respectively, as shown in Table 10.3.

WRZ	Population (000s)	Normal Year Average Annual demand (Ml/d)	Dry Year Annual Average demand (Ml/d)	Dry Year MDO demand (Ml/d)	Dry Year Peak Period demand (Ml/d)
Hampshire South	589.15	144.42	157.83	152.33	206.41
Hampshire Kingsclere	14.81	5.06	5.24	4.95	7.13
Hampshire Andover	63.90	15.28	16.62	17.51	21.30
Isle of Wight	135.20	30.31	34.96	33.70	44.36
Western Area	**803.06**	**195.07**	**214.65**	**208.49**	**279.20**

Table 10.3 Summary of Base Year (2007-08) Demands in the Western Area (Ml/d)

10.3.6 Strategic Development to Date

There have been a number of strategic developments in the area over the last 10-15 years, which are summarised as follows:

- Leakage has been reduced over the last 12 years from 33.7 Ml/d to 26.0 Ml/d;
- There has been an increase in meter installation over the last 12 years in the Hampshire WRZs from 11% to 30%. The Isle of Wight became essentially fully metered as part of the National Metering Trials which began in 1989; and
- In the light of the current robustness of the area's sources and the positive supply demand balance there have been no significant strategic supply side improvements in recent years. However, the cross-Solent main was replaced in 2008, with an increase in actual transfer capacity from 12 Ml/d to 14 Ml/d.

The underwater pipeline was sized to allow an increase up to 20 Ml/d subject to additional infrastructure upgrades at either end.

10.3.7 Levels of Service

This area, as with other parts of the South East, has suffered from the effects of the recent droughts, in 1989-92, 1995 and more recently 2004-06. However, due the robustness of sources and the healthy existing supply demand balance surplus, the area was not as badly affected as the other areas within Southern Water.

A review of the past performance against Target Levels of Service for both the demand (Customer Level of Service) and supply (Environment Level of Service) sides is given below.

10.3.7.1 Customer Level of Service

A summary of the frequency of restrictions since 1989, compared to Target Levels of Service, is given in Table 10.4:

- Hosepipe bans have been imposed on the Isle of Wight for two years giving a percentage of 10%; and
- The Isle of Wight is the only WRZ to have had a hosepipe ban. Although hosepipe bans were in force over parts of two reporting years, the actual duration was less than 24 months, so the appropriate measure for the Island is 4%.

For ease of comparison this analysis has assumed that sprinkler and unattended hosepipe bans have the same Target Level of Service as full hosepipe bans (1-in-10 years) although strictly speaking, the Target Level of Service for sprinkler and unattended hosepipe bans is 1-in-8 years.

WRZ	Target Level of Service		Actual Level of Service	
	1 in x years	% years	% no. of reporting years (taken as the no. of years, irrespective of duration during the year)	Time expressed as % of (population x weeks)
Hosepipe/Sprinkler ban				
Hampshire South	1:10	10%	0%	0%
Hampshire Andover	1:10	10%	0%	0%
Hampshire Kingsclere	1:10	10%	0%	0%
Isle of Wight	1:10	10%	10%	4%
Western Area	**1:10**	**10%**	**10%**	**1%**
Drought Orders implemented “Non-essential use” ban				
Hampshire South	1:20	5%	-	-
Hampshire Andover	1:20	5%	-	-
Hampshire Kingsclere	1:20	5%	-	-
Isle of Wight	1:20	5%	-	-
Western Area	**1:20**	**5%**	-	-

Table 10.4 Summary of Restrictions in the Western Area Since 1989

There have been no occasions on which an application has been made, or prepared, for a Drought Order to limit or restrict the so-called “non-essential uses” of water. This has been due to the relative healthy status of the supply demand balance to date.

Table 10.4 clearly shows the resilience of Western Area to past drought events and that the company has always been able to meet its customer Target Levels of Service.

10.3.7.2 Environmental Levels of Service

There was considerable stress on the Isle of Wight sources during the 2004-06 drought. A Drought Order was granted for the U433 source, where the groundwater abstraction is itself subject to a local Minimum Residual Flow condition. The unusually high rainfall during May 2006 meant that it was not necessary to abstract under the terms of the Drought Order. Nevertheless it was vital that the Drought Order was in place in good time should the lack of winter rainfall have persisted to May and beyond.

Southern Water considers that the past performance against environmental Target Levels of Service has been satisfactory.

10.3.7.3 Influence of a supply demand balance deficit on operations during a drought

During the AMP5 period there are no supply demand balance deficits forecast in any of the WRZs in the Western Area, namely the Isle of Wight, Hampshire South, Hampshire Andover and Hampshire Kingsclere WRZs.

10.3.8 The Baseline Supply Demand Balance for the Western Area

The baseline supply demand balances in the WRP Tables assume the following:

- Continuation of current metering policies. In 2007-08 there were 326,600 domestic properties in this area, 45% of which were metered. By 2015, the number of metered domestic properties is expected to rise to 206,300;
- Deployable outputs according to Unified Methodology, which ensures that the deployable outputs for groundwater and surface water sources are estimated for the same design drought event;
- Deployable outputs include assumed incremental yields from source improvements planned for the AMP5 period, with timings assumed throughout the AMP5 period;
- Sustainability Reductions, as given by the Environment Agency, but with a progressive timetable for implementation, from 2015, as set out in the draft Memorandum of Understanding developed as a result of discussions between Ofwat, EA, Portsmouth Water and the company since the draft WRMP;
- Renewal of existing inter-company bulk transfers until the end of the planning period, at the rates prevailing at the time of contract renewal; and
- In the baseline supply demand balance, inter-zonal transfers are adjusted to ensure the optimal use of surplus resources. For the investment model however, the transfers are set to zero at the start of the planning period. Then transfer options up to the full transfer capacity can be selected by the model as part of the derivation of a least-cost solution.

The baseline supply demand balances for each WRZ in the Western Area, assuming Sustainability Reductions, are given in Table 10.5 for both the MDO and PDO conditions. These supply demand balances over the planning period are shown in annotated graphs in Figure 10.2 to Figure 10.9.

Implementation of universal metering throughout the area by 2015 would lead to the following reductions in demand;

- Hampshire South WRZ: 6.9 Ml/d (MDO) and 13.6 Ml/d (PDO);
- Isle of Wight WRZ: 0.3 Ml/d (MDO) and 0.6 Ml/d (PDO);
- Hampshire Andover WRZ: 0.8 Ml/d (MDO) and 1.3 Ml/d (PDO); and
- Hampshire Kingsclere WRZ: 0.1 Ml/d (MDO) and 0.2 Ml/d (PDO).

Water Resource Zone	Planning scenario	Base year 2007-08	2009/10	Start of planning period 2010-11	2014-15	2019-20	2024-25	2029-30	2034-35
Hampshire South	MDO	49.32	50.14	43.26	52.85	-39.26	-40.45	-42.19	-44.17
Isle of Wight	MDO	4.65	4.19	6.87	8.24	-6.02	-6.56	-7.26	-7.96
Hampshire Andover	MDO	2.45	2.43	2.04	2.35	2.28	2.13	1.96	1.73
Hampshire Kingsclere	MDO	2.63	2.68	2.70	2.74	2.73	2.70	2.66	2.63
Hampshire South	PDO	22.66	23.73	3.76	18.82	-52.26	-52.54	-54.36	-56.80
Isle of Wight	PDO	-0.90	-1.67	1.62	3.34	-11.57	-12.94	-14.50	-16.07
Hampshire Andover	PDO	2.63	2.63	2.48	2.85	2.89	2.74	2.59	2.733
Hampshire Kingsclere	PDO	0.10	0.19	0.52	1.79	1.80	1.73	1.69	1.66

Notes: All figures in Ml/d
Positive figures indicate a surplus of resources, negative indicate a deficit

Table 10.5 Baseline Supply Demand Balances for Western Area for the MDO and PDO Condition, Assuming Sustainability Reductions

These baseline supply demand balances assume that after 2014-15, when the progressive implementation of the Sustainability Reductions begins, the full inter-zonal transfer from Hampshire South to the Isle of Wight through the cross-Solent main ceases, but any water that is available in the Hampshire South WRZ can still be transferred. At the same time, the investment model is able to choose whether it is better to cease, continue, or increase, existing inter-zonal transfers, or to develop new resources, or to enhance demand management activities in the WRZ in deficit.

Under a scenario which makes allowance for Sustainability Reductions, the following summary of the baseline condition applies, for both the MDO and PDO condition:

- The Hampshire South WRZ starts the planning period with a significant surplus for both the MDO and PDO condition. However, this is radically changed to a very significant deficit in 2019-20, as a result of the introduction of the full Sustainability Reductions for the River Itchen by the end of AMP6. It is assumed that in the previous four years of AMP6 the Sustainability Reduction can be progressively introduced as the level that ensures that available headroom equals target headroom in each year (see Figure 10.3 and Figure 10.7);
- The Isle of Wight WRZ starts the planning period in surplus for the MDO condition and with a small deficit for the PDO condition. This situation remains until the introduction of the Sustainability Reductions for the River Itchen, when the WRZ falls sharply into a significant deficit. Any transfer from Hampshire South WRZ would be at the expense of even greater deficits in that WRZ;
- The Hampshire Andover WRZ starts the planning period in surplus and remains so until the end of the planning period; and

- The Hampshire Kingsclere WRZ starts the planning period in surplus and remains so until the end of the planning period.

The severe impact of the proposed Sustainability Reductions for the River Itchen on the supply demand balances for both the Hampshire South and Isle of Wight WRZs can be clearly seen.

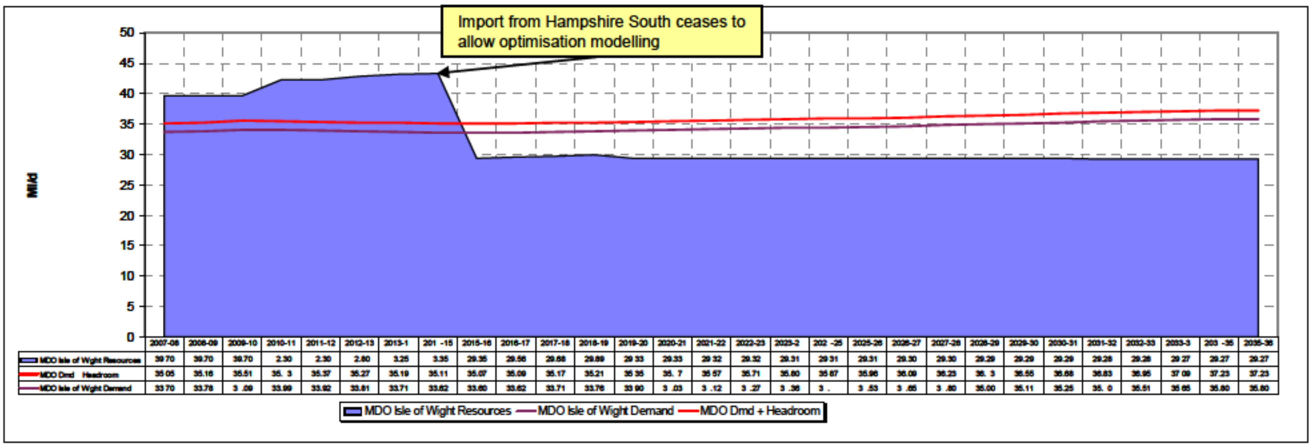


Figure 10.2 Isle of Wight MDO Baseline Supply Demand Balance assuming Sustainability Reductions

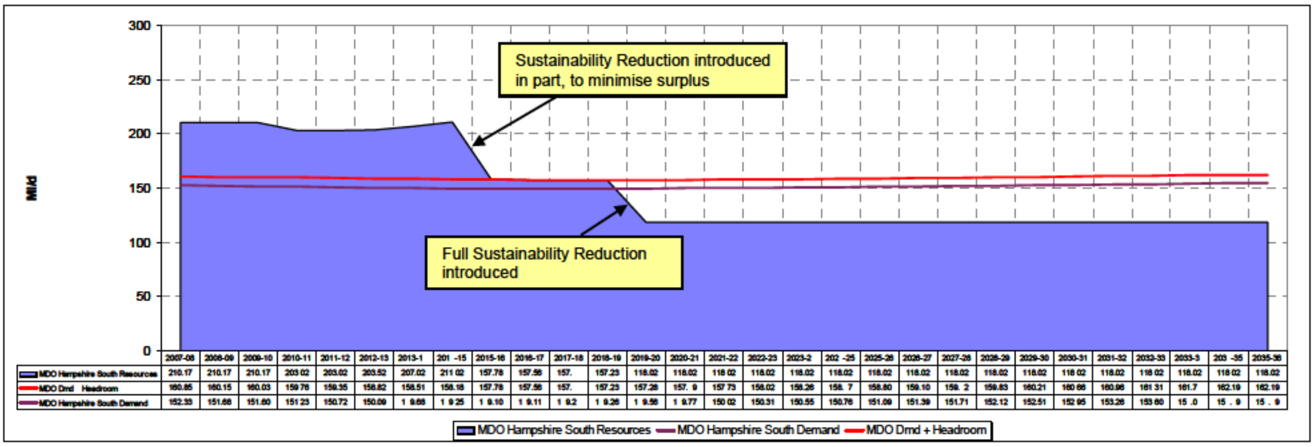


Figure 10.3 Hampshire South MDO Baseline Supply Demand Balance assuming Sustainability Reductions

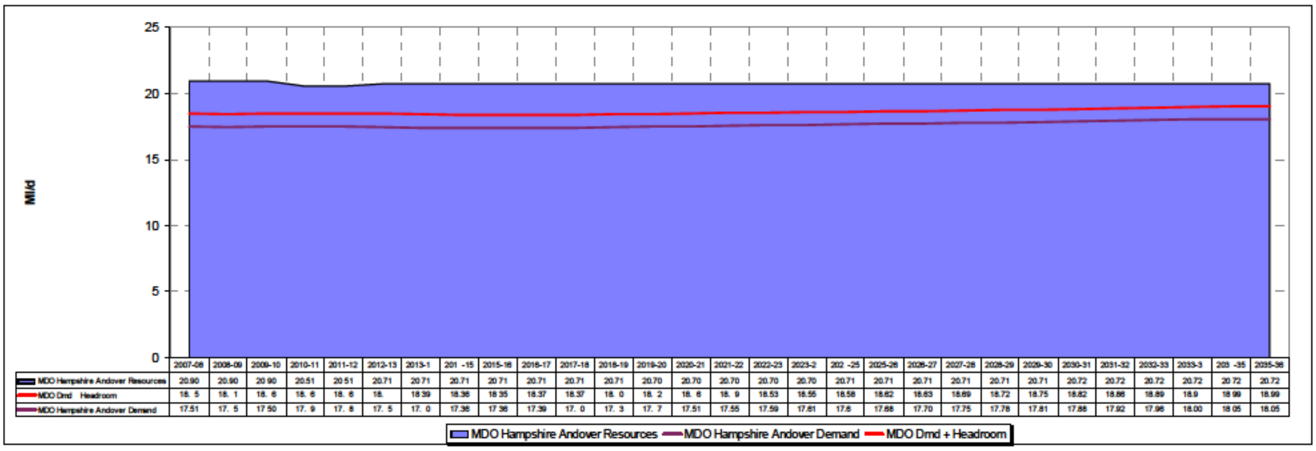


Figure 10.4 Hampshire Andover MDO Baseline Supply Demand Balance

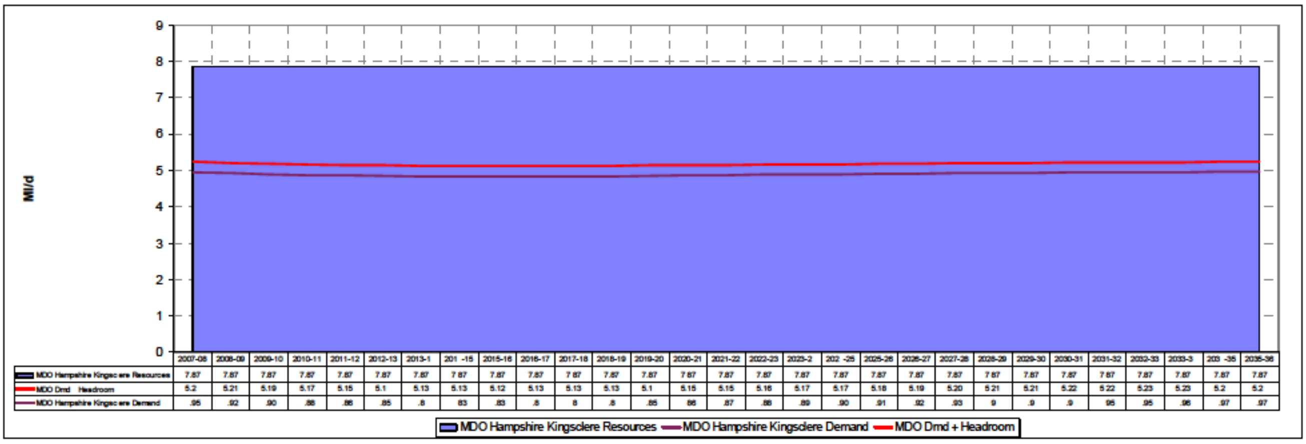


Figure 10.5 Hampshire Kingsclere MDO Baseline Supply Demand Balance

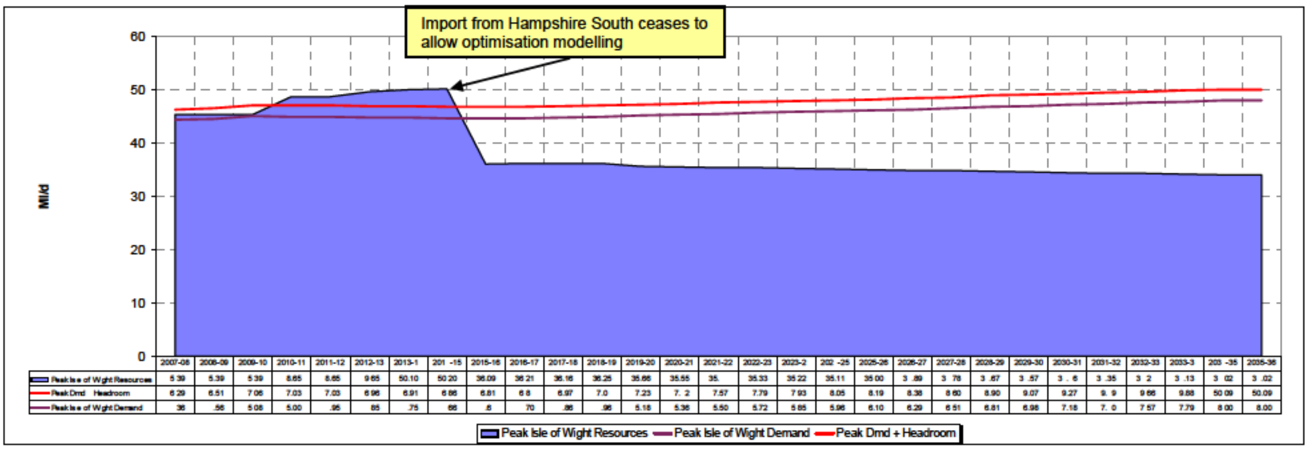


Figure 10.6 Isle of Wight PDO Baseline Supply Demand Balance assuming Sustainability Reductions

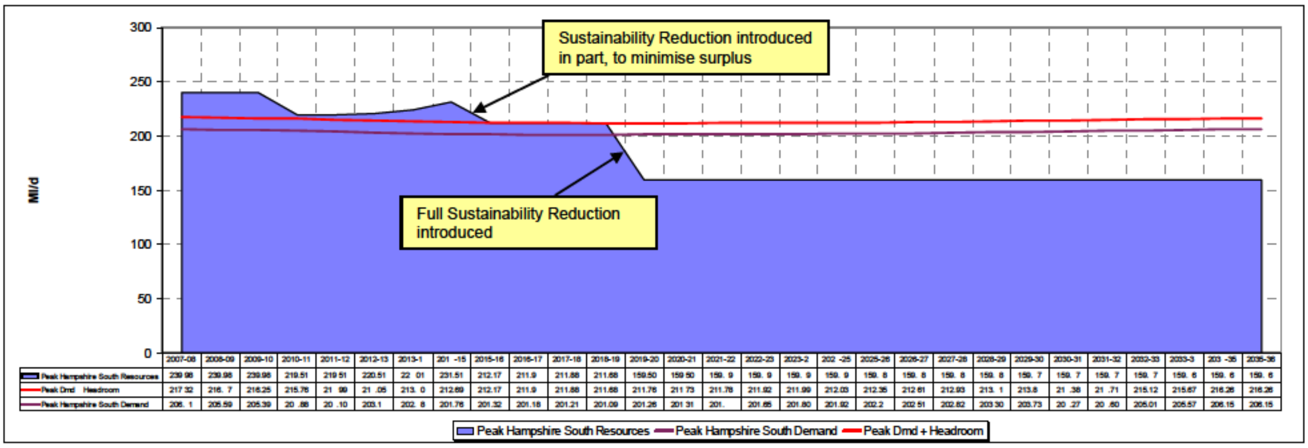
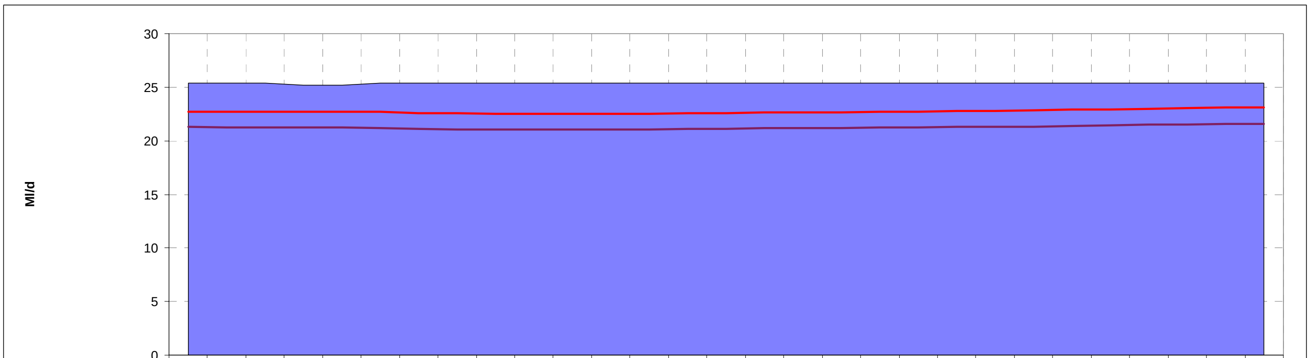
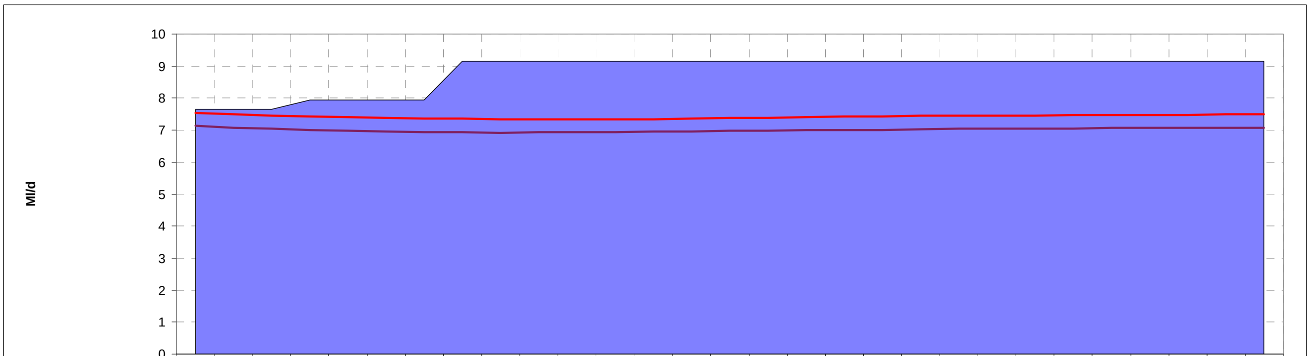


Figure 10.7 Hampshire South PDO Baseline Supply Demand Balance assuming Sustainability Reductions



	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-1	201 -15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-2	202 -25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-3	203 -35	2035-36
Peak Hampshire Andover Resources	25.38	25.38	25 38	25.22	25.22	25. 2	25. 2	25. 2	25. 2	25. 2	25. 2	25. 2	25. 2	25. 2	25. 2	25. 2	25. 2	25. 2	25. 2	25. 2	25. 2	25. 2	25. 2	25. 2	25. 2	25. 2	25. 2	25. 2	25. 2
Peak Dmd Headroom	22.7	22.69	22 7	22.7	22.73	22.69	22.61	22 57	22.53	22.53	22.51	22.52	22 52	22.56	22.60	22.63	22.65	22.68	22.71	22.72	22.78	22.80	22.83	22.90	22.9	22.98	23 03	23.09	23.09
Peak Hampshire Andover Demand	21.30	21.23	21 27	21.25	21.2	21.19	21.10	21 0	21.01	21.03	21.02	21.05	21 07	21.09	21.12	21.15	21.16	21.18	21.22	21.22	21.28	21.30	21.33	21. 1	21.	21. 8	21 53	21.59	21.59

Figure 10.8 Hampshire Andover PDO Baseline Supply Demand Balance



	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-1	201 -15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-2	202 -25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-3	203 -35	2035-36
Peak Hampshire Kingsclere Resources	7 65	7.65	7.65	7 95	7.95	7.95	7 95	9.15	9.15	9.15	9.15	9.15	9.15	9.15	9.15	9.15	9.15	9.15	9.15	9.15	9.15	9.15	9.15	9.15	9.15	9.15	9.15	9.15	9.15
Peak Dmd Headroom	7 55	7.50	7. 6	7. 3	7. 0	7.38	7 37	7.36	7.35	7 35	7.35	7.3	7.35	7 36	7.37	7 39	7. 0	7. 2	7. 2	7.	7. 5	7. 6	7. 6	7. 6	7. 7	7. 7	7. 8	7. 9	7. 9
Peak Hampshire Kingsclere Demand	7.13	7.08	7.0	7 01	6.98	6.96	6 9	6.93	6.92	6 93	6.9	6.9	6.95	6 96	6.97	6 98	6.99	7.01	7.01	7.03	7.0	7.05	7 05	7.05	7.06	7.06	7.07	7.08	7 08

Figure 10.9 Hampshire Kingsclere PDO Baseline Supply Demand Balance

10.3.8.1 The Impact of the Proposed Sustainability Reductions

The Habitats Directive Stage 4 Review of Consents undertaken by the Environment Agency concluded that Sustainability Reductions were required to mitigate the effect of current abstractions (including Habitat Directive sites) which have been "investigated and identified" as having a detrimental effect on the environment. The Environment Agency *Water Resources Planning Guideline* (April 2007) requires water companies to include "Sustainability Reductions" in their WRMPs.

The River Itchen is designated as a Special Area of Conservation (SAC). The Environment Agency completed its Stage 4 Review of Consents (November 2007) as part of its assessment of abstractions at the River Itchen SAC. The 48 water resource permissions reviewed by the Environment Agency include public water supply licences (including Southern Water's abstractions), spray irrigation, industrial and industrial cooling, fish farms, watercress farms and two augmentation schemes (River Alre augmentation scheme and Candover boreholes scheme).

The outcome of the Stage 4 Review of Consents was that the Environment Agency has advised Southern Water that significant changes to the Southern Water Lower Itchen abstraction licences are required.

The changes that the Environment Agency proposes to make are as follows:

(a) An aggregate monthly abstraction maximum in the following months:

- June – 4,110 Ml;
- July – 3,940 Ml;
- August – 3,445 Ml; and
- September – 2,280 Ml;

(b) An annual aggregate of 51,138 Ml; and

(c) A "hands off flow" (HoF) condition to be imposed, at 198 Ml/d.

The impact of these proposed changes to abstraction licences results in a very significant reduction in deployable output from the sources affected. The latest NEP letter from the Environment Agency dated 28th November 2008 states that there will be a reduction in deployable output of 104 Ml/d and 86 Ml/d for the MDO and PDO conditions respectively. These reductions represent approximately 50% of the public water supply demand under the respective critical planning periods. The baseline supply demand balance therefore shows a significant deficit when the Sustainability Reductions take effect in 2019-20. This major impact is evident not only in Hampshire South WRZ but also in the Isle of Wight WRZ because once the supply demand balance in the Hampshire South WRZ moves into deficit transfers through the cross-Solent main would not necessarily be available. The Isle of Wight WRZ then also suffers a significant supply demand balance deficit.

Hampshire South WRZ currently has a healthy supply demand balance with available headroom above target headroom. Following implementation of the Sustainability Reductions, funding to restore available headroom to its current level would not be available which means that the current security of the supply demand balance in the WRZ would be reduced.

10.3.9 Options to Meet the Supply Demand Balance in the Western Area

A number of supply side and demand side options have been considered to meet any supply demand balance deficit.

The supply side options have been assessed using the options appraisal methodology described in section 8. In summary an initial list of over 100 options within the Western Area was considered; further details are given in Appendix G. However the availability of new resources within Hampshire South WRZ is severely constrained as a result of the Environment Agency's CAMS process which concluded that all the surface water and groundwater management units are "over licensed", with some management units considered to be "over abstracted".

Following the various successive screening processes, the number of "feasible" options, by generic type, that was chosen to be available for selection by the investment model can be summarised, by generic type, as follows:

- Two sites for surface storage reservoirs, for which the sole lead promoter would be Southern Water;
- Six sites for possible increases in abstraction from either surface water or groundwater;
- No sites for enlarging existing reservoirs;
- Three sites for potential re-commissioning of old/existing sources;
- No possible abstraction licence variations;
- One site for the further upgrade of WSW treatment facilities, for the purposes of the supply demand balance;
- Three potential inter-zonal bulk transfers, either existing or proposed;
- No potential inter-company bulk transfers, either existing or proposed;

- Four potential schemes for wastewater recycling;
- No sites for potential Aquifer Storage and Recovery schemes; and
- Nine potential schemes for desalination.

This shows that a wide range of generic types of option were available for selection, thus ensuring that the selection of preferred schemes was robust. The total number includes a number of generic schemes, for instance desalination at the same site but at different capacities. This is to ensure that a generic option is not ruled out from selection on the basis of capacity and cost alone.

There are three generic types of demand side options: metering; leakage reduction; and water efficiency. Different modelling scenarios have been devised to reflect a different selection of options (see section 10.1.13).

As noted in section 10.3.8, scenario 3 (Universal Metering) has been used as the starting point for the supply demand balance from which the Final Planning Solution has been developed.

In order to consider leakage options, a number of incremental "step" reductions in leakage were considered, based on outputs from the Sustainable Economic Level of Leakage analysis as explained in Chapter 6 and Appendix E.

Water efficiency options for both household and non-households were included in the model. More details of the options are given in section 8 and Appendix G.

10.3.10 The Water Resources Strategy for the Western Area

The water resources strategy is described in three different sections over the planning period:

- AMP5, the first five years from 2010-11 to 2014-15, which formed the basis of the Final Business Plan Submission;
- AMP6 to the end of the planning period, based on the company only least-cost strategy; and then
- An explanation of how this company only strategy is modified to take into account the recommendations of the current WRSE regional modelling results.

The company preferred water resources strategy for each of these intervals, with Sustainability Reductions, is described below and is summarised in Table 10.6.

During AMP5 (2010-15)

The supply demand balance will be satisfied for the Western Area for the AMP5 period through the following:

- A policy of universal metering throughout the area by 2015, which will give benefits in terms of demand savings and associated reductions in supply pipe leakage;
- The optimisation of inter-zonal transfers, from the Hampshire South WRZ to the Isle of Wight WRZ via the cross-Solent main;
- A series of groundwater source improvements, which could deliver over 9 Ml/d for the average condition;
- The development of Testwood WSW up to the current licence limit; and
- The development of the enabling Testwood to Otterbourne transfer.

The Testwood schemes need to be implemented during AMP5 so that implementation of the Sustainability Reductions on the River Itchen can begin from the start of AMP6.

From AMP6 to the end of the planning period (2015-35) (company only)

For the company only least-cost solution, there are a number of other interventions that will be required for on both the supply and demand side, as follows:

- The transfer of the Candover/Alre augmentation scheme to Southern Water from the Environment Agency, to enable the full yield benefits of the scheme to be realised, and satisfy any residual supply demand balance deficit arising from the Sustainability Reductions;
- The refurbishment of two small groundwater sources, at K628 and L536, on the Isle of Wight;
- The refurbishment of three groundwater sources, at R176, O541 and O641, in the Hampshire South WRZ;
- Water efficiency kits being issued on the Isle of Wight as part of a SELWE approach; and
- A total further reduction in leakage of 8.9 Ml/d, which is equivalent to a reduction of 34% below the 2007-08 outturn figure.

From AMP6 to the end of the planning period (2015-35) (company preferred regional solution)

The results of the WRSE modelling results did not suggest any further options that were not included in the company only least-cost solution, and so the company preferred regional solution is the same as the company only least-cost strategy. Therefore, there are no incremental costs to the strategy.

Water Resource Zone	Schemes During AMP5	Schemes beyond AMP 5 – company only solution	Schemes beyond AMP 5 – Water Resources in the South East of England
Isle of Wight	• Enhanced Metering • Asset improvement schemes for groundwater sources (1.55 Ml/d peak, 1.05 Ml/d average) • Optimisation of inter-zonal transfers (cross-Solent main)	• Water Efficiency kits • 1.1 Ml/d further leakage reduction • Refurbishment of L536 borehole • Refurbishment of K628 borehole	As previous column
Hants South	• Universal Metering • Asset improvement schemes for groundwater sources (12.00 Ml/d peak, 8.00 Ml/d average) • Increase Testwood WSW to licence limit • Development of the enabling Testwood to Otterbourne transfer • Optimisation of inter-zonal transfers (cross-Solent main)	• Candover & Alre augmentation schemes • 7.8 Ml/d of leakage reduction • R176 borehole rehabilitation And, subject to satisfactory completion of AMP5 schemes: • River Itchen Sustainability Reductions residual at end of AMP5	As previous column
Hants Kingsclere	• Universal Metering • Asset improvement schemes for groundwater sources (1.2 Ml/d peak only)		
Hants Andover	• Universal metering • Asset improvement schemes for groundwater sources (0.2 Ml/d peak & average)		

Table 10.6 Summary of Water Resources Strategy for the Western Area, with Sustainability Reductions

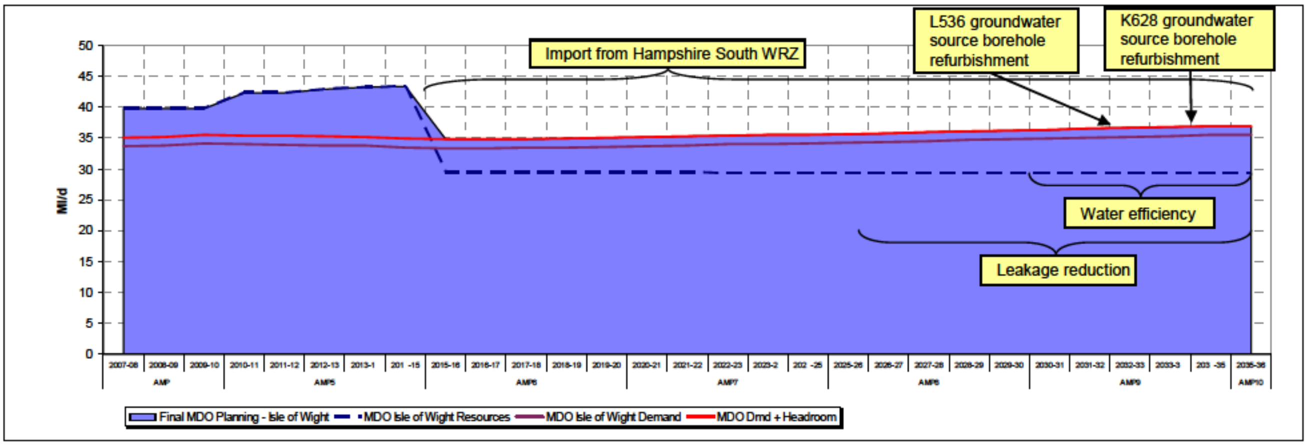


Figure 10.10 Isle of Wight Company Preferred Regional Strategy (Scenario 4), assuming Sustainability Reductions, MDO Solution

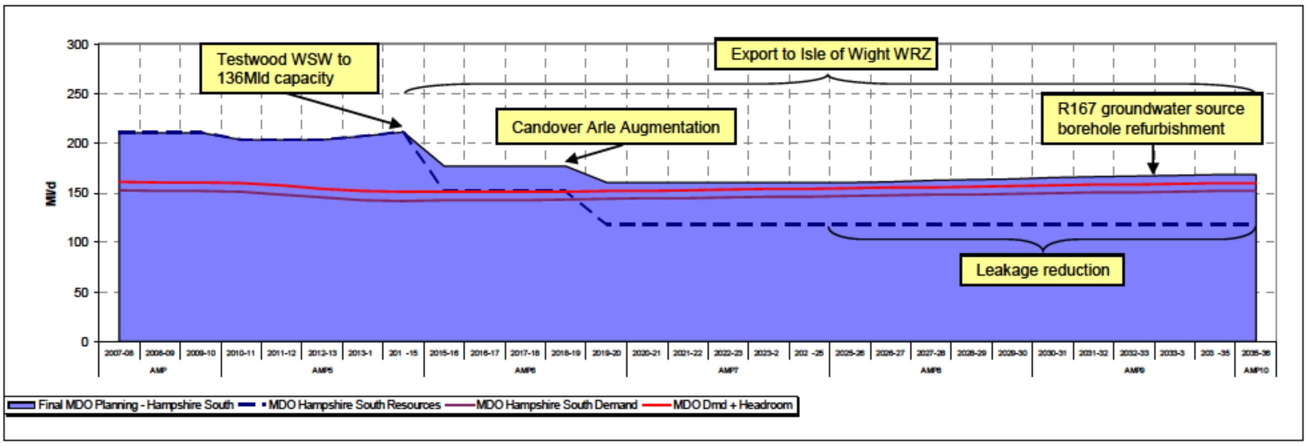


Figure 10.11 Hampshire South Company Preferred Regional Strategy (Scenario 4), assuming Sustainability Reductions, MDO Solution

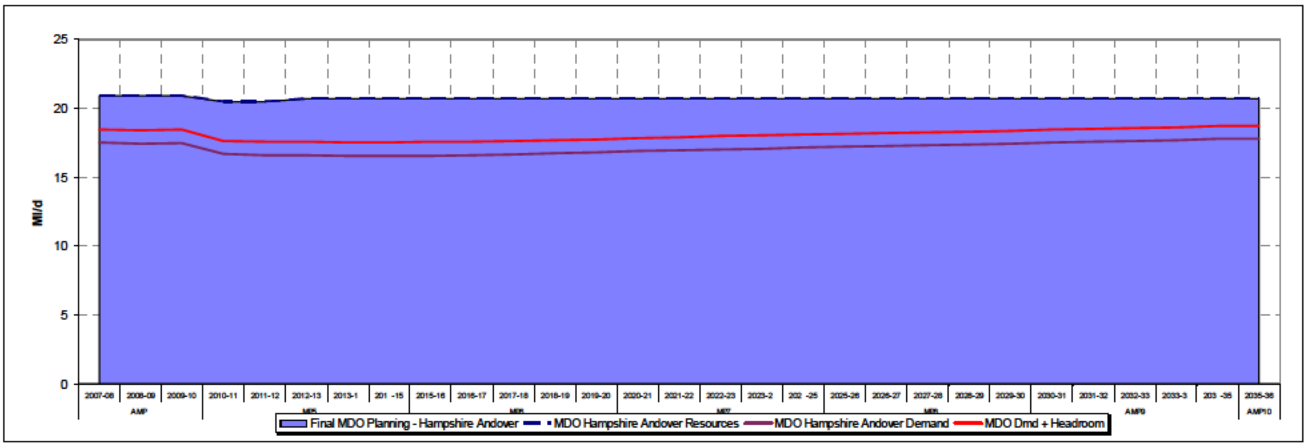


Figure 10.12 Hampshire Andover Company Preferred Regional Strategy (Scenario 4), MDO Solution

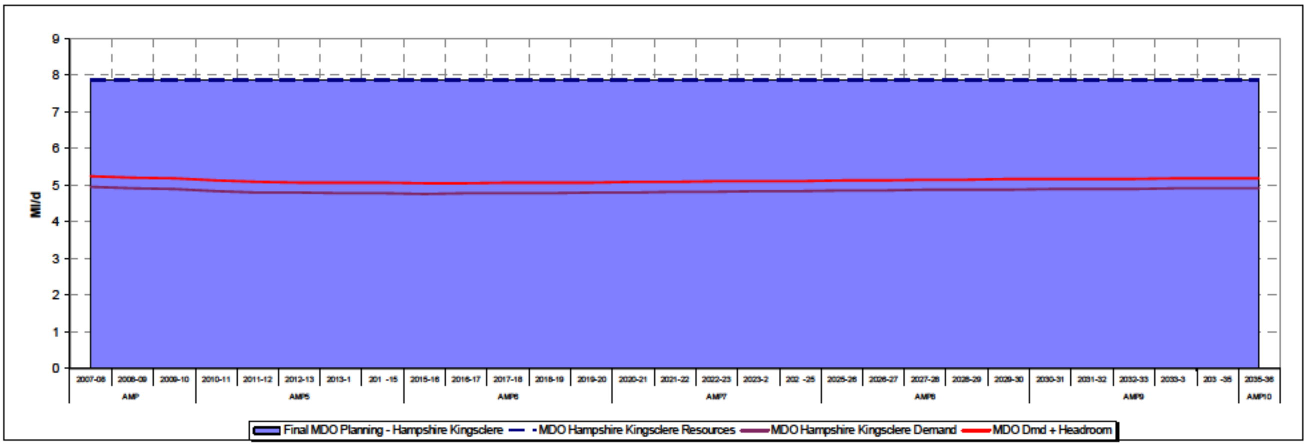


Figure 10.13 Hampshire Kingsclere Company Preferred Regional Strategy (scenario 4), MDO Solution

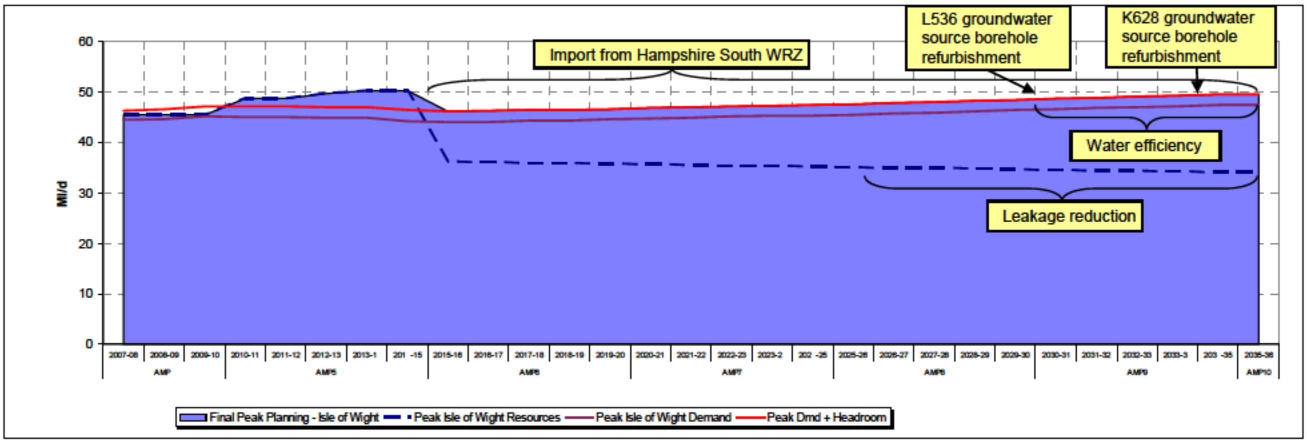


Figure 10.14 Isle of Wight Company Preferred Regional Strategy (Scenario 4), assuming Sustainability Reductions, PDO Solution

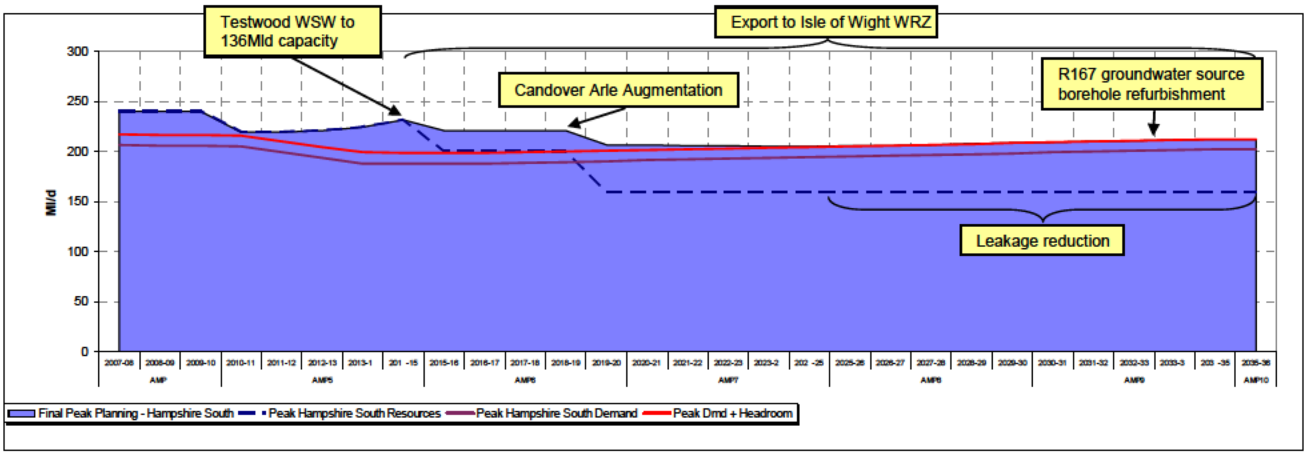


Figure 10.15 Hampshire South Company Preferred Regional Strategy (Scenario 4), assuming Sustainability Reductions, PDO Solution

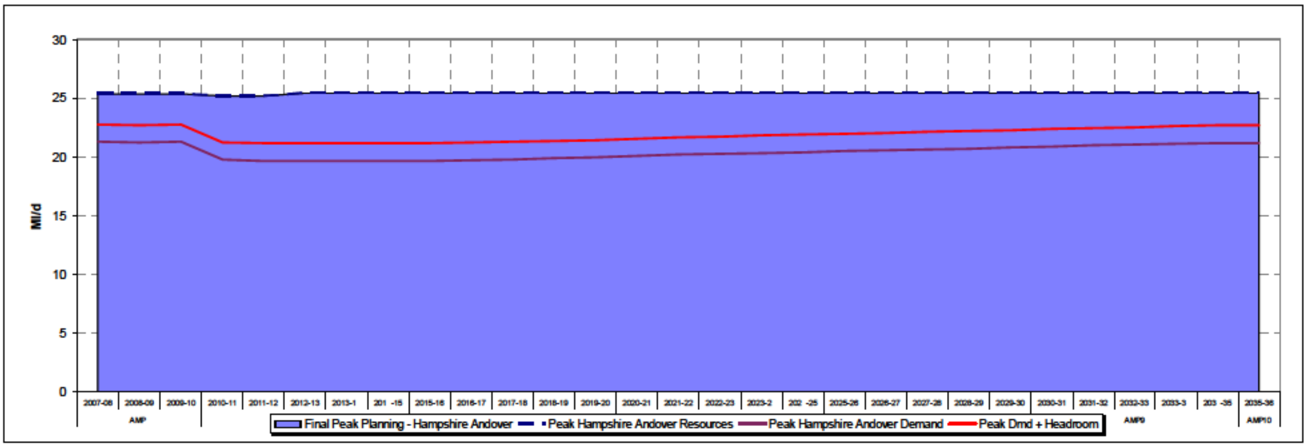


Figure 10.16 Hampshire Andover Company Preferred Regional Strategy (Scenario 4), PDO Solution

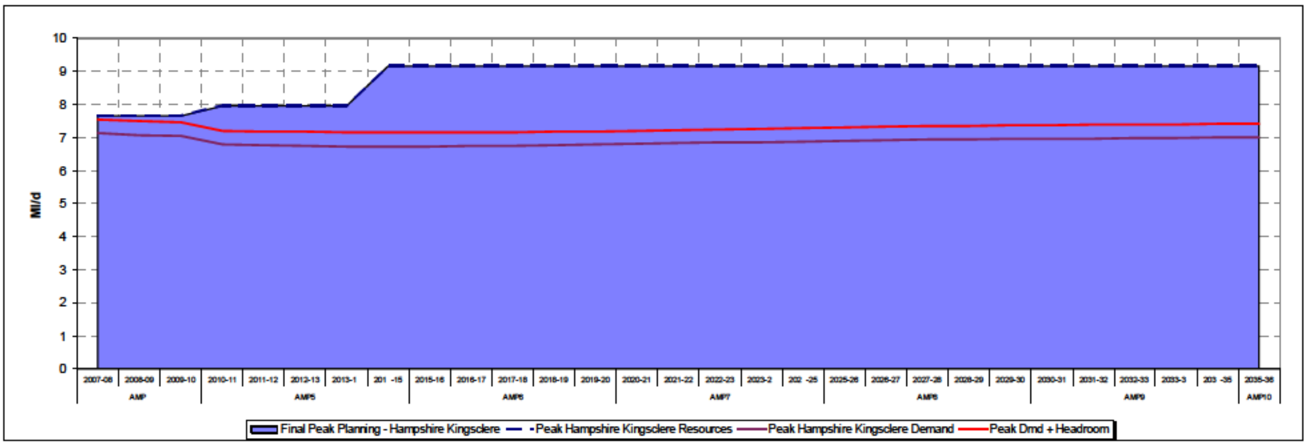


Figure 10.17 Hampshire Kingsclere Company Preferred Regional Strategy (Scenario 4), PDO Solution

10.3.10.1 SEA Influence on Strategy

All options were assessed against 17 SEA objectives, and assigned an overall environmental risk (high, medium or low), based on the significance of potential long term effects.

Table 10.7 sets out the environmental risk of each resource development option. More detail is given in Appendix I.

Option	Environmental Risk Score
Development of Testwood WSW up to the current licence limit	Medium
Augmentation with the Alre and Candover Schemes	Medium
R176 borehole rehabilitation	Medium
Refurbishment of L536 Borehole	Medium
Refurbishment of K628 borehole	Medium
Woodmill abstraction (56 Ml/d) and treatment at Otterbourne	Medium
Colden Common Reservoir	High
Cross Solent Increase	Medium
Sandown wastewater recycling (5Ml/d)	Medium

Table 10.7 Environmental Risks of Resource Development Options Selected in the Western Area Strategy

The demand management options (metering; leakage reduction; and water efficiency) were also assessed against the SEA objectives. More detail is given in Appendix I. All three generic demand management measures are broadly compatible with the majority of SEA objectives due to the minimal amount of physical intervention required in implementing each measure. However, water efficiency measures have no potential conflicts with SEA objectives and are therefore the preferred demand management measure from an SEA perspective.

10.3.10.2 SEA preferred strategy

Options assessed as being likely to result in the lowest environmental risk are preferable from a SEA perspective. None of the options in the Western Area were assessed as being likely to have a low environmental risk.

The overriding objective of this WRMP is to identify a package of options that removes the risk of supply demand balance deficits over the whole of the planning period. It is therefore necessary to include within the SEA preferred strategy some options that had been assessed as having medium environmental risk. Employing the mitigation measures proposed for each option will enable the likely environmental damage from adopting these options to be reduced. The medium risk options from the SEA are:

- R176 borehole rehabilitation;
- K628 borehole refurbishment;
- L536 borehole refurbishment;
- J358 WSW route 1;
- Development of Testwood WSW up to the current licence limit (capacity increase to 136 Ml/d);
- Augmentation with the Alre and Candover Schemes;
- Cross-Solent Increase;
- Sandown wastewater recycling;
- Testwood to Otterbourne;

- Woodmill Abstraction (56 Ml/d) and treatment at Otterbourne or Gaters Mill; and
- Woodmill Abstraction (85 Ml/d) and treatment at Otterbourne or Gaters Mill.

The company preferred strategy is therefore compatible with the SEA preferred strategy, with the exception of L536 Borehole which has strong negative effects because pipeline routes are located within an AONB. This scheme is not required under the company preferred strategy until the end of the planning period. However, detailed consideration of all potential mitigation measures would be needed prior to introducing this scheme.

A preliminary 'high-level' strategic assessment was undertaken of the possible impact of the proposed plan on the integrity of European and Ramsar sites under the Habitats Regulations. This concluded that sufficient safeguards are available to ensure that implementation of the plan will not adversely affect the integrity of any of the protected sites.

10.3.11 Scenario Analysis

A number of scenarios have been modelled, in order to check the stability of the company preferred strategy to changes in some of the basic assumptions.

	Scenario	**Company preferred Regional strategy**	**Company only Universal metering**	**Company only Change of occupier**	**Company only Optant**	**Company only Universal metering with no climate change**	**Company only Leakage rise to Ofwat target**	**Hybrid Baseline where no deficit, otherwise universal metering**
	Number	**4**	**3**	**2**	**1**	**11**	**8**	
	Metering policy	Universal	Universal	Change of occupier	Optant and selective	Universal	Universal	Universal or optant
	Leakage policy	JR08, then SPL saving	JR08, then SPL saving	JR08	JR08	JR08, then SPL saving	Ofwat, then SPL saving	JR08, then SPL saving
	WRSE preferred options & bulk supplies	Yes	No	No	No	No	No	Yes
WRZ	**Scheme**	**Earliest year required**						
Hampshire South	Testwood new DAF plant to utilise full licence & enabling transfer pipeline to Otterbourne	2015	2015	2015	2015	2015	2015	2015
Hampshire South	Candover Alre Augmentation	2019	2019	2019	2019	2019	2019	2019
Hampshire South	West Tytherley borehole rehabilitation	2033	2033	2031	2027	-	-	2033
Hampshire South	Woodmill abstraction (56 Ml/d) and treatment at Otterbourne	-	-	-	-	-	2028	-
Hampshire South	New surface water storage at Colden Common Reservoir	-	-	2033	-	-	-	-
Hampshire South	Leakage reduction	2025 reduction by 7.8 Ml/d	2025 reduction by 7.8 Ml/d	2019 reduction by 8.4 Ml/d	2017 reduction by 8.4 Ml/d	2028 reduction by 4.8 Ml/d	2010 reduction by 6.6 Ml/d	2025 reduction by 7.8 Ml/d
Hampshire South	Water efficiency kit (box)	-	-	2030	2030	-	2025	-
Hampshire South	Water efficiency low flow shower heads	-	-	-	2030	-	-	-
Isle of Wight	L536 borehole rehabilitation	2032	2032	2027	2019	-	2026	2032
Isle of Wight	K628 borehole rehabilitation	2034	2034	2034	2028	-	2027	2034
Isle of Wight	Sandown wastewater recycling (5Ml/d)	-	-	-	2031	-	-	-

	Scenario	Company preferred Regional strategy	Company only Universal metering	Company only Change of occupier	Company only Optant	Company only Universal metering with no climate change	Company only Leakage rise to Ofwat target	Hybrid Baseline where no deficit, otherwise universal metering
	Number	**4**	**3**	**2**	**1**	**11**	**8**	
	Cross-Solent main increase (to 20 Ml/d)	-	-	-	-	-	2033	-
	Leakage reduction	2026 reduction by 1.1 Ml/d	2026 reduction by 1.1 Ml/d	2019 reduction by 1.2 Ml/d	2017 reduction by 1.3 Ml/d	2032 reduction by 0.7 Ml/d	2020 reduction by 1.2 Ml/d	2026 reduction by 1.1 Ml/d
	Water efficiency kit (box)	2030	2030	2030	2030	-	2025	2030
	Water efficiency low flow shower heads	-	-	2030	-	-	-	-
	Water efficiency trigger hoses	-	-	-	-	-	2025	-
Hants. Andover	*No supply side, water efficiency, or leakage reduction schemes*	-	-	-	-	-	-	-
Hants. Kings.	*No supply side, water efficiency, or leakage reduction schemes*	-	-	-	-	-	-	-
	Costs (£m)							
	Total metering cost (£m)	52.70	52.70	56.81	48.17	52.70	52.70	52.20
	Total resource, leakage reduction and water efficiency activity cost (£m)	42.65	42.65	48.28	55.48	40.30	56.26	42.65
	Total cost of Strategy (£m)	**95.35**	**95.35**	**105.09**	**103.65**	**93.00**	**108.96**	**94.85**

Table 10.8 gives a summary of the different baseline assumptions for these scenarios, and the results in terms of scheme inclusion, scheme timing, and costs for the different investment strategies. The following points can be seen from the results:

- The company only least-cost scenario (3) assumes the baseline condition of universal metering by 2015;
- All scenarios assume the renewal of existing bulk supplies to other companies until the end of the planning period, at the rates which are appropriate at the time of renewal;
- The company only least-cost scenario (3) selects further leakage reductions of 8.9 Ml/d;
- Under the company only change of occupier metering scenario (2), the scheme options remain the same, but they are needed up to 5 years earlier, although an additional scheme (new surface water reservoir at Colden Common) is required in Hampshire South WRZ at the end of the planning period. The scenario includes further leakage reductions of 9.6 Ml/d;
- Under the company only optant metering scenario (1), the same resource development schemes are selected, but at times up to 13 years before the company only universal metering scenario (3); and Sandown desalination is also introduced towards the end of the planning period. The scenario includes further reductions in leakage of 9.7 Ml/d;
- Under the company only scenario, without any allowance for climate change impacts (11), only two schemes are required: Increase Testwood WSW to licence limit; and use of the Candover Alre groundwater augmentation

schemes to support public water supply abstractions. Both these are required at the same time as the company only universal metering scenario (3) to allow the Sustainability Reductions to be implemented. No other resource development options are necessary, but further leakage reduction of 5.5 Ml/d is required;

- Under the scenario which allows leakage to rise up to the Ofwat target level (8) in any WRZ currently operating below its target level, the same options are required as for the company only universal metering scenario (3), but these may be needed 6-7 years earlier. In addition, the scenario requires Woodmill abstraction (56 Ml/d) rather than the far smaller R176 borehole rehabilitation, and additional water is transferred to the Isle of Wight by increasing the cross-Solent main to 20 Ml/d. Further leakage reduction of 8.8 Ml/d is required from 2010. The cost of this strategy was £13.6 m greater than for the company preferred least-cost scenario (3); and
- The total cost of the resources strategy (including new resources, leakage reduction, and water efficiency) plus metering strategy, for the various company only scenarios is as follows:
  - Universal metering - £95.4 m.
  - Change of occupier - £105.1 m.
  - Optant and selective - £103.7 m.
  - Hybrid scenario -£94.9m
- There is no difference in cost between the company preferred regional strategy and the company only least-cost strategy.

Scenario / Number		Company preferred Regional strategy 4	Company only Universal metering 3	Company only Change of occupier 2	Company only Optant 1	Company only Universal metering with no climate change 11	Company only Leakage rise to Ofwat target 8	Hybrid Baseline where no deficit, otherwise universal metering
Metering policy		Universal	Universal	Change of occupier	Optant and selective	Universal	Universal	Universal or optant
Leakage policy		JR08, then SPL saving	JR08, then SPL saving	JR08	JR08	JR08, then SPL saving	Ofwat, then SPL saving	JR08, then SPL saving
WRSE preferred options & bulk supplies		Yes	No	No	No	No	No	Yes
WRZ	**Scheme**	**Earliest year required**						
Hampshire South	Testwood new DAF plant to utilise full licence & enabling transfer pipeline to Otterbourne	2015	2015	2015	2015	2015	2015	2015
Hampshire South	Candover Alre Augmentation	2019	2019	2019	2019	2019	2019	2019
Hampshire South	West Tytherley borehole rehabilitation	2033	2033	2031	2027	-	-	2033
Hampshire South	Woodmill abstraction (56 Ml/d) and treatment at Otterbourne	-	-	-	-	-	2028	-
Hampshire South	New surface water storage at Colden Common Reservoir	-	-	2033	-	-	-	-

	Scenario	Company preferred Regional strategy	Company only Universal metering	Company only Change of occupier	Company only Optant	Company only Universal metering with no climate change	Company only Leakage rise to Ofwat target	Hybrid Baseline where no deficit, otherwise universal metering
	Number	4	3	2	1	11	8	
	Leakage reduction	2025 reduction by 7.8 Ml/d	2025 reduction by 7.8 Ml/d	2019 reduction by 8.4 Ml/d	2017 reduction by 8.4 Ml/d	2028 reduction by 4.8 Ml/d	2010 reduction by 6.6 Ml/d	2025 reduction by 7.8 Ml/d
	Water efficiency kit (box)	-	-	2030	2030	-	2025	-
	Water efficiency low flow shower heads	-	-	-	2030	-	-	-
Isle of Wight	L536 borehole rehabilitation	2032	2032	2027	2019	-	2026	2032
Isle of Wight	K628 borehole rehabilitation	2034	2034	2034	2028	-	2027	2034
Isle of Wight	Sandown wastewater recycling (5Ml/d)	-	-	-	2031	-	-	-
Isle of Wight	Cross-Solent main increase (to 20 Ml/d)	-	-	-	-	-	2033	-
Isle of Wight	Leakage reduction	2026 reduction by 1.1 Ml/d	2026 reduction by 1.1 Ml/d	2019 reduction by 1.2 Ml/d	2017 reduction by 1.3 Ml/d	2032 reduction by 0.7 Ml/d	2020 reduction by 1.2 Ml/d	2026 reduction by 1.1 Ml/d
Isle of Wight	Water efficiency kit (box)	2030	2030	2030	2030	-	2025	2030
Isle of Wight	Water efficiency low flow shower heads	-	-	2030	-	-	-	-
Isle of Wight	Water efficiency trigger hoses	-	-	-	-	-	2025	-
Hants. Andover	*No supply side, water efficiency, or leakage reduction schemes*	-	-	-	-	-	-	-
Hants. Kings.	*No supply side, water efficiency, or leakage reduction schemes*	-	-	-	-	-	-	-
	Costs (£m)							
	Total metering cost (£m)	52.70	52.70	56.81	48.17	52.70	52.70	52.20
	Total resource, leakage reduction and water efficiency activity cost (£m)	42.65	42.65	48.28	55.48	40.30	56.26	42.65
	Total cost of Strategy (£m)	**95.35**	**95.35**	**105.09**	**103.65**	**93.00**	**108.96**	**94.85**

Table 10.8 Results of Scenario Analysis for the Western Area, with Sustainability Reductions

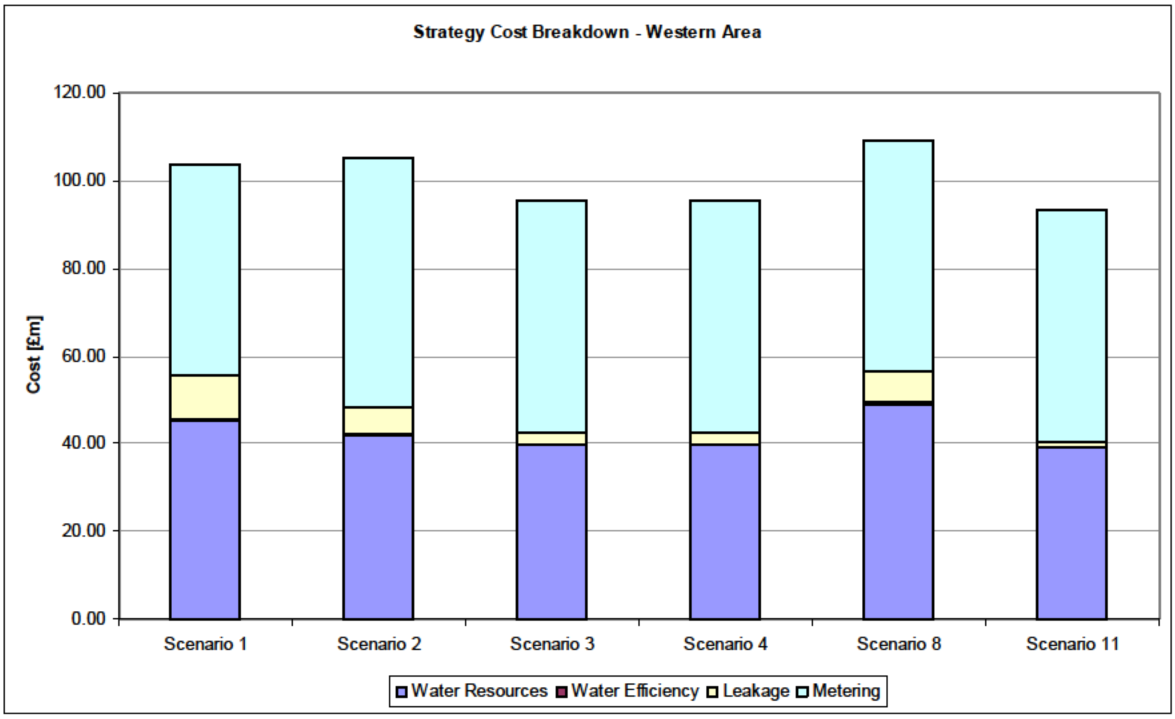


Figure 10.18 Western Area Scenario Cost Comparisons

10.3.12 Sensitivity Analysis

10.3.12.1 Range of Sensitivity Analysis

The "possible worst-case" focused on any changes in supply side or demand side factors which would worsen the supply demand balance. Any decrease in deployable output and/or increase in demand would mean that deficits would occur earlier in the planning period and would be larger than those identified in the baseline conditions. This could pose a threat to the security of supplies if the selected schemes, and/or any others that might then be required, could not be commissioned quickly enough.

Following consideration of a number of such demand and supply side factors and the potential magnitude of each, it was decided that a "global" change in the demand forecast of +/- 5% should be assumed for the area. This sensitivity assumption would change the supply demand balance components for the Western Area as follows:

- A change in demand of +/- 5% is equivalent to +/- 10.5 Ml/d and +/- 13.9 Ml/d at the MDO and PDO condition respectively by the end of the planning period; and
- A change in demand of +/- 5% is equivalent to a change in the area deployable output +/- 3.4% and +/- 4.1% at the MDO and PDO condition respectively.

10.3.12.2 Results of Sensitivity Analysis

The results of the sensitivity analysis for the possible "best-case" and "worst-case" are presented in Table 10.9 and can be summarised as follows:

Under the "worst-case" sensitivity:

- There is no change to the timing of the Testwood WSW increase to utilise full licence capacity, nor the Candover Alre Augmentation, as these are both driven by the Sustainability Reduction;

- The Woodmill abstraction is required in 2026, replacing the much smaller West Tytherley borehole rehabilitation scheme;
- The cross-Solent main increase (to 20 Ml/d) is required, but K628 is no longer needed on the Isle of Wight;
- The refurbishment of L536 borehole is still needed, but earlier than in the base case;
- Further leakage reduction is required from 2020; and
- Additional water efficiency schemes are selected in both Hampshire South and the Isle of Wight WRZs.

In summary, if the assumptions of worst-case sensitivity analysis were to occur, the Woodmill Scheme would be needed together with an increase in the capacity of the cross-Solent main.

Under the “best-case” sensitivity:

- There is no change to the timing of the Testwood WSW increase to utilise full licence capacity, nor the Candover Alre Augmentation;
- None of the borehole schemes are required in either Hampshire South WRZ or on the Isle of Wight; and
- There is no need for further leakage reduction or water efficiency schemes.

In summary, the results of the best-case sensitivity analysis do not change the need for the Testwood scheme at full licence and use of the Candover Alre Augmentation schemes because these are both driven by the introduction of the Lower Itchen Sustainability Reductions.

WRZ	Scenario / Number	Company preferred Regional strategy 4	Company only Universal metering 3	Increase in demand of 5% by end of planning period "Worst case"	Decrease in demand of 5% by end of planning period "Best case"
	Metering policy	Universal	Universal	Universal	Universal
	Leakage policy	JR08, then SPL saving	JR08, then SPL saving	JR08, then SPL saving	JR08, then SPL saving
	WRSE preferred options & bulk supplies	Yes	No	No	No
WRZ	**Scheme**	**Earliest year required**			
Hampshire South	Testwood new DAF plant to utilise full licence & enabling transfer pipeline to Otterbourne	2015	2015	2015	2015
Hampshire South	Candover Alre Augmentation	2019	2019	2019	2019
Hampshire South	R176 borehole rehabilitation	2033	2033	-	-
Hampshire South	Woodmill abstraction (56 Ml/d) and treatment at Otterbourne	-	-	2026	-
Hampshire South	Leakage reduction	2025 reduction by 7.8 Ml/d	2025 reduction by 7.8 Ml/d	2020 reduction by 5.4 Ml/d	-
Hampshire South	Water efficiency kit (box)	-	-	2025	-
Hampshire South	Water efficiency low flow shower heads	-	-	2025	-
Isle of Wight	L536 borehole rehabilitation	2032	2032	2025	-
Isle of Wight	K628 borehole rehabilitation	2034	2034	-	-
Isle of Wight	Cross-Solent main increase (to 20 Ml/d)	-	-	2030	-
Isle of Wight	Leakage reduction	2026 reduction by 1.1 Ml/d	2026 reduction by 1.1 Ml/d	2021 reduction by 1.2 Ml/d	-
Isle of Wight	Water efficiency kit (box)	2030	2030	2025	-
Hants. Andover	*No supply side, water efficiency, or leakage reduction schemes*	-	-	-	-
Hants. Kings.	*No supply side, water efficiency, or leakage reduction schemes*	-	-	-	-
	Costs (£m)				
	Total metering cost (£m)	52.70	52.70	52.70	52.70
	Total resource, leakage reduction and water efficiency activity cost (£m)	42.65	42.65	56.47	38.49
	Total cost of Strategy (£m)	**95.35**	**95.35**	**109.17**	**91.19**

Table 10.9 Results of Sensitivity Analysis for the Western Area

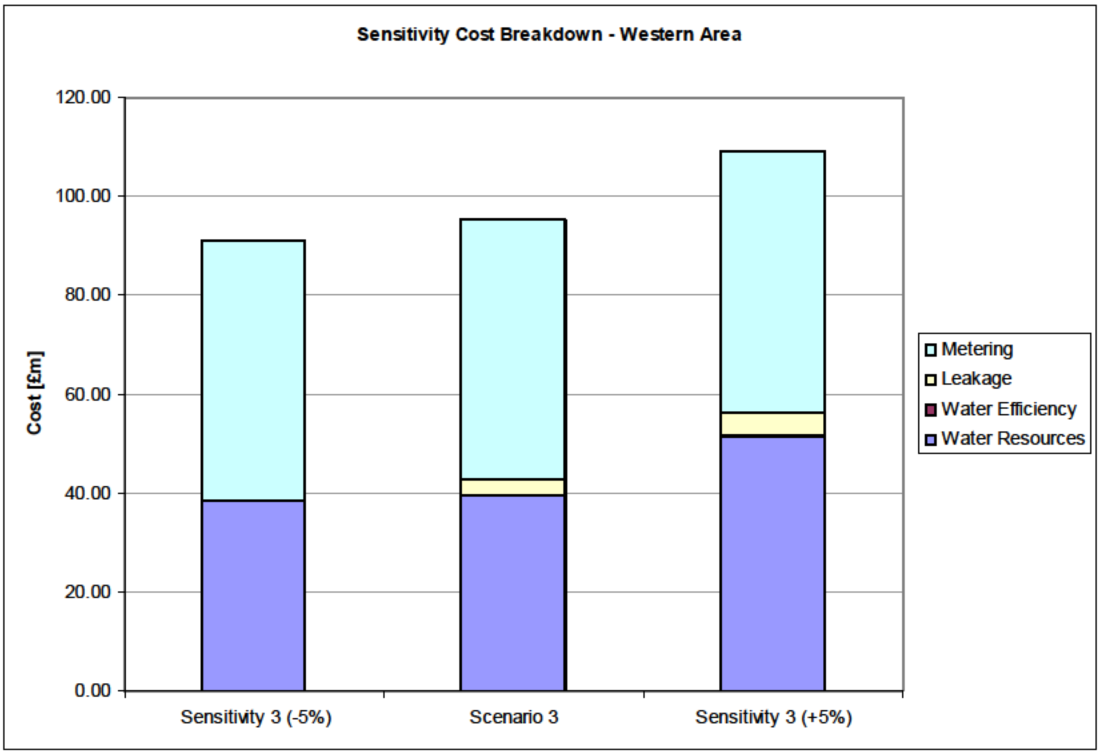


Figure 10.19 Western Area Sensitivity Analysis Cost Comparisons

10.3.13 Conclusions

The proposed Sustainability Reductions have a significant impact on the baseline supply demand balance, and therefore the Water Resources Strategy for the area. Following submission of the draft WRMP the company has met with Ofwat, EA, Natural England and Portsmouth Water to explore alternative options for allowing the Sustainability Reductions to be implemented without compromising security of supply. The company prepared a draft Memorandum of Understanding that set out the roles and responsibilities of each party and the schemes that would need to be implemented before the Lower Itchen abstraction licences would be voluntarily changed. Investigations would also need to be undertaken during AMP5 to confirm or otherwise the assumptions for the proposed operation of the Candover and Alre groundwater augmentation schemes which have been used for the supply demand balance of Hampshire South WRZ.

The Memorandum of Understanding has been agreed and signed off by the relevant parties and is included in Appendix A.

The company would not be able to confirm its commitment to implementation of the full Sustainability Reductions at the end of AMP6 unless the following options are implemented in the Hampshire South and Isle of Wight WRZs, so that the security of supplies is maintained throughout the planning period (see Table 10.6):

- Universal metering;
- Leakage reduction;
- Asset improvement schemes for groundwater sources;
- Increase of Testwood WSW to licence limit;
- Development of the enabling Testwood to Otterbourne transfer and associated distribution infrastructure; and
- Optimisation of inter-zonal transfers (cross-Solent main).

10.4 The Water Resources Strategy for the Central Area

10.4.1 Location

The Central Area is situated in central and north west Sussex, and comprises the WRZs of Sussex North, Sussex Worthing and Sussex Brighton. The Sussex North WRZ lies north of the South Downs, and includes the towns of Crawley and Horsham and the rural parts of mid-Sussex. The Sussex Worthing WRZ extends across the coast from just beyond the river Arun in the west to the river Adur in the east and includes the towns of Worthing, Littlehampton and Arundel. The Sussex Brighton WRZ extends across the coast from the river Adur in the west to Peacehaven in the east, and includes the city of Brighton and Hove and the surrounding area.

There are the following inter-zonal connections:

- The Sussex North and Sussex Worthing WRZs are connected via a bi-directional main; and
- The Sussex Worthing WRZ is connected to the Sussex Brighton WRZ via a main, but the direction of the transfer is currently only from the Sussex Worthing WRZ to the Sussex Brighton WRZ.

There are the following inter-company connections:

- A bulk import to R648 in the Sussex North WRZ from Portsmouth Water, recently enhanced by the facility to take part of this bulk import into the Sussex Worthing WRZ;
- A bulk export to South East Water from Weir Wood reservoir; and
- Some small exports to South East Water from the Sussex North WRZ.

A schematic of the Central Area is given as Figure 10.20.

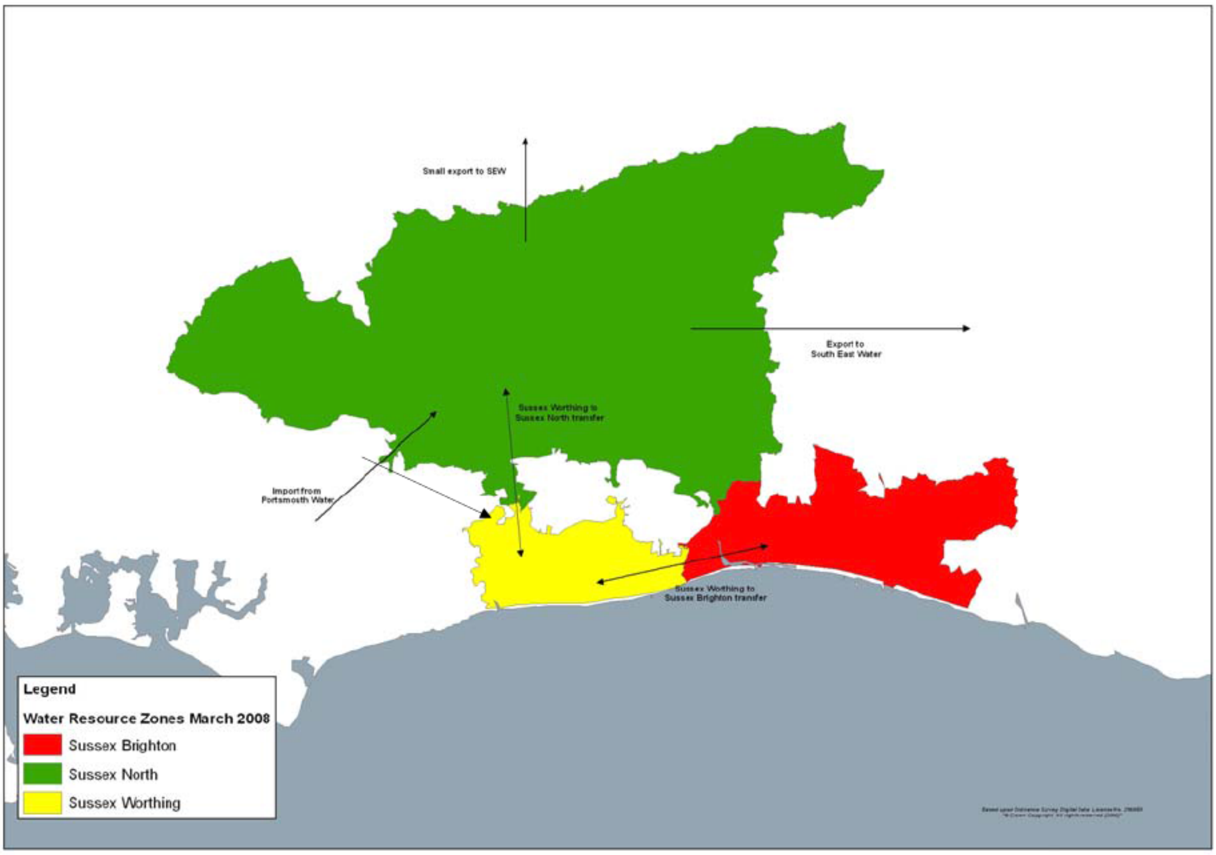


Figure 10.20 Schematic of the Central Area

10.4.2 Sources of Supply

The area is supplied by both surface water and groundwater sources. There are two surface water sources and over 30 groundwater sources in the Central Area. The Sussex North WRZ contains the only surface water sources in the area; at R648, which is supported by the S466 groundwater wellfield; and Weir Wood reservoir, together with a number of minor local groundwater sources.

R648 is the largest source in the area. It comprises a run-of-river abstraction which is subject to a Minimum Residual Flow condition which normally curtails abstraction during the late summer and autumn periods every year. There is no storage facility associated with this abstraction. The surface water abstraction is supported by adjacent groundwater sources. Weir Wood is a small direct impounding reservoir, which has no facility for pumped inflow.

The Sussex Worthing and Brighton WRZs are supplied entirely from Chalk groundwater sources. The nature of the sources in Sussex Worthing WRZ means that the WRZ is more drought resilient than the Sussex North and Sussex Brighton WRZs. The hydrogeological nature of the Brighton Chalk block, and the presence of a number of old, well and adit systems means that the sources can be very vulnerable to drought events.

10.4.3 Supplies Available

The total deployable output for the area is 187.2 Ml/d for MDO and 241.3 Ml/d for PDO. Sussex Worthing and Sussex Brighton WRZs have a combined, groundwater sourced, MDO and PDO of 147.2 Ml/d and 177.5 Ml/d respectively.

The total proportion of groundwater to surface water for the area is approximately 90% : 10%. However, a more detailed breakdown shows that the Sussex Worthing and Sussex Brighton WRZs are solely dependent on groundwater sources, whereas the Sussex North WRZ has a groundwater : surface water ratio of 60% : 40%. Furthermore, the Sussex North WRZ depends on a surface water balance of 46% run-of-river and 54% direct inflow reservoir storage.

This mixture of source types means that the area is especially sensitive to design drought events as explained in section 10.4.4.

WRZ	Groundwater			Surface Water			Total	
	No. sources	MDO Ml/d	PDO Ml/d	No. sources	MDO Ml/d	PDO Ml/d	MDO Ml/d	PDO Ml/d
Sussex North	7	23.85	39.29	2	16.20	24.50	40.05	63.79
Sussex Worthing	11	57.85	68.98	0	0.00	0.00	57.85	68.98
Sussex Brighton	13	89.30	108.52	0	0.00	0.00	89.30	108.52
Total	**31**	**171.00**	**216.79**	**2**	**16.20**	**24.50**	**187.20**	**241.29**

Note: Values are for indigenous sources only, and do not take transfers, either for inter-zonal or inter-company transfers into account.

Note: further detail is given for individual sources in Appendix D

Table 10.10 Summary of Base Year (2010-11) Deployable Outputs for the Central Area

10.4.4 Strategic Management of Sources

The mix of types of source within the area and their distribution within the different WRZs, combined with the lack of storage makes the whole area very susceptible to short-term, severe, drought events. Therefore, one of the primary objectives for the future development of water resources in this area is to make the supply system more resilient to drought events, especially against a background of the increasing impacts of climate change.

R648 is the largest source. However, it is a run-of-river source, with an associated Minimum Residual Flow condition. It is therefore very prone to even single season events. It also has no storage facility to provide over-year protection. The only reservoir is at Weir Wood. However this direct inflow reservoir is small with no pumped inflow facility. It is also prone to even single season events.

The coastal WRZs of Sussex Worthing and Sussex Brighton are supplied solely from groundwater sources and are susceptible to one, two and three season droughts, with the associated progressive reduction in groundwater storage, and resulting loss in deployable output. The WRZs are therefore single source type dominant, and thus there are no other source types to support them. Many of the old well and adit systems, especially in the Brighton area, are prone to severe problems if the adits are dewatered. The sources can also suffer from saline intrusion. A seasonal groundwater operational management strategy has been developed and is used to optimise the seasonal management of these sources, but the whole area is prone to recharge deficit conditions.

There is a bi-directional transfer between the Sussex North and Sussex Worthing WRZs. However, if the transfer is from Sussex Worthing WRZ, the groundwater sources in that WRZ will become depleted and thus even more prone to longer design drought events.

The Sussex North WRZ, and more recently, the Sussex Worthing WRZ, can be supported through the bulk supply import from Portsmouth Water. However, balancing the utilisation of the different types of sources of supply, all of which are sensitive to even short duration droughts, becomes very difficult and reveals how sensitive the area is to actual droughts as well as design drought events.

10.4.5 Demand Summary

Southern Water provides drinking water to a population in the area of about 732,000. Normal year average annual demands are 187.5 Ml/d, which can rise to 197.0 Ml/d during dry years. However, during dry years, the demands at the critical MDO and PDO periods can be 192.3 Ml/d and 240.6 Ml/d respectively, as shown in Table 10.11.

WRZ	Population (000s)	Normal Year Average Annual demand (Ml/d)	Dry Year Annual Average demand (Ml/d)	Dry Year MDO demand (Ml/d)	Dry Year Peak Period demand (Ml/d)
Sussex North	242.61	62.37	67.57	65.92	85.20
Sussex Worthing	168.38	41.53	42.95	41.94	51.57
Sussex Brighton	320.82	83.60	86.47	84.39	103.80
Central Area	**731.81**	**187.50**	**196.99**	**192.25**	**240.57**

Table 10.11 Summary of Base Year (2007-08) Demand in the Central Area (Ml/d)

10.4.6 Strategic Development to Date

There have been a number of strategic developments over the last 10-15 years within the area that have improved, to some extent, its flexibility and drought resilience. These include:

- Leakage has been reduced over the last 12 years from 32.6 Ml/d to 29.5 Ml/d;
- There has been an increase in meter installation over the last 12 years from 8% to 36%;
- The development of the Portsmouth Water bulk import to the Sussex North WRZ up to 15 Ml/d, and, recently, the subsequent connection to the Sussex Worthing WRZ;
- The upgrade of the Sussex Worthing WRZ to Sussex North WRZ transfer to 15 Ml/d; and
- The construction of a strategic main to connect and provide support for the local groundwater sources.

10.4.7 Levels of Service

The area, as with other parts of the south-east, has suffered from the effects of the recent droughts, in 1989-92, 1995 and more recently 2004-06. There was serious stress on the area's water resources and a risk to security of supply. In order to respond to the increasingly severe drought conditions Southern Water followed its Drought Plan and introduced its programme of both demand side and supply side measures which had an impact on Customer and Environmental Levels of Service.

10.4.7.1 Customer Level of Service

A summary of the frequency of restrictions since 1989, compared to Target Levels of Service, is given in Table 10.12. Despite its best endeavours to alleviate the effects of the droughts, Southern Water was unable to meet its Target Levels of Service:

- In some WRZs in this area the company has introduced sprinkler/full hosepipe bans in eight out of the last 20 years (40%), although this varied from seven years (35%) in the Sussex North WRZ to eight years (40%) in both the Sussex Worthing and Sussex Brighton WRZs.
- The amount of time on average that customers have been subject to restrictions, calculated as the percentage of the actual (population times weeks of restriction) compared to the total (population times weeks under review) is 23% (varying from 19% in the Sussex North WRZ to 25% in the Sussex Worthing and Brighton WRZS). If Target Levels of Service are being met then this measure would not exceed 10%.

There has also been one occasion on which a Drought Order was granted authorising Southern Water to limit or restrict the so-called "non-essential uses" of water. This Drought Order was granted in 2006, and covered the whole area. It turned out that powers granted under this Drought Order did not need to be used due to the successful introduction of a number of other supply and demand side measures combined with wetter hydrological conditions.

WRZ	Target Levels of Service		Actual Levels of Service	
	1 in x years	% years	% no. of reporting years (taken as the no. of years, irrespective of duration during the year)	Time expressed as % of (population x weeks)
Hosepipe/Sprinkler ban				
Sussex North	1:10	10%	35%	19%
Sussex Worthing	1:10	10%	40%	25%
Sussex Brighton	1:10	10%	40%	25%
Central Area	**1:10**	**10%**	**40%**	**23%**
Drought Orders implemented "Non-essential use" ban				
Sussex North	1:20	5%	0%	0%
Sussex Worthing	1:20	5%	0%	0%
Sussex Brighton	1:20	5%	0%	0%
Central Area	**1:20**	**5%**	**0%**	**0%**

Table 10.12 Summary of Restrictions in the Central Area Since 1989

10.4.7.2 Environment Level of Service

Four Drought Permits/Orders were applied for and granted during this period. Three of these were for a reduction in the Minimum Residual Flow (MRF) for the surface water abstraction at R648. Applications were also prepared on a number of other occasions, but changes in demand and supply circumstances meant that the applications were not submitted. A Drought Order was authorised in 2006 to reduce the amount of compensation water to be released from Weir Wood reservoir.

Whilst there were a number of occasions that the sources did not, in the event, need to be operated under the terms of the Drought Permits/Orders, it was necessary to have the Drought Permits/Orders in place, should drought conditions have continued and increased the risk to security of supplies.

Southern Water considers that the past performance against Target Levels of Service must be improved. This can only be achieved through the development of a more robust supply system with a supply demand balance that is resilient in the face of drought conditions. This requires the introduction of a number of supply and demand side measures.

10.4.7.3 Influence of a supply demand balance deficit on operations during a drought

Even after taking into account inter-zonal transfers to reduce baseline supply demand balance deficits, the Sussex North and Sussex Brighton WRZs would experience deficits for the full five years and first two years of the AMP5 period respectively. There would be no deficits in the Sussex Worthing WRZ.

The Sussex North WRZ has a supply demand balance deficit for the full five years of AMP5 of about 11 decreasing to 6 Ml/d over the period for the MDO condition and about 7 decreasing to 3 Ml/d for the PDO condition. This represents about 12 and 6% of Distribution Input respectively, and compares to the sum of the planning allowances for target headroom and outage of about 5 and 6 Ml/d respectively.

As mentioned previously the MDO situation is sensitive because there is limited storage in the Sussex North WRZ. The MDO condition is caused by low river flows at Hardham which affect the Hardham run-of-river abstraction. The possibility of such a condition occurring can be predicted some months in advance from analysis of the river flow recession curve. In addition the MISER model developed for the AMP4 Water Resources Investigations means that there is now a much better understanding of the water supply system which will assist in operational management under all, not just drought conditions. Furthermore, any opportunities to accelerate the groundwater asset improvement schemes in the other WRZs should be taken to enable enhanced transfers to be made to the Sussex North WRZ.

The Sussex Brighton WRZ has a supply demand balance deficit for the first two years of the planning period of about 1 and 2 Ml/d for the MDO and PDO condition respectively. This represents about 1 and 2 % of Distribution Input respectively, and compares to the sum of the planning allowances for target headroom and outage of about 8 and 11 Ml/d respectively.

Whilst these deficits are not large, the situation will require monitoring closely, and any opportunity to accelerate the groundwater asset improvement schemes for the WRZ needs to be taken.

10.4.8 The Baseline Supply Demand Balance for the Central Area

The baseline supply demand balances in the WRP Tables assume the following:

- Continuation of current metering policies. In 2007-08 there were 316,200 domestic properties in this area, 36% of which were metered. By 2015, the number of metered domestic properties is expected to rise to 227,100;
- Deployable outputs according to the Unified Methodology, which ensures that the deployable outputs for groundwater and surface water sources are estimated for the same design drought event;
- Deployable outputs include assumed incremental yields from source improvements for both AMP4 and planned for the AMP5 period, with timings assumed throughout the AMP5 period;
- No Sustainability Reductions (as advised by the Environment Agency);
- Renewal of existing inter-company bulk transfers until the end of the planning period, at the rates prevailing at the time of contract renewal; and
- Inter-zonal transfers are adjusted in the supply demand balance to represent the optimal use of surplus resources; while for the purposes of the investment model they are set to zero at the start of the planning period.

The baseline supply demand balances for each WRZ in the Central Area are given in Table 10.13 for both the MDO and PDO conditions. These baseline supply demand balances over the planning period are shown in annotated graphs Figure 10.21 to Figure 10.26. Full detailed build-up tables given In Appendix I.

Water Resource Zone	Planning scenario	Base year 2007-08	2009-10	Start of planning period 2010-11	2014-15	2019-20	2024-25	2029-30	2034-35
Sussex North	MDO	0.00	0.00	-11.07	-5.91	-6.26	-7.02	-7.84	-8.77
Sussex	MDO	12.87	14.01	0.00	0.63	1.05	1.03	0.50	0.00

Worthing									
Sussex Brighton	MDO	2.69	4.84	-0.96	8.49	9.75	9.85	9.32	8.72
Sussex North	PDO	1.55	2.07	-7.07	-2.72	-1.78	-2.43	-4.02	-5.84
Sussex Worthing	PDO	18.67	20.09	0.00	0.00	0.00	0.00	0.00	0.00
Sussex Brighton	PDO	1.37	4.22	-2.65	8.11	10.39	11.03	10.61	10.01

Notes: Positive figures indicate a surplus of resources, negative indicate a deficit

Table 10.13 Baseline Supply Demand Balance for Central Area for the MDO and PDO Condition (Ml/d)

In these baseline supply demand balances, inter-zonal transfers from 2010-11 are balanced to make the best use of inter-connected resources where water can be transferred from a WRZ with a surplus to one with a deficit, namely from Sussex Worthing to Sussex North in the Central Area. At the same time, the investment model is able to chose whether it is better to cease continue, or increase, existing inter-zonal transfers, or to develop new resources, or enhance demand management in the WRZ in deficit.

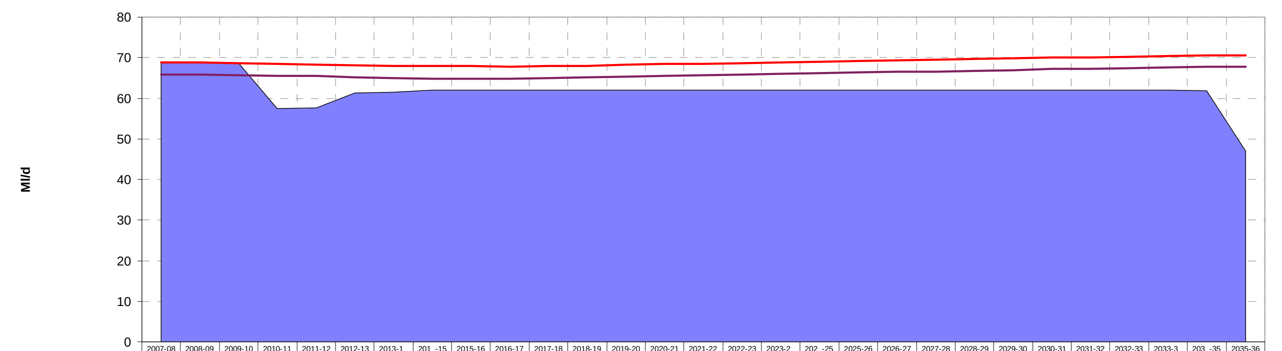
Despite the relatively healthy baseline supply demand balances, this area has very little resilience to drought events over one, two or three seasons. In the event that the drought of 2004-06 had continued into a third dry winter, there would have been very serious concerns over supplies to the area in general, and to the groundwater sources in the coastal WRZs in particular.

For both the MDO and PDO conditions:

- The Sussex North WRZ starts the planning period in severe deficit, and remains so throughout the planning period. This change from previous analysis is mainly as a result of the more rigorous methodology used to estimate the design drought surface water deployable outputs being available as a result of the AMP4 Water Resources Investigations, given the conjunctive use of the various source types available. It also arises from the application of the Unified Methodology, which ensures that the same drought event is used to estimate both surface and groundwater deployable outputs. Application of this methodology has reduced groundwater deployable outputs in the Sussex Brighton and Sussex Worthing WRZs, which in turn means that there is less water to transfer from the Sussex Worthing WRZ to the Sussex North WRZ during the design event;
- The Sussex Worthing WRZ starts the planning period in surplus and remains so throughout the planning period, enhanced by some AMP5 source improvements. The baseline supply demand balance shows surplus water being transferred to Sussex North; and
- The Sussex Brighton WRZ starts the planning period in deficit, but, due to decreasing demands and AMP5 improvements to groundwater sources, returns to surplus for the remainder of the planning period.

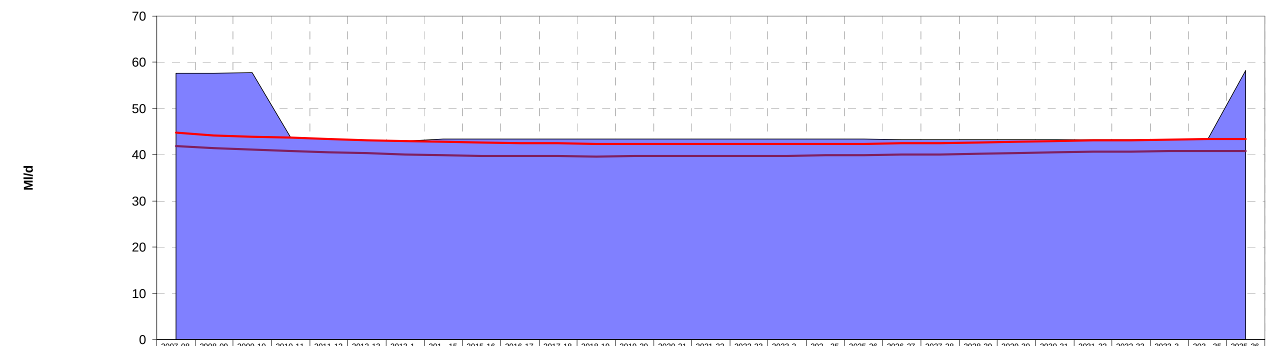
Implementation of universal metering throughout the area by 2015 would lead to the following reductions in demand;

- Sussex Nouth WRZ: 1.0 Ml/d (MDO) and 2.1 Ml/d (PDO);
- Sussex Worthing WRZ: 1.5 Ml/d (MDO) and 2.4 Ml/d (PDO); and
- Sussex Brighton WRZ: 3.6 Ml/d (MDO) and 5.7 Ml/d (PDO).



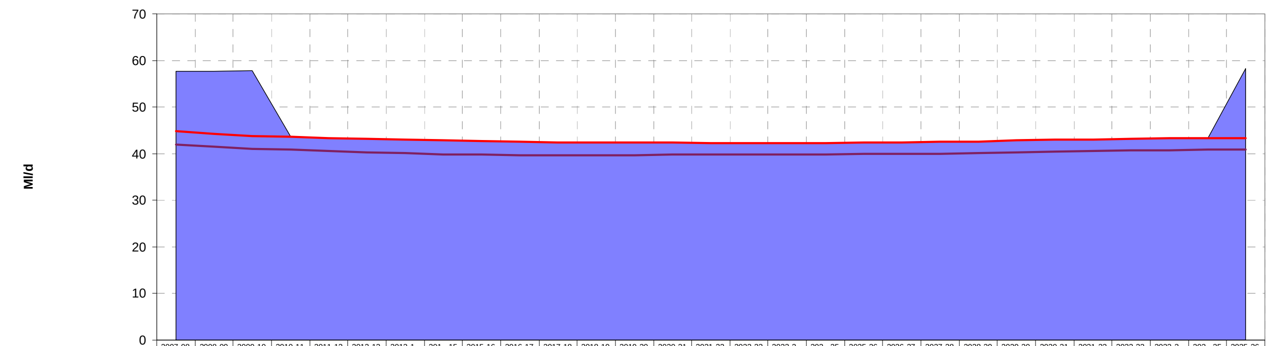
	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-1	201 -15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-2	202 -25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-3	203 -35	2035-36
MDO Sussex North Resources	68.77	68.75	68.61	57. 1	57 69	61. 0	61.56	61.98	61 97	61.97	61 97	61.97	61.97	61.97	61 97	61.97	61 96	61.96	61.96	61.96	61.96	61.96	61 96	61.96	61.95	61.95	61.95	61.85	6.95
MDO Dmd Headroom	68.77	68.75	68.61	68. 8	68 38	68.1	68.01	67.88	67 87	67.85	67 96	68.00	68.23	68. 3	68 55	68.71	68 89	68.98	69.17	69.36	69.	69.62	69 79	70.00	70.10	70.2	70. 3	70.62	70.62
MDO Sussex North Demand	65.92	65.86	65.69	65.55	65. 3	65.18	65.03	6 .88	6 88	6 .88	65 01	65.07	65.32	65.53	65 67	65.8	66 0	66.1	66.33	66.52	66.60	66.78	66 95	67.16	67.26	67. 1	67.59	67.78	67.78

Figure 10.21 Sussex North MDO Baseline Supply Demand Balance



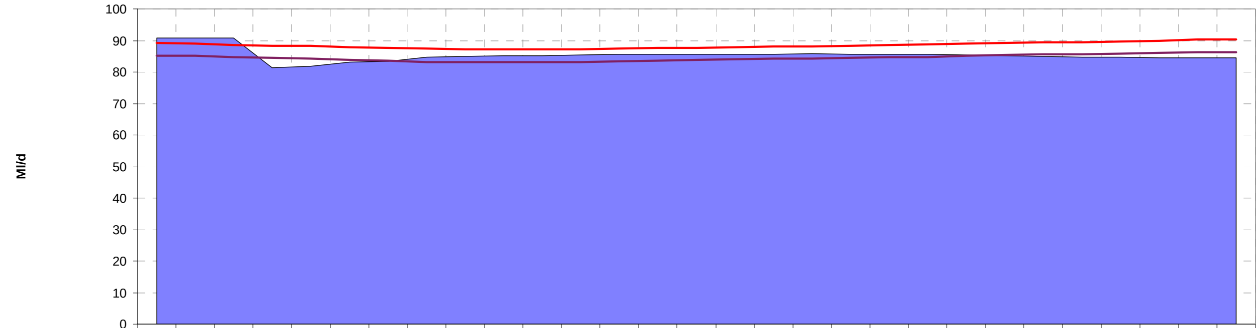
	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-1	201 -15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-2	202 -25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-3	203 -35	2035-36
MDO Sussex Worthing Resources	57.66	57.69	57.83	3.6	3.36	3.16	2 99	3. 3	3. 2	3. 1	3. 0	3. 0	3 39	3.38	3.37	3 36	3.35	3.3	3 33	3.33	3.32	3 31	3.30	3.29	3 28	3.27	3.26	3 35	58.26
MDO Dmd Headroom	.79	.21	3.82	3.6	3.36	3.16	2 99	2.80	2.6	2.51	2. 7	2.3	2 3	2.3	2.30	2 30	2.31	2.31	2 39	2. 7	2.50	2 61	2.80	2.9	3 07	3.15	3.25	3 35	3.35
MDO Sussex Worthing Demand	1.9	1. 1	1.06	0.85	0.53	0.29	0 09	39.86	39.76	39.69	39.71	39.65	39 71	39.7	39.7	39 77	39.81	39.8	39 92	0.00	0.03	0.1	0.33	0. 7	0 60	0.68	0.78	0 88	0.88

Figure 10.22 Sussex Worthing MDO Baseline Supply Demand Balance



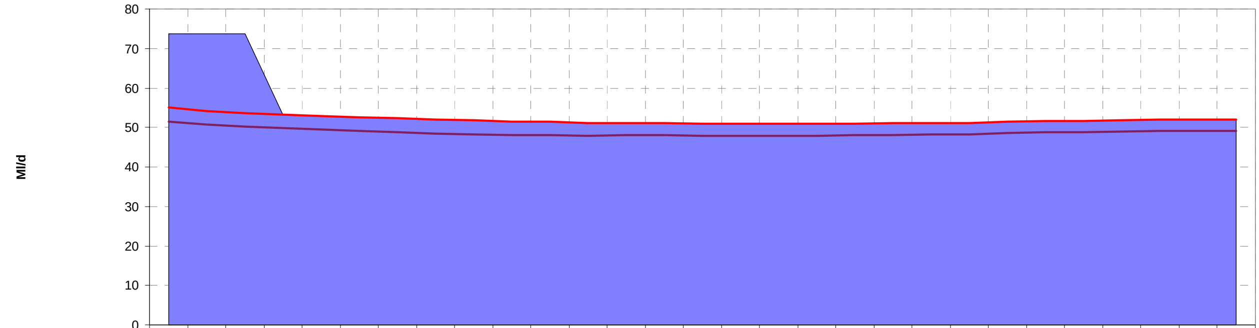
	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-1	201 -15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-2	202 -25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-3	203 -35	2035-36
MDO Sussex Worthing Resources	57.66	57.69	57.83	3.6	3.36	3.16	2 99	2.80	2.6	2.51	2. 7	2.3	2 3	2.3	2.30	2 30	2.31	2.31	2 39	2. 7	2.50	2 61	2.80	2.9	3 07	3.15	3.25	3 35	58.26
MDO Dmd Headroom	.79	.21	3.82	3.6	3.36	3.16	2 99	2.80	2.6	2.51	2. 7	2.3	2 3	2.3	2.30	2 30	2.31	2.31	2 39	2. 7	2.50	2 61	2.80	2.9	3 07	3.15	3.25	3 35	3.35
MDO Sussex Worthing Demand	1.9	1. 1	1.06	0.85	0.53	0.29	0 09	39.86	39.76	39.69	39.71	39.65	39 71	39.7	39.7	39 77	39.81	39.8	39 92	0.00	0.03	0.1	0.33	0. 7	0 60	0.68	0.78	0 88	0.88

Figure 10.23 Sussex Brighton MDO Baseline Supply Demand Balance



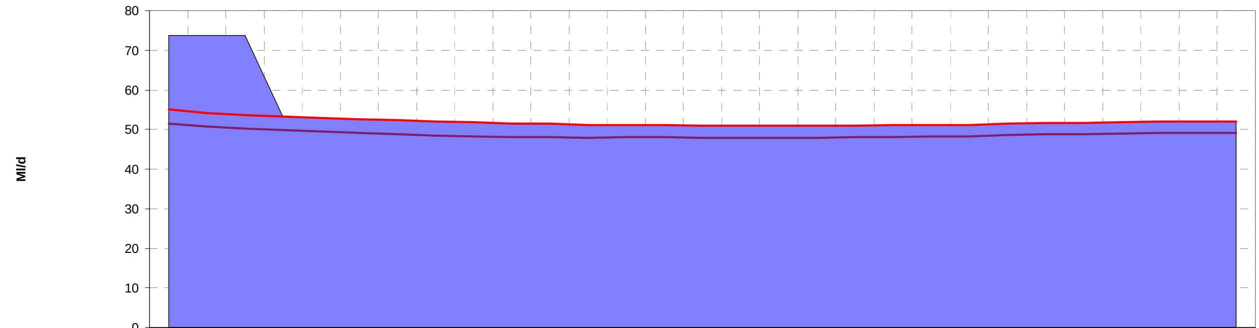
	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-1	201 -15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-2	202 -25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-3	203 -35	2035-36
Peak Sussex North Resources	90.72	90 72	90.72	81 35	81.77	83.07	83. 3	8 67	8 .95	85.18	85.28	85. 9	85 55	85.59	85.68	85.70	85 72	85.7	85.65	85.55	85.52	85.38	85.13	8 9	8 .77	8 .67	8 .53	8 . 0	8 . 0
Peak Dmd Headroom	89.16	89 02	88.65	88. 2	88.23	87.8	87.61	87 39	87.23	87.09	87.15	87.12	87 32	87.5	87.66	87.85	88 07	88.18	88. 0	88.6	88.70	88.9	89.15	89. 3	89.5	89.73	89.98	90 2	90.2
Peak Sussex North Demand	85.20	85 07	8 .71	8 .	8 .20	83.77	83. 9	83 23	83.13	83.05	83.17	83.20	83. 6	83.68	83.80	83.99	8 21	8 .31	8 .53	8 .77	8 .83	85.08	85.29	85 57	85.67	85.87	86.12	86 37	86.37

Figure 10.24 Sussex North PDO Baseline Supply Demand Balance



	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-1	201 -15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-2	202 -25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-3	203 -35	2035-36
Peak Sussex Worthing Resources	73 69	73.69	73.69	53 33	52.92	52.62	52.36	52.07	51.78	51.5	51. 2	51.20	51.13	51.07	50 97	50.93	50.90	50 87	50.95	51.0	51.05	51.18	51. 2	51.59	51 75	51.8	51.96	52 09	52.09
Peak Dmd Headroom	55 02	5 .19	53.60	53 33	52.92	52.62	52.36	52.07	51.78	51.5	51. 2	51.20	51.13	51.07	50 97	50.93	50.90	50 87	50.95	51.0	51.05	51.18	51. 2	51.59	51 75	51.8	51.96	52 09	52.09
Peak Sussex Worthing Demand	51 57	50.79	50.25	9 93	9. 6	9.11	8.79	8. 5	8.26	8.12	8.10	7.97	8.00	7.99	7 9	7.95	7.96	7 98	8.06	8.15	8.16	8.30	8.53	8.70	8 86	8.95	9.07	9 20	9.20

Figure 10.25 Sussex Worthing PDO Baseline Supply Demand Balance



	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-1	201 -15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-2	202 -25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-3	203 -35	2035-36
Peak Sussex Worthing Resources	73 69	73.69	73.69	53 33	52.92	52.62	52.36	52.07	51.78	51.5	51. 2	51.20	51.13	51.07	50 97	50.93	50.90	50 87	50.95	51.0	51.05	51.18	51. 2	51.59	51 75	51.8	51.96	52 09	52.09
Peak Dmd Headroom	55 02	5 .19	53.60	53 33	52.92	52.62	52.36	52.07	51.78	51.5	51. 2	51.20	51.13	51.07	50 97	50.93	50.90	50 87	50.95	51.0	51.05	51.18	51. 2	51.59	51 75	51.8	51.96	52 09	52.09
Peak Sussex Worthing Demand	51 57	50.79	50.25	9 93	9. 6	9.11	8.79	8. 5	8.26	8.12	8.10	7.97	8.00	7.99	7 9	7.95	7.96	7 98	8.06	8.15	8.16	8.30	8.53	8.70	8 86	8.95	9.07	9 20	9.20

Figure 10.26 Sussex Brighton PDO Baseline Supply Demand Balance

10.4.9 Options to Meet the Supply Demand Balance in the Central Area

A number of demand and supply side options have been considered to meet any supply demand balance deficit.

The supply side options have been assessed using the options appraisal methodology described in section 8. In summary, an initial list of nearly 120 options has been considered within the Central Area, for which further details are given in Appendix G.

Following the various screening processes, the number of “feasible” options, by generic type, that was chosen to be available for selection by the investment model can be summarised, by generic type, as follows:

- Two sites for a new surface storage reservoir, for which the sole lead promoter would be Southern Water;
- Five sites for possible increases in abstraction from either surface or groundwater, although only one or two would be chosen;
- No sites for enlarging existing reservoirs;
- One site for potential re-commissioning of old/existing sources;
- Three possible abstraction licence variations;
- No sites for the further upgrade of WSW treatment facilities, for the purposes of the supply demand balance;
- Three potential inter-zonal bulk transfers, either existing or proposed;
- No potential inter-company bulk transfers, either existing or proposed;
- Two potential schemes for wastewater recycling;
- One site for potential Aquifer Storage and Recovery scheme; and
- Four potential schemes for desalination.

This shows that a wide range of generic types of option were available for selection, thus ensuring that the selection of preferred schemes was robust. The total number includes a number of generic schemes, for instance desalination, at the same site but for different capacities. This is to ensure that a generic option is not ruled out from selection on the basis of the size and associated cost alone.

There are three generic types of demand side options: metering; leakage reduction; and water efficiency. Different modelling scenarios have been devised to reflect a different selection of options (see section 10.1.13).

As noted in section 10.3.8, scenario 3 (Universal Metering) has been used as the starting point for the supply demand balance from which the Final Planning solution has been developed.

In order to consider leakage options, a number of incremental “step” reductions in leakage were considered, based on outputs from the Sustainable Economic Level of Leakage analysis, as explained in Chapter 6 and Appendix G.

Water efficiency options for both households and non-households were included in the model. More details of the options are given in section 8 and Appendix G.

10.4.10 The Water Resources Strategy for the Central Area

The water resources strategy is described in three different sections over the planning period:

- AMP5, the first five years from 2010-11 to 2014-15, which formed the basis of the Final Business Plan Submission;

- AMP6 to the end of the planning period, based on the company only least-cost strategy; and then
- An explanation of how this company only strategy is modified to take into account the recommendations of the WRSE regional modelling results.

The company preferred water resource strategy for each of these intervals is described below and is summarised in Table 10.14.

During AMP5 (2010-15)

The supply demand balance will be satisfied for the Central Area for the AMP5 period through the following:

- A policy of universal metering throughout the area by 2015, which will give benefits in terms of demand savings and associated reductions in supply pipe leakage;
- The optimisation of inter-zonal transfers, from the Sussex Worthing WRZ to the Sussex North and Sussex Brighton WRZs;
- The renewal of the existing bulk supply from Portsmouth Water to Sussex North WRZ;
- A series of groundwater source improvements, which could deliver up to 11.6 Ml/d for the average condition; and
- The construction of a new intake on the River Arun, which has been the subject of extensive investigations during AMP4. A planning application and abstraction licence application have been made, and it is planned that the source will be commissioned by 2012.

From AMP6 to the end of the planning period (2015-35) (company only)

For the company only least-cost solution, there are no further interventions identified as being required until the end of the planning period, with the supply demand balance being satisfied through the optimisation of inter-zonal bulk transfers, the continuation of the inter-company bulk import from Portsmouth Water and the benefits of the supply and demand side interventions made during AMP5.

From AMP6 to the end of the planning period (2015-35) (company preferred regional solution)

Following the results of the WRSE modelling work, Southern Water reaffirmed its commitment to the development of a regional solution. As such, as a result of the preferred options identified from the WRSE modelling work, we have included the following option in our company preferred regional strategy, over and above the company only least-cost solution:

- The provision of a 4 Ml/d bulk supply of 2028 from the Sussex Brighton WRZ to South East Water.

It should be noted that the WRSE work identified the possibility of an enhanced bulk import from Portsmouth, associated with the development of Havant Thicket reservoir. However, this has not been included in our preferred strategy as there was no requirement for it in the supply demand balance.

There is a supply demand balance surplus in Sussex Brighton WRZ and so there is minimal incremental cost associated with the adoption of the company preferred regional strategy.

The Water Resources Strategy for the Central Area is summarised in Table 10.14.

Water Resource Zone	Schemes During AMP 5	Schemes beyond AMP 5 – company only solution	Schemes beyond AMP 5 – Water Resources in the South East of England
Sussex North	• Universal metering • Renewal of the existing bulk supply contract from Portsmouth Water • Asset improvement schemes for groundwater sources (0.30 Ml/d peak, 0.10 Ml/d average) • Optimisation of inter-zonal transfers (from Sussex Worthing) • River Arun Abstraction	• Renewal of the bulk supply of contract to South East Water	As previous column
Sussex Worthing	• Universal metering • Asset improvement schemes for groundwater sources (1.75 Ml/d peak, 4.25 Ml/d average) • Optimisation of inter-zonal transfers (to Sussex North and Sussex Brighton)		
Sussex Brighton	• Universal metering • Asset improvement schemes for groundwater sources (7.25 Ml/d peak & average) • Optimisation of inter-zonal transfers (from Sussex Worthing)		• Provision of a 4 Ml/d bu k supply to South East Water

Table 10.14 Summary of Water Resources Strategy for the Central Area

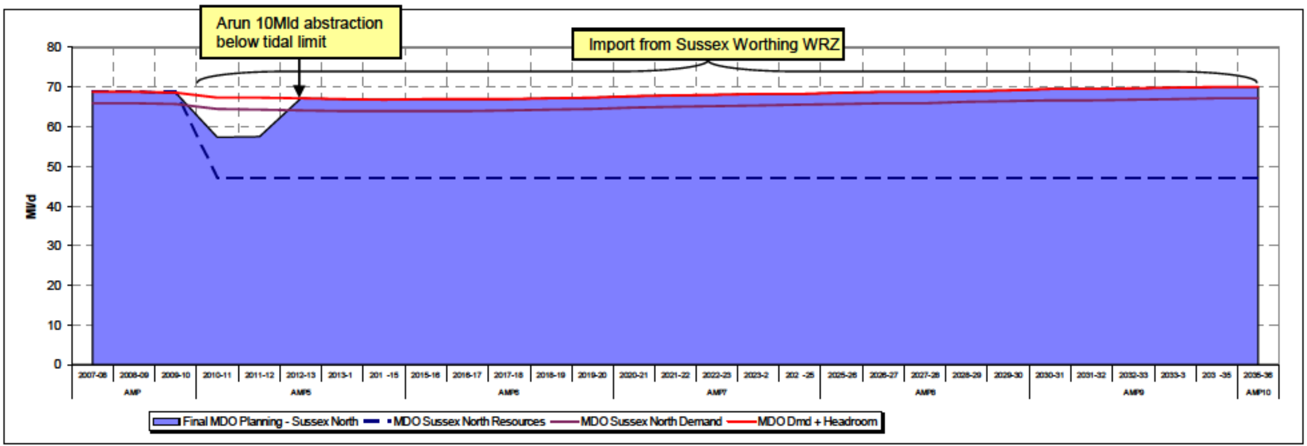


Figure 10.27 Sussex North Company Preferred Regional Strategy (Scenario 4), MDO Solution

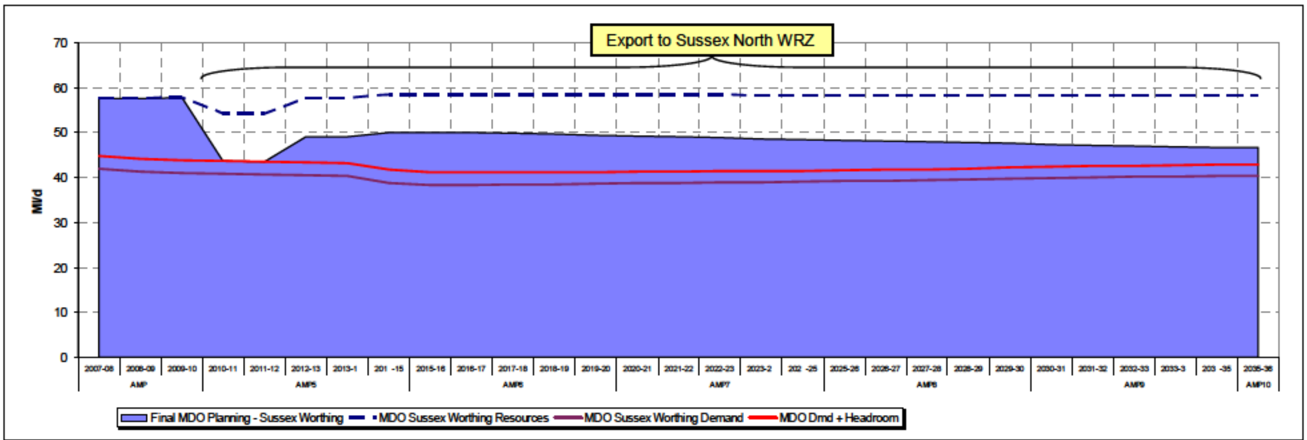


Figure 10.28 Sussex Worthing Company Preferred Regional Strategy (Scenario 4), MDO Solution

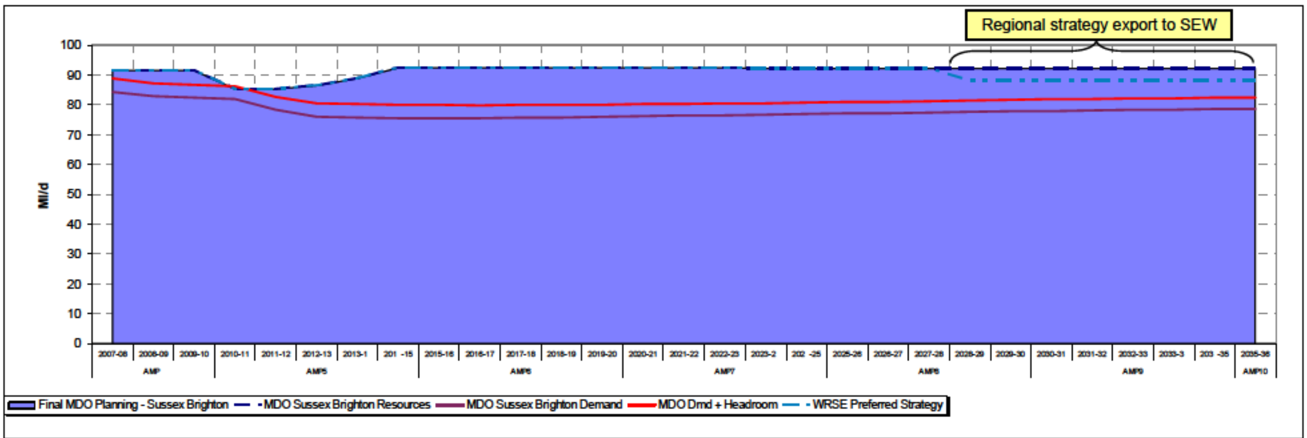


Figure 10.29 Sussex Brighton Company Preferred Regional Strategy (Scenario 4), MDO Solution

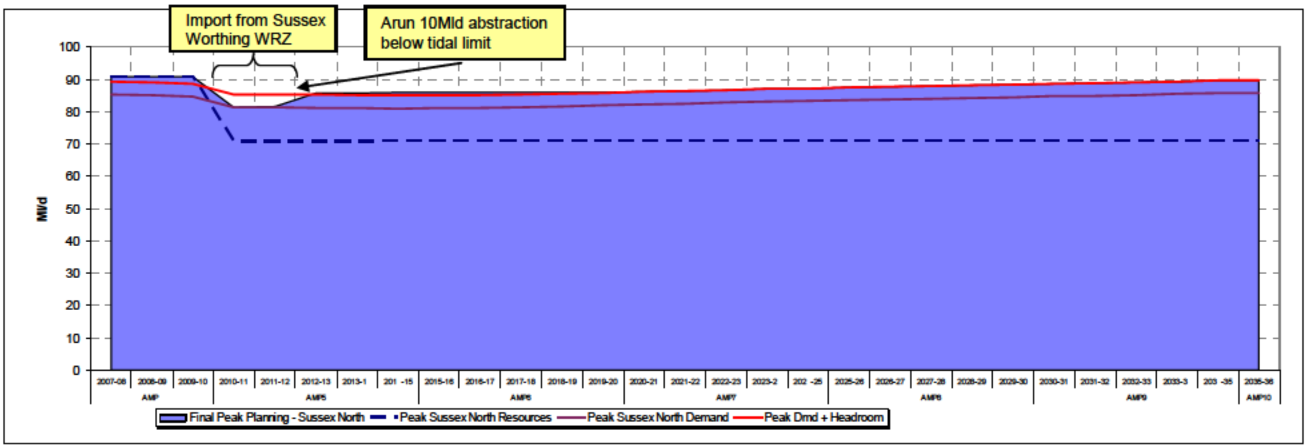


Figure 10.30 Sussex North Company Preferred Regional Strategy (Scenario 4), PDO Solution

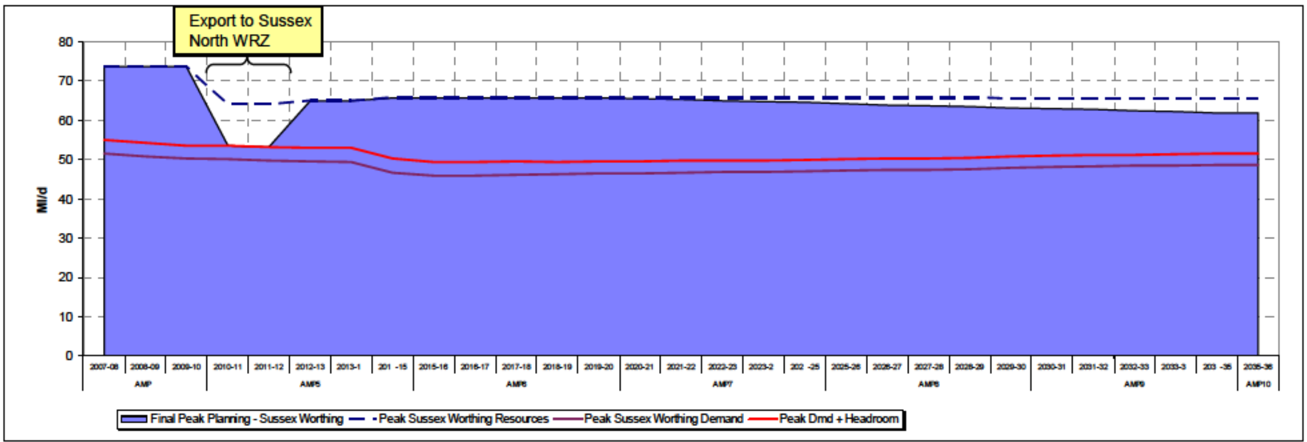


Figure 10.31 Sussex Worthing Company Preferred Regional Strategy (Scenario 4), PDO Solution

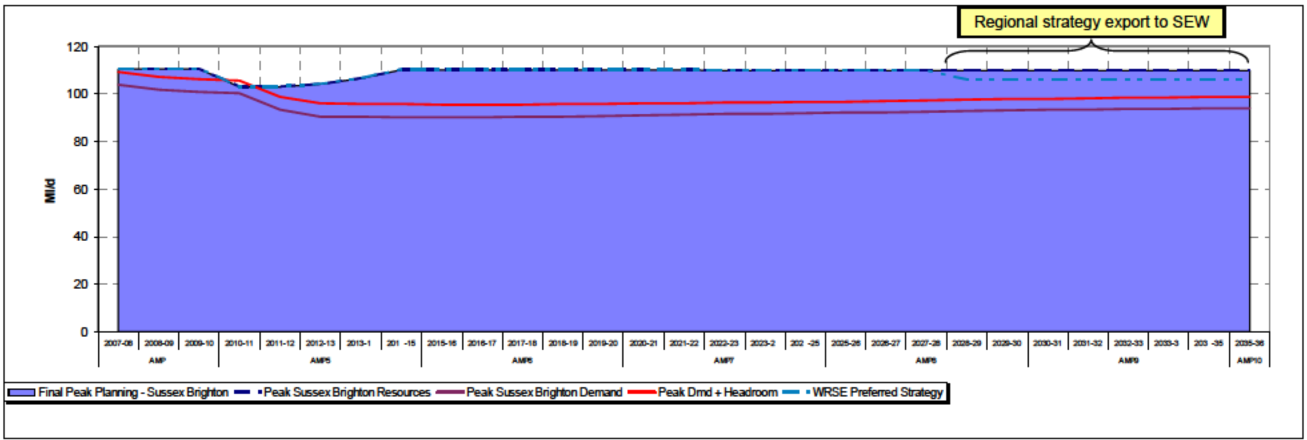


Figure 10.32 Sussex Brighton Company Preferred Regional Strategy (Scenario 4), PDO Solution

10.4.10.1 SEA Influence on Strategy

All options were assessed against 17 SEA objectives, and assigned an overall environmental risk (high, medium or low), based on the significance of potential long term effects.

Table 10.15 sets out the environmental risk of each resource development option. More detail is given in Appendix I.

Option	Environmental Risk Score
N9-10 - Arun Abstraction Below Tidal Limit	Low

Table 10.15 Environmental Risks of Resource Development Options Selected in the Central Area Strategy

The demand management options (metering; leakage reduction; and water efficiency) were also assessed against the SEA objectives. More detail is given in Appendix I. All three generic demand management measures are broadly compatible with the majority of SEA objectives due to the minimal amount of physical intervention required in implementing each measure. However, water efficiency measures have no potential conflicts with SEA objectives and are therefore the preferred demand management measure from an SEA perspective.

10.4.10.2 SEA preferred strategy

The options assessed as being likely to result in the lowest environmental risk are preferable from a SEA perspective and have been used to create the SEA preferred strategy. The low risk, and therefore preferred water resource management options are set out below:

- Arun Abstraction below Tidal Limit.

The company preferred strategy is therefore compatible with the SEA preferred strategy.

10.4.11 Scenario Analysis

A number of scenarios have been modelled, in order to assess the stability of the company only least-cost strategy to changes in some of the basic assumptions.

	Scenario	Company preferred Regional strategy	Company only Universal metering	Company only Change of occupier	Company only Optant	Company only Universal metering with no climate change	Company only Leakage rise to Ofwat target	Hybrid Baseline where no deficit, otherwise universal metering
	Number	4	3	2	1	11	8	
	Metering policy	Universal	Universal	Change of occupier	Optant and selective	Universal	Universal	Universal or change of occupier
	Leakage policy	JR08, then SPL saving	JR08, then SPL saving	JR08	JR08	JR08, then SPL saving	Ofwat, then SPL saving	JR08, then SPL saving
	WRSE preferred options & bulk supplies	Yes	No	No	No	No	No	Yes
WRZ	**Scheme**	**Earliest year required**						
sse x Nor	River Arun abstraction below tidal limit (10 Ml/d)	2012	2012	2012	2012	2012	2012	2012

	Scenario	**Company preferred Regional strategy**	**Company only Universal metering**	**Company only Change of occupier**	**Company only Optant**	**Company only Universal metering with no climate change**	**Company only Leakage rise to Ofwat target**	**Hybrid Baseline where no deficit, otherwise universal metering**
	Number	**4**	**3**	**2**	**1**	**11**	**8**	
	Leakage reduction	-	-	-	-	-	2010 reduction by 0.6 Ml/d	-
	Water efficiency trigger hoses	-	-	-	-	-	2010	-
	Water efficiency low flow shower heads	-	-	-	-	-	2010	-
Sussex Brighton	*No supply side, water efficiency, or leakage reduction schemes*	-	-	-	-	-	-	-
Sussex Worthing	Leakage reduction	-	-	-	-	-	2010 reduction by 0.4 Ml/d	-
	Costs (£m)							
	Total metering cost (£m)	56.82	56.82	61.25	51.94	56.82	56.82	59.91
	Total resource, leakage reduction and water efficiency activity cost (£m)	18.42	18.42	18.62	18.81	18.35	20.22	18.42
	Total cost of Strategy (£m)	**75.24**	**75.24**	**79.87**	**70.75**	**75.17**	**77.04**	**78.33**

Table 10.16 gives a summary of the different baseline assumptions for these scenarios, and the results in terms of scheme inclusion, scheme timing, and costs for the different investment strategies. The following points can be seen from the results:

- The company only least-cost scenario (3) assumes the baseline condition of universal metering by 2015;
- All scenarios assume the renewal of existing bulk supplies to other companies until the end of the planning period, at the rates which are appropriate at the time of renewal;
- All scenarios include the Arun abstraction as the only resource development, and do not include for any further reductions in leakage;
- The exception to this is the scenario in which leakage is initially allowed to rise to the Ofwat target level, where further leakage reduction of 1.0 Ml/d is required from 2010 to try to reduce any AMP5 deficits to the same levels as seen in the company only least-cost scenario (3);
- The total cost of the resources strategy (including new resources, leakage reduction, and water efficiency) plus metering strategy, for the various company only scenarios is as follows:
  - Universal metering - £75.2 m.
  - Change of occupier - £79.9 m.
  - Optant and selective - £70.8 m.
  - Hybrid metering policy - £m78.3 m
- There is no difference in cost between the company preferred regional strategy and the company only least-cost strategy, because there is a supply demand balance surplus in Sussex Brighton WRZ and the regional solution

only entails a minor increase in bulk supplies towards the end of the planning period.

Scenario		Company preferred Regional strategy	Company only Universal metering	Company only Change of occupier	Company only Optant	Company only Universal metering with no climate change	Company only Leakage rise to Ofwat target	Hybrid Baseline where no deficit, otherwise universal metering
Number		4	3	2	1	11	8	
Metering policy		Universal	Universal	Change of occupier	Optant and selective	Universal	Universal	Universal or change of occupier
Leakage policy		JR08, then SPL saving	JR08, then SPL saving	JR08	JR08	JR08, then SPL saving	Ofwat, then SPL saving	JR08, then SPL saving
WRSE preferred options & bulk supplies		Yes	No	No	No	No	No	Yes
WRZ	**Scheme**	**Earliest year required**						
Sussex North	River Arun abstraction below tidal limit (10 Ml/d)	2012	2012	2012	2012	2012	2012	2012
Sussex North	Leakage reduction	-	-	-	-	-	2010 reduction by 0.6 Ml/d	-
Sussex North	Water efficiency trigger hoses	-	-	-	-	-	2010	-
Sussex North	Water efficiency low flow shower heads	-	-	-	-	-	2010	-
Sussex Brighton	*No supply side, water efficiency, or leakage reduction schemes*	-	-	-	-	-	-	-
Sussex Worthing	Leakage reduction	-	-	-	-	-	2010 reduction by 0.4 Ml/d	-
Costs (£m)								
Total metering cost (£m)		56.82	56.82	61.25	51.94	56.82	56.82	59.91
Total resource, leakage reduction and water efficiency activity cost (£m)		18.42	18.42	18.62	18.81	18.35	20.22	18.42
Total cost of Strategy (£m)		**75.24**	**75.24**	**79.87**	**70.75**	**75.17**	**77.04**	**78.33**

Table 10.16 Results of Scenario Analysis for Central Area

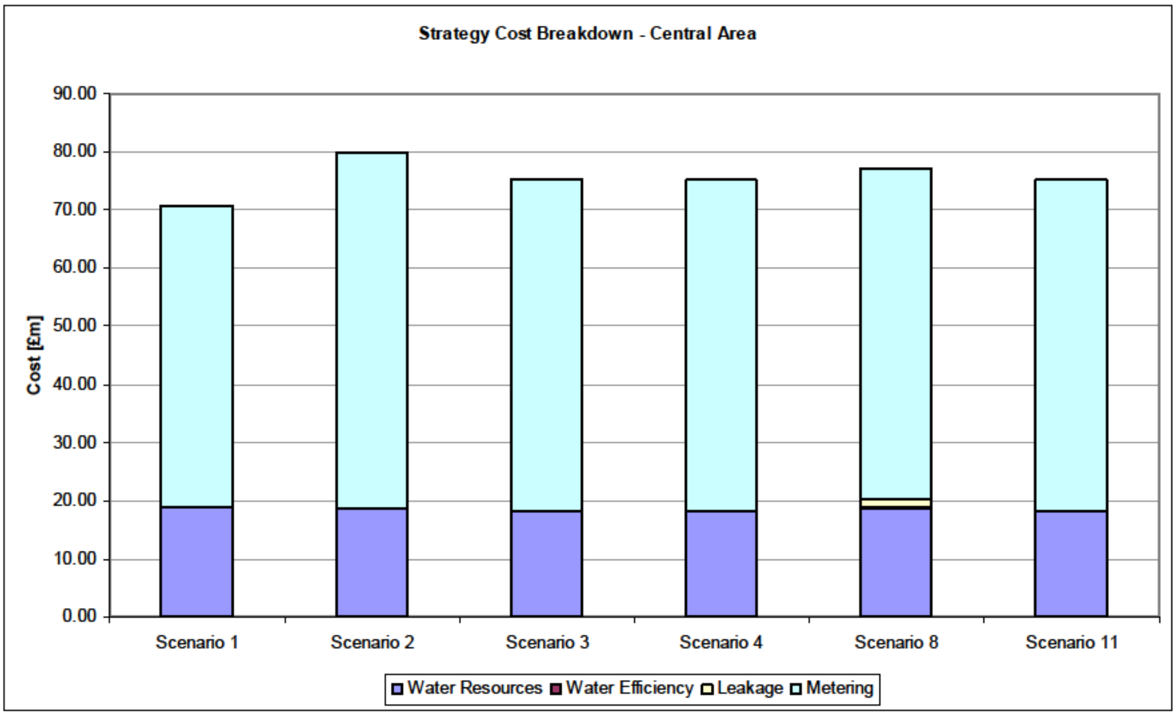


Figure 10.33 Central Area Scenario Cost Comparisons

10.4.12 Sensitivity Analysis

10.4.12.1 Range of Sensitivity Analysis

The "possible worst-case" focused on any changes in supply side or demand side factors which would worsen the supply demand balance. Any decrease in deployable output and/or increase in demands would mean that deficits occur earlier in the planning period and would be larger than those identified in the baseline conditions. This could pose a threat to the security of supplies if the selected schemes, and/or any others that might then be required, could not be commissioned quickly enough.

Following consideration of a number of such demand and supply side factors and the potential magnitude of each it was decided that a "global" change in the demand forecast of +/- 5%, would be assumed for the area. To put this sensitivity into context, at the end of the planning period, for the Central Area:

- A change in demand of +/- 5% would result in an increase in a change in demand of +/- 9.3 Ml/d and +/- 11.4 Ml/d at the MDO and PDO condition respectively by the end of the planning period;
- A change in demand of +/- 5% would be equivalent to a change in the area deployable output of +/- 5.0% and +/- 4.7% at the MDO and PDO condition respectively.

10.4.12.2 Results of Sensitivity Analysis

The results of the sensitivity analysis for the possible "best-case" and "worst-case" are presented in Table 10.17 and can be summarised as follows:

Under the "worst-case" sensitivity:

- The timing of the Arun abstraction scheme remains unchanged; however

- In view of the increase in demand, a small amount of further leakage reduction is required in Sussex North and Sussex Worthing WRZs.

Under the "best-case" sensitivity:

- The timing of the Arun abstraction scheme remains unchanged.

In summary, the company only least-cost strategy is largely unaffected by sensitivity runs, as the selection of the Arun abstraction in Sussex North is governed by the large deficits in that WRZ.

	Scenario Number	Company preferred WRSE Regional 4	Company only Universal metering 3	Increase in demand of 5% by end of planning period "Worst case"	Decrease in demand of 5% by end of planning period "Best case"
	Metering policy	Universal	Universal	Universal	Universal
	Leakage policy	JR08, then SPL saving	JR08, then SPL saving	JR08, then SPL saving	JR08, then SPL saving
	WRSE preferred options & bulk supplies	Yes	No	No	No
WRZ	**Scheme**	**Earliest year required**			
Sussex North	River Arun abstraction below tidal limit (10 Ml/d)	2012	2012	2012	2012
Sussex North	Leakage reduction	-	-	2032 reduction by 1.2 Ml/d	-
Sussex Brighton	*No supply side, water efficiency, or leakage reduction schemes*	-	-	-	-
Sussex Worthing	Leakage reduction	-	-	2033 reduction by 0.4 Ml/d	-
	Costs (£m)				
	Total metering cost (£m)	56.82	56.82	56.82	56.82
	Total resource, leakage reduction and water efficiency activity cost (£m)	18.42	18.42	18.96	18.05
	Total cost of Strategy (£m)	**75.24**	**75.24**	**75.78**	**74.87**

Table 10.17 Results of Sensitivity Analysis for the Central Area

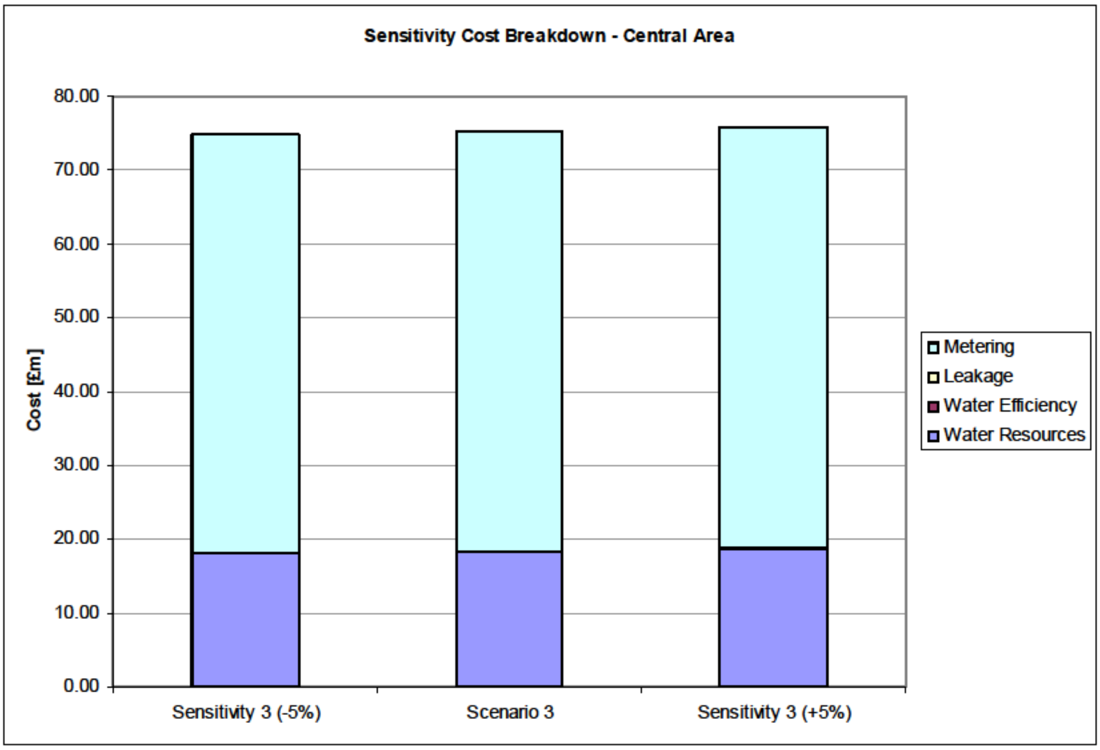


Figure 10.34 Central Area Sensitivity Analysis Cost Comparisons

10.5 The Water Resources Strategy for the Eastern Area

10.5.1 Location

The Eastern Area is situated in north and east Kent, and east Sussex, and comprises the Water Resource Zones (WRZs) of Kent Medway, Kent Thanet and Sussex Hastings. The Kent Medway WRZ is situated in the northern part of Kent, and extends from Gravesend in the west, Sittingbourne in the east and the North Downs in the south. It supplies the towns of Chatham, Rochester, Strood, Gillingham, the Isle of Grain and surrounding area. The Kent Thanet WRZ is located in the north-east corner of Kent, and includes the towns of Margate, Broadstairs, Ramsgate, Sandwich and Deal, together with the rural area east of Canterbury. The Sussex Hastings WRZ is in the eastern part of Sussex, and supplies the towns of Hastings and Rye and the surrounding area.

There are a number of inter-zonal transfers between the WRZs, as follows:

- From the Kent Medway WRZ to the Kent Thanet WRZ via a transfer main; and
- From the Kent Medway WRZ to the Sussex Hastings WRZ via a transfer main.

There are also a number of inter-company transfers:

- An export to South East Water in the Kent Medway WRZ;
- An export to South East Water from its entitlement to 25% of the yield of G457 in the Kent Medway WRZ;
- A number of small metered supplies to South East Water in the Kent Medway WRZ;
- A seasonal export to Folkestone and Dover Water Services from the Kent Thanet WRZ; and
- An export to South East Water from the Sussex Hastings WRZ from Darwell reservoir.

A schematic showing the key features of the Eastern Area is given as Figure 10.35.

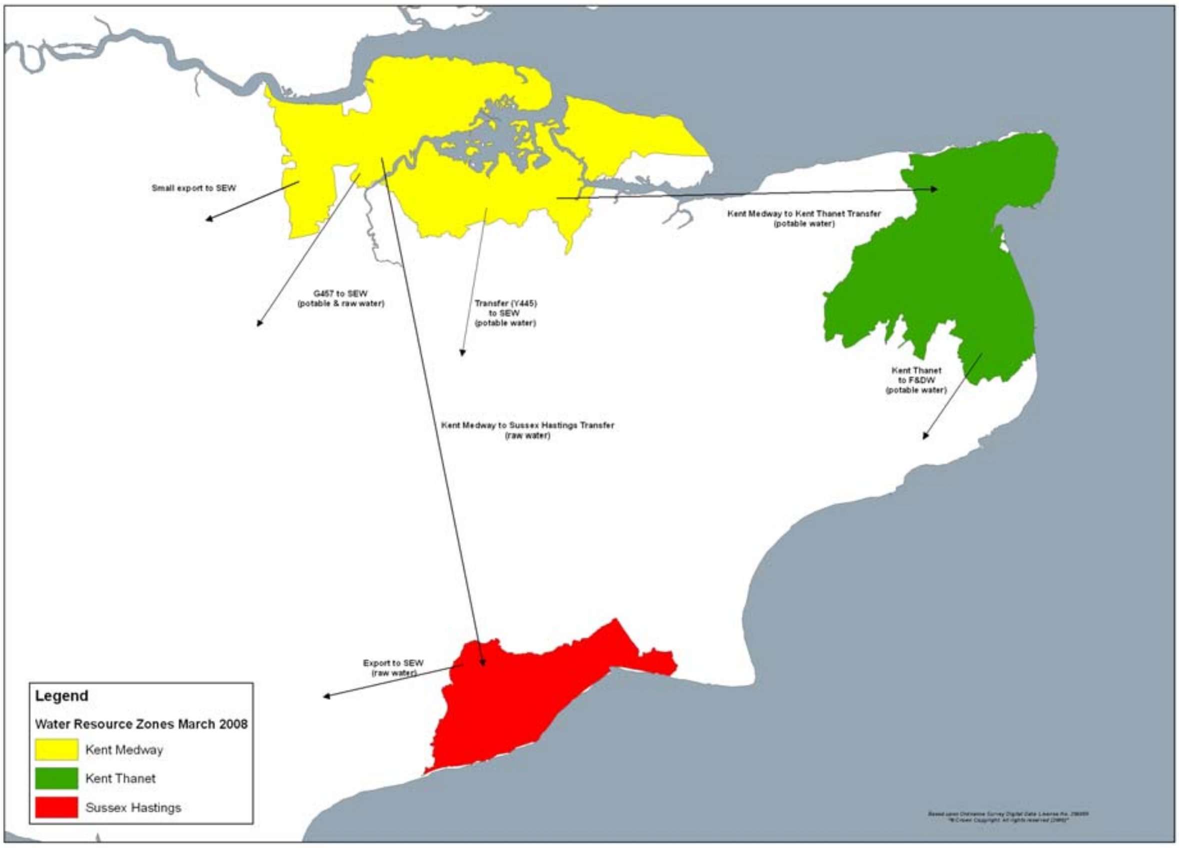


Figure 10.35 Schematic of the Eastern Area

10.5.2 Sources of Supply

The area is supplied by both surface water and groundwater sources. There are four surface water sources and over 50 groundwater sources. Groundwater abstraction is almost exclusively from the Chalk aquifer with a few small sources that abstract from the Lower Greensand. Most of the sources comprise boreholes only, but a number also have a well and adit design.

The surface water sources comprise the three reservoirs; Bewl Water, Darwell and Powdermill and a small direct river abstraction at T656.

G457 is the largest surface water source in the area. It comprises Bewl Water, a reservoir at the headwaters of the River Medway, which is filled from two river intakes, on the River Teise and the River Medway. The reservoir supports the company's downstream abstraction, from where water is pumped for treatment at P647. South East Water is entitled to 25% of the yield of the scheme, and takes some of its entitlement as treated water at P647 and the rest as raw water directly to its treatment works at Bewl Water. There is also a raw water transfer between Bewl Water and Darwell reservoir. This transfer assists in enhancing the yield of Darwell to support the Sussex Hastings WRZ. There is also a bulk supply made from Darwell reservoir to South East Water.

The only surface water source in the Kent Thanet WRZ is on the River Stour. It is a run-of-river abstraction, and subject to a Minimum Residual Flow condition. This abstraction is supported by discharge from a wastewater treatment works, which allows abstraction to continue when the river flow reduces to below the Minimum Residual Flow which controls the abstraction

There are two small reservoirs in the Sussex Hastings WRZ, Darwell and Powdermill. Both are pumped storage impounding reservoirs, with pumped inflows from the Eastern Rother to

Darwell and from the River Brede to Powdermill respectively. There is also the facility to transfer from Bewl Water to Darwell reservoir via a raw water transfer pipeline.

10.5.3 Supplies Available

The total deployable output for the area is 242.2 Ml/d at ADO and 289.7 Ml/d at PDO. Each WRZ has a different mixture of types of source, and thus a different ratio of groundwater to surface water. These proportions are shown in Table 10.18, which demonstrates that, whilst the area proportion is 68% groundwater : 32% surface water (ADO), this varies from almost complete dominance of groundwater in the Kent Thanet WRZ to almost complete dominance of surface water in the Sussex Hastings WRZ, with the Kent Medway WRZ having an intermediate balance of 76% groundwater : 24% surface water.

WRZ	Groundwater			Surface Water			Total	
	No. sources	ADO Ml/d	PDO Ml/d	No. sources	ADO Ml/d	PDO Ml/d	ADO Ml/d	PDO Ml/d
Sussex Hastings	5	1.89	3.50	2	38.08	42.85	39.97	46.35
Kent Medway	33	110.44	135.67	1	30.90	46.90	141.34	182.57
Kent Thanet	12	56.36	57.29	1	4.51	3.50	60.87	60.79
Total	**53**	**168.69**	**196.46**	**4**	**73.49**	**93.25**	**242.18**	**289.71**

Note: Values are for indigenous sources only, and do not take either inter-zonal or inter-company transfers into account.
Note: further detail is given for individual sources in Appendix D.1

Table 10.18 Summary of PR09 Base Year (2010-11) Deployable Outputs for the Eastern Area

This variation in the groundwater to surface water ratio has a major influence on how the area's sources are managed strategically especially when planning for the extreme conditions of a design event. This is an important influence when assessing the most appropriate options for future development.

10.5.4 Strategic Management of Sources

The inter-connections between the various WRZs in the Eastern Area enable the whole area to be strategically managed in a conjunctive way, especially in the design drought event. The nature of the different types of sources within the area, especially the presence of surface water storage, means that the area is generally resilient to one season droughts, but becomes more vulnerable to two season, and particularly to three season drought events, which see the progressive depletion of both surface water and groundwater storage. The Kent Medway WRZ, and the River Medway Scheme in particular, is central to the strategic management of supplies throughout the Eastern Area. The balance of groundwater and surface water supplies is vital in ensuring that the WRZ is provided with some resilience in the event of differing drought conditions. The Kent Medway WRZ supports the Kent Thanet WRZ via a potable water main, and the Sussex Hastings WRZ via the Bewl-Darwell transfer.

The Kent Thanet WRZ is supplied almost exclusively from groundwater sources. It is therefore prone to water resources stress in the event of prolonged periods of low rainfall and drought, which leads to the progressive depletion of groundwater. A number of the sources have extensive adit systems, which can make them even more susceptible to drought conditions. A risk assessment has concluded that adits should not be de-watered due to the risk of structural failure and increased turbidity. Support can be provided form the Kent Medway WRZ via a potable water main, although this is also groundwater dependant. However these groundwater sources can be supported by the strategic use of the River Medway Scheme. The nature of the conjunctive use of these surface water sources means that the ratio of loss of water at Bewl and gain at Darwell is not 1:1. The supply demand balance takes this into account by an adjustment in the transfer which reverses a small proportion of water to maximise supplies in the Eastern Area as a whole.

The Sussex Hastings WRZ is dependent on surface water supplies from the two reservoirs at Darwell and Powdermill. These two reservoirs are smaller than Bewl and are prone to the effects of shorter duration droughts, even single winter events. However, this can be offset through enhanced refill support via the Bewl-Darwell transfer, which in turn is dependent on the River Medway Scheme.

G457 is thus important to the supply demand balance of the Eastern Area. It should also be noted that, in the event of design drought conditions, this is the only source that can benefit significantly from the introduction of Drought Orders/Permits. Unfortunately, this has been the case too frequently in the past 20 years, with 18 successful applications for Drought Orders/Permits (see section 10.5.7.2). In order to reduce the frequency of applications, more resilience is required for the Eastern Area.

10.5.5 Demand Summary

Southern Water provides drinking water to a population in the area of about 722,500. Normal year average annual demands are 181.0 Ml/d, which can rise to 195.7 Ml/d during dry years. However, during dry years, the demands at the critical MDO and PDO periods can be 186.8 Ml/d and 241.5 Ml/d respectively, as shown in Table 10.19.

WRZ	Population (000s)	Normal Year Average Annual demand (Ml/d)	Dry Year Annual Average demand (Ml/d)	Dry Year MDO demand (Ml/d)	Dry Year Peak Period demand (Ml/d)
Kent Medway	441.31	111.97	122.33	116.47	148.95
Kent Thanet	180.19	43.43	46.39	43.67	59.81
Sussex Hastings	101.03	25.63	26.95	26.69	32.69
Eastern Area	**722.53**	**181.03**	**195.67**	**186.83**	**241.45**

Table 10.19 Summary of Base Year (2007-08) Demand for the Eastern Area

10.5.6 Strategic Development to Date

There have been a number of strategic developments in the area over the last 10-15 years, which are summarised as follows:

- Leakage has decreased over the last 12 years from 28.2 Ml/d to 26.0 Ml/d;
- There has been an increase in meter installation over the last 12 years from 7% to 28%;
- A new river abstraction to enhance the refill of Bewl Water and thus the deployable output of G457;
- The Bewl-Darwell transfer, subsequently upgraded in 2003, to enhance the deployable output of Darwell reservoir and improve security of supplies to the Sussex Hastings WRZ and provide a bulk supply to South East Water; and

- A number of groundwater sources were improved and/or re-introduced as part of the 2004-06 drought initiative in the Kent Medway WRZ.

10.5.7 Levels of Service

The area, as with other parts of the south-east, has suffered from the effects of the recent droughts, in 1989-92, 1995 and more recently 2004-06. There was serious stress on the area's water resources and a risk to security of supply. In order to respond to the increasingly severe drought conditions Southern Water followed its Drought Plan and introduced its programme of both demand side and supply side which had an impact on Customer and Environmental Levels of Service.

10.5.7.1 Customer Levels of Service

A summary of the frequency of restrictions since 1989., compared to Target Levels of Service, is given in Table 10.20. Despite its best endeavours to alleviate the effects of the droughts, Southern Water was unable to meet its Target Levels of Service:

- In some WRZs in this area the company has introduced sprinkler/full hosepipe bans in eight out of the last 20 years (40%), although this varied from six years (30%) in the Kent Medway and Kent Thanet WRZs to eight years (40%) in the Sussex Hastings WRZ.
- The amount of time on average that customers have been subject to restrictions, calculated as the percentage of the actual (population times weeks of restriction) compared to the total (population times weeks under review is 22% (varying from 21% in the Kent Thanet WRZ to 27% in the Sussex Hastings WRZ). It would be expected that, for Target Levels of Service to be met, this measure would be a maximum of 10%.

There have also been a number of Drought Orders to restrict the so-called "non-essential uses" of water. These were restricted to the Kent Medway and Kent Thanet WRZs, and occurred during the early 1990s. A Drought Order was granted in 2006, and covered the whole area. It turned out that powers granted under this Drought Order did not need to be used due to the successful introduction of a number of other supply and demand side measures combined with wetter hydrological conditions.

WRZ	Target Levels of Service		Actual Level of Service	
	1 in x years	% years	% no. of reporting years (taken as the no. of years, irrespective of duration during the year)	Time expressed as % of (population x weeks)
Hosepipe / Sprinkler ban				
Kent Medway	1:10	10%	30%	21%
Kent Thanet	1:10	10%	30%	21%
Sussex Hastings	1:10	10%	40%	27%
Eastern Area	**1:10**	**10%**	**40%**	**22%**
Drought Orders implemented **"Non essential use" ban**				
Kent Medway	1:20	5%	20%	11%
Kent Thanet	1:20	5%	20%	11%
Sussex Hastings	1:20	5%	-	-
Eastern Area	**1:20**	**5%**	**20%**	**9%**

Table 10.20 Summary of Restrictions in the Eastern Area Since 1989

10.5.7.2 Environment Levels of Service

There have also been 36 Drought Permits/Orders granted since 1989. The following summary gives the sources affected and the terms of the Drought Permit/Order;

- G457 – eighteen Drought Permit/Orders, which authorised the reduction in Minimum Residual Flow conditions controlling abstractions and releases. Whilst most of these were for the purpose of winter refill, some were granted for the more environmentally sensitive summer period, although all authorisations included measures for appropriate environmental mitigation;
- T656 – seven Drought Orders, which authorised the reduction in Minimum Residual Flow conditions controlling abstractions;
- Bewl Darwell transfer – two Drought Orders, which enabled the transfer of water between Bewl Water and Darwell reservoir, pending abstraction licences being subsequently issued;
- Kent Groundwater – two Drought Orders, which authorised the relaxation of abstraction licence conditions for specific sources that were licence constrained in terms of either/and/or peak day, seasonal and annual limits;
- Medway Groundwater – three Drought Orders which authorised the relaxation of abstraction licence conditions for specific sources that were licence constrained in terms of either/and/or peak day, seasonal and annual limits; and
- Thanet Groundwater – five Drought Orders which authorised the relaxation of abstraction licence conditions for specific sources that were licence constrained in terms of either/and/or peak day, seasonal and annual limits;

There were a number of occasions when the sources did not, in the event, need to be operated under the terms of the Drought Permit/Order. Nevertheless it was essential that the Drought Permits/Orders were place, should the drought conditions have continued with increasing and unacceptable risks to security of supplies. It should also be noted that all authorisations were subject to environmental assessment which identified appropriate environmental mitigation measures.

Southern Water considers that the past performance against its Target Levels of Service on both the customer and the environmental side must be improved. This can only be achieved though the introduction of a number of supply and demand side measures to create a more robust supply system with a supply demand balance that is resilient to drought conditions which may become more severe and more frequent under climate change.

10.5.7.3 Influence of a supply demand balance deficit on operations during a drought

Even after taking into account inter-zonal transfers to reduce baseline supply demand balance deficits, Kent Medway and Kent Thanet WRZs would experience deficits in the first four and two years of the AMP5 period respectively. There would be no deficits in the Sussex Hastings WRZ.

The Kent Medway WRZ has a supply demand balance deficit for the first four years of the planning period for the ADO condition only, of about 7 Ml/d for the first two years, followed by 3 Ml/d and 0.3 Ml/d by the fourth year. This represents between about 6 and 1 % of Distribution Input respectively, and compares to the sum of the planning allowances for target headroom and outage of about 10 Ml/d.

The ADO situation, although sensitive, can be managed in the event of drought conditions through the conjunctive use of the different types of sources in the WRZ. Whilst these deficits are noteworthy for the first two years, the situation will require monitoring closely, and any opportunity to accelerate the groundwater asset improvement schemes for the WRZ should be taken.

The Kent Thanet WRZ has a supply demand balance deficit for the first two years of the planning period for the PDO condition only, of about 4 Ml/d and 3 Ml/d respectively. This represents about 7 %and 5 % of Distribution Input respectively, and compares to the sum of the planning allowances for target headroom and outage of about 8 Ml/d.

The PDO situation, although sensitive, can be managed in the event of drought conditions through the conjunctive use of the different types of sources in the adjacent Kent Medway WRZ, which can enable possibly greater inter-zonal transfers, depending on the operational supply demand balance in the adjacent WRZs. Whilst these deficits are noteworthy for the first two years, the situation will require monitoring closely, and any opportunity to accelerate the groundwater asset improvement schemes for the WRZ should be taken.

10.5.8 The Baseline Supply Demand Balance for the Eastern Area

The baseline supply demand balances in the WRP tables assume the following for each WRZ in the Eastern Area:

- Continuation of current metering policies. In 2007-08 there were 302,300 domestic properties in this area, 30% of which were metered. By 2015, the number of metered domestic properties is expected to rise to 162,300;
- Deployable outputs according to the Unified Methodology, which ensures that the deployable outputs for groundwater and surface water sources are estimated for the same design drought event;
- Deployable outputs include assumed incremental yields from source improvements for both AMP4 and planned for the AMP5 period, with timings assumed throughout the AMP5 period;
- No Sustainability Reductions (as advised by the Environment Agency);
- Renewal of existing inter-company bulk transfers until the end of the planning period, at the rates prevailing at the time of contract renewal; and
- Inter-zonal transfers are adjusted in the supply demand balance to represent the optimal use of surplus resources; while for the purposes of the investment model they are set to zero at the start of the planning period.

The baseline supply demand balance over the planning period are given in Table 10.21 for both the ADO and PDO conditions, and are shown in annotated graphs as Figure 10.36 to Figure 10.41. Full detailed build-up tables are given in Appendix I.

Note that in the Eastern Area, Kent Medway WRZ is driven by annual average (AA) deficits rather than MDO, while the other two WRZs are driven by peak deficits. Thus the Eastern Area solution is based on PDO and ADO design scenarios, not the PDO and MDO scenario used in other areas.

Water Resource Zone	Planning scenario	Base year 2007-08	2009-10	Start of planning period 2010-11	2014-15	2019-20	2024-25	2029-30	2034-35
Kent Medway	ADO	19.15	20.80	-7.37	3.68	0.63	-3.74	-8.47	-12.30
Kent Thanet	ADO	10.56	11.25	7.40	8.23	7.95	7.06	6.04	5.04
Sussex Hastings	ADO	0.00	0.00	0.00	0.00	0.00	0.00	0.02	-1.54
Kent Medway	PDO	7.21	10.36	0.00	11.02	6.96	0.33	0.00	-5.26
Kent Thanet	PDO	0.00	0.00	-4.00	0.00	0.00	0.00	-6.64	-8.17
Sussex Hastings	PDO	-0.82	0.00	0.00	0.00	0.00	0.00	-1.06	-2.79

Notes: Positive figures indicate a surplus of resources, negative indicate a deficit

Table 10.21 Baseline Supply Demand Balance for Eastern Area for the ADO and PDO Condition (Ml/d)

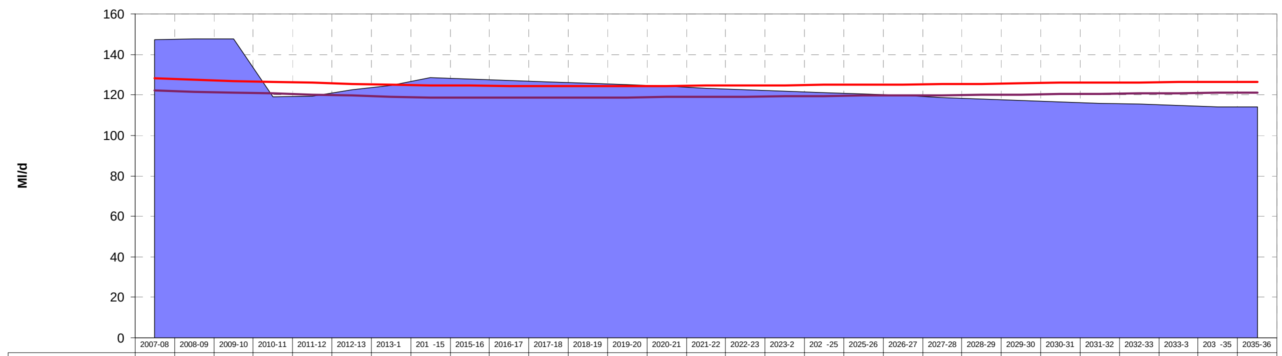
In these baseline supply demand balances, inter-zonal transfers from 2010-11 are balanced to make the best use of inter-connected resources where water can be transferred from a WRZ with a surplus to one with a deficit. At the same time, the investment model is able to chose whether it is better to cease continue, or increase, existing inter-zonal transfers, or to develop new resources, or enhance demand management in the WRZ in deficit.

For the ADO condition:

- The Kent Medway WRZ starts the planning period with a deficit, but achieves a surplus by the end of AMP5 due to various source improvements, and only goes into deficit near the end of the planning period;
- The Kent Thanet WRZ starts the planning period with a surplus, which remains throughout the planning period; and
- The Sussex Hastings WRZ starts the planning period with sufficient supplies and only goes into deficit near the end of the planning period.

For the PDO condition:

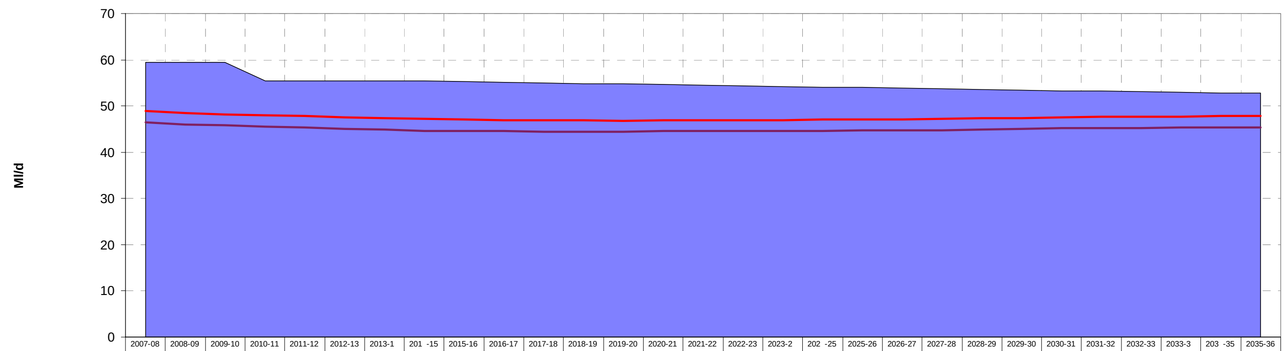
- The Kent Medway WRZ starts the planning period in surplus, and remains so until after 2029-30 with some surplus water transferred to Kent Thanet as required;
- The Kent Thanet WRZ starts the planning period in deficit, before surplus water from Kent Medway is transferred and able to meet demand until the end of AMP7 when it returns to deficit; and
- The Sussex Hastings WRZ starts the planning period with sufficient supplies, but goes into deficit after 2024-25.



	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-1	201 -15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22
AA Kent Medw ay Resources	1 7.30	1 7 5	1 7.72	119.15	119.28	122 68	12 .79	128.39	127.73	127.05	126.35	125.67	12 .92	12 .18	123. 2
AA Dmd Headroom	128.15	127 33	126.92	126.52	126.0	125 53	125.09	12 .72	12 .52	12 .32	12 .26	12 .19	12 .29	12 . 5	12 .56
AA Kent Medw ay Demand	122.33	121 51	121.08	120.67	120.17	119 66	119.20	118.81	118.70	118.60	118.63	118.6	118.8	118 99	119.09

	2022-23	2023-2	202 -25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-3	203 -35	2035-36
AA Kent Medw ay Resources	122.66	121.93	121.16	120.38	119.62	118.82	118 02	117.26	116.6	116.02	115. 0	11 79	11 .17	11 .17
AA Dmd Headroom	12 .67	12 .82	12 90	125.07	125.20	125.38	125 50	125.73	125.92	126.06	126.16	126 31	126. 7	126. 7
AA Kent Medw ay Demand	119.20	119.35	119. 3	119.60	119.72	119.91	120 03	120.25	120. 5	120.58	120.68	120 83	120.99	120.99

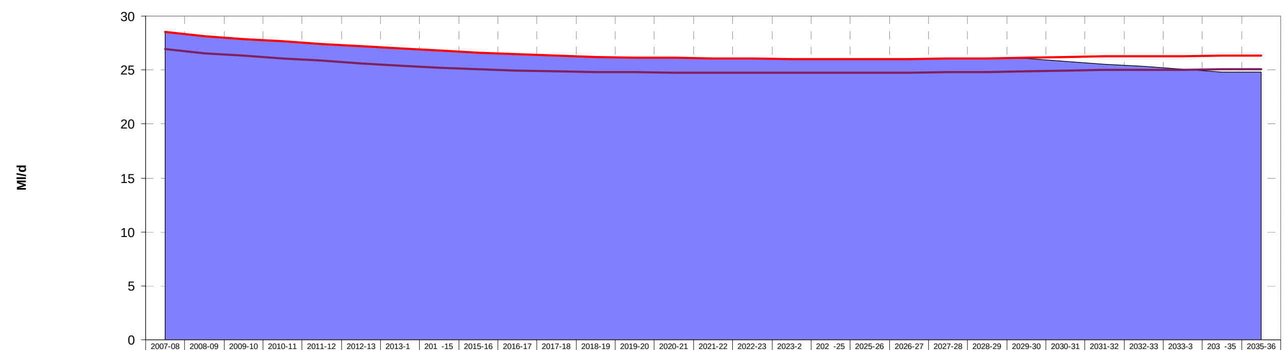
Figure 10.36 Kent Medway ADO Baseline Supply Demand Balance



	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-1	201 -15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22
AA Kent Thanet Resources	59. 6	59. 6	59. 6	55. 1	55. 1	55. 1	55. 1	55. 1	55 28	55.15	55 02	5 .89	5 76	5 .63	5 .50
AA Dmd Headroom	8.89	8.50	8.21	8.00	7.78	7.5	7.36	7.17	7 08	6.98	6 90	6.86	6 81	6.87	6.92
AA Kent Thanet Demand	6.39	6.0	5.80	5.57	5.32	5.05	.85	.6	59	.53	. 9	.50	50	.5	.57

	2022-23	2023-2	202 -25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-3	203 -35	2035-36
AA Kent Thanet Resources	5 .38	5 .25	5 .12	53.99	53.86	53.73	53.60	53. 7	53 3	53.21	53 09	52.96	52.83	52.83
AA Dmd Headroom	6.96	6.98	7.06	7.10	7.13	7.21	7.35	7.	7 5	7.6	7 68	7.73	7.79	7.79
AA Kent Thanet Demand	.60	.60	.67	.71	.7	.82	.96	5.05	5.15	5.25	5 29	5.3	5. 0	5. 0

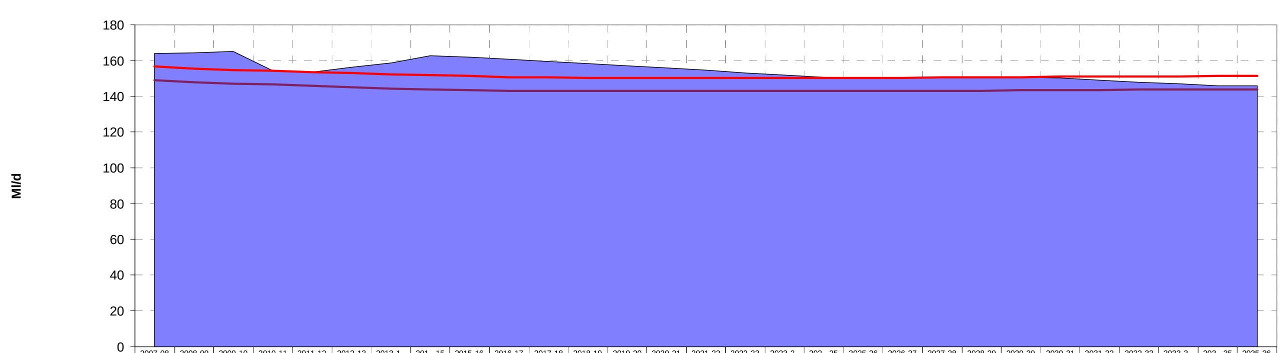
Figure 10.37 Kent Thanet ADO Baseline Supply Demand Balance



	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-1	201 -15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22
AA Sussex Hastings Resources	28.52	28.11	27.90	27.66	27.	27.17	26.99	26.81	26.6	26. 7	26.35	26.20	26.16	26.11	26.10
AA Dmd Headroom	28.52	28.11	27.90	27.66	27.	27.17	26.99	26.81	26.6	26. 7	26.35	26.20	26.16	26.11	26.10
AA Sussex Hastings Demand	26.95	26.5	26.3	26.09	25.86	25.58	25.39	25.20	25.07	2 .96	2 .88	2 .79	2 .80	2 .76	2 .78

	2022-23	2023-2	202 -25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-3	203 -35	2035-36
AA Sussex Hastings Resources	26.07	26.01	26.01	26.02	26 01	26.06	26.10	26.10	25.83	25.57	25 31	25.05	2 .79	2 .79
AA Dmd Headroom	26.07	26.01	26.01	26.02	26 01	26.06	26.10	26.12	26.19	26.25	26 27	26.30	26.33	26.33
AA Sussex Hastings Demand	2 .77	2 .73	2 .75	2 .76	2 7	2 .79	2 .8	2 86	2 .93	2 .99	25 01	25.0	25.07	25.07

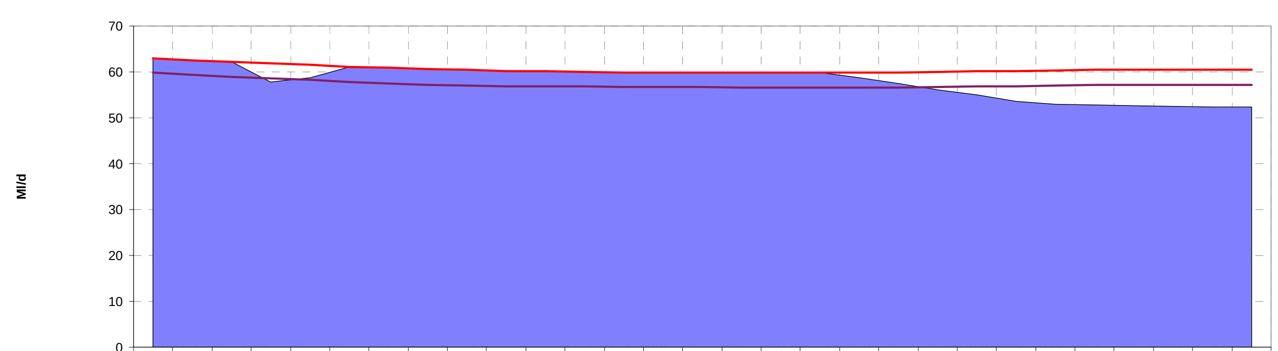
Figure 10.38 Sussex Hastings ADO Baseline Supply Demand Balance



	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-1	201 -15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-2	202 -25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-3	203 -35	2035-36
Peak Kent Medw ay Resources	163.92	16 . 0	165.22	15 .33	153.66	156.21	158.81	162.77	161.72	160.68	159.56	158.38	157.18	155.88	15 .56	153.2	151.99	150.59	150.3	150.37	150.50	150 5	150.7	150.09	1 9.07	1 8 05	1 7.03	1 6.01	1 6.01
Peak Dmd Headroom	156.71	155.5	15 .86	15 .33	153.66	152.95	152.30	151.75	151.29	150.8	150.59	150.31	150.22	150.25	150.23	150.22	150.28	150.25	150.3	150.37	150.50	150 5	150.7	150.89	150.97	151 02	151.1	151.28	151.28
Peak Kent Medw ay Demand	1 8.95	1 7.80	1 7.16	1 6.57	1 5.8	1 5.09	1 .39	1 3.78	1 3. 7	1 3.16	1 3.06	1 2.93	1 2.98	1 2.99	1 2.9	1 2.92	1 2.96	1 2.90	1 2.99	1 3.02	1 3.15	1 3.19	1 3.39	1 3.5	1 3.62	1 3 67	1 3.79	1 3.93	1 3.93

Peak Kent Medway Resources — Peak Kent Medway Demand — Peak Dmd + Headroom

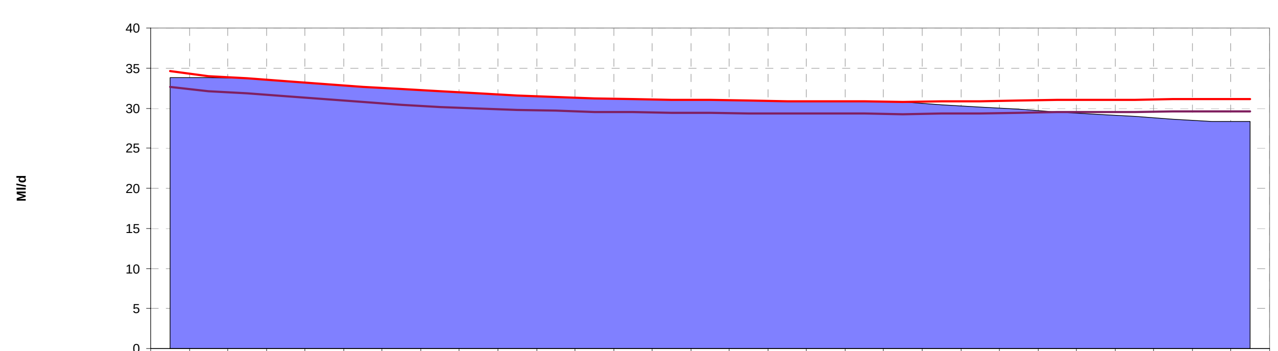
Figure 10.39 Kent Medway PDO Baseline Supply Demand Balance



	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-1	201 -15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-2	202 -25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-3	203 -35	2035-36
Peak Kent Thanet Resources	63.02	62 5	62.16	57.87	58.73	61.15	60.86	60.55	60. 0	60.22	60.09	60 02	59.91	59.91	59 90	59 90	59.85	59.91	58 80	57. 7	56.16	5 93	53.55	53.01	52.85	52.69	52.52	52.36	52 36
Peak Dmd Headroom	63.02	62 53	62.16	61.86	61.51	61.15	60.86	60.55	60. 0	60.22	60.09	60 02	59.91	59.91	59 90	59 90	59.85	59.91	59 90	59.90	59.96	60.12	60.19	60.31	60. 1	60. 2	60. 7	60.52	60 52
Peak Kent Thanet Demand	59.81	59 32	58.93	58.62	58.25	57.87	57.56	57.23	57.10	56.95	56.8	56 80	56.71	56.69	56 66	56 6	56.58	56.61	56 61	56.60	56.67	56 82	56.90	57.02	57.11	57.13	57.17	57.23	57 23

Peak Kent Thanet Resources — Peak Kent Thanet Demand — Peak Dmd + Headroom

Figure 10.40 Kent Thanet PDO Baseline Supply Demand Balance



	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-1	201 -15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-2	202 -25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-3	203 -35	2035-36
Peak Sussex Has ings Resources	33.77	33 77	33.70	33 3	33.02	32.6	32.36	32.09	31 8	31.61	31. 3	31.23	31.15	31.05	31 01	30.95	30.8	30.83	30.82	30 73	30. 3	30.13	29.8	29 5	29.2	28 95	28.65	28.35	28.35
Peak Dmd Headroom	3 .59	3 01	33.70	33 3	33.02	32.6	32.36	32.09	31 8	31.61	31. 3	31.23	31.15	31.05	31 01	30.95	30.8	30.83	30.82	30 79	30.8	30.89	30.90	30 99	31.05	31 07	31.10	31.1	31.1
Peak Sussex Has ings Demand	32.69	32.11	31.81	31. 5	31.11	30.73	30.	30.17	29 96	29.78	29.65	29.51	29. 8	29. 1	29. 0	29.36	29.29	29.30	29.30	29 26	29.32	29.36	29.37	29. 6	29.53	29 55	29.58	29.61	29.61

Peak Sussex Hastings Resources — Peak Sussex Hastings Demand — Peak Dmd + Headroom

Figure 10.41 Sussex Hastings PDO Baseline Supply Demand Balance

10.5.9 Options to Meet the Supply Demand Balance in the Eastern Area

A number of demand and supply side options have been considered to meet any supply demand balance deficit.

The supply side options have been assessed using the options appraisal methodology described in section 8. In summary, an initial list of some 90 options has been considered within the Eastern Area, for which further details are given in Appendix G.

Following the various screening processes, the number of "feasible" options, by generic type, chosen to be available for selection by the investment model can be summarised, by generic type, as follows:

- One site for new surface storage reservoir, for which Southern Water would take the lead, although another was considered for possible joint promotion;
- One site for possible increases in abstraction from either surface or groundwater;
- Two sites for enlarging existing reservoirs;
- One site for potential re-commissioning of old/existing sources;
- Three possible abstraction licence variations;
- No sites for the further upgrade of WSW treatment facilities, for the purposes of the supply demand balance;
- Two potential inter-zonal bulk transfers, either existing or proposed, although this was modified as part of the introduction of the results from the WRSE modelling work;
- No potential inter-company bulk transfers, either existing or proposed;
- Four potential schemes for wastewater recycling;
- No sites for potential Aquifer Storage and Recovery schemes; and
- Four potential schemes for desalination.

The summary shows that a wide range of generic types of option were available for selection, thus ensuring that the selection of preferred schemes was robust. The total number includes a number of generic schemes, for instance desalination, at the same site but for different capacities. This was to ensure that a generic option was not ruled out from selection on the basis of the size and associated cost alone.

There are three generic types of demand management measures: metering; leakage reduction; and water efficiency. Different modelling scenarios have been devised to reflect a different selection of options (see section 10.1.10).

As noted in section 10.3.8, scenario 3 (Universal Metering) has been used as the starting point for the supply demand balance from which the Final Planning solution has been developed.

In order to consider leakage options, a number of incremental "step" reductions in leakage were considered, based on outputs from the Sustainable Economic Level of Leakage analysis, as explained in Chapter 6 and Appendix E.

Water efficiency options for both households and non-households were included in the model. More details are given in section 8 and Appendix G.

10.5.10 The Water Resources Strategy for the Eastern Area

The water resources strategy is described in three different sections over the planning period:

- AMP5, the first five years from 2010-11 to 2014-15, which formed the basis of the Final Business Plan Submission;
- AMP6 to the end of the planning period, based on the company only least-cost strategy; and then
- An explanation of how this company only strategy is modified to take into account the recommendations of the WRSE regional modelling results.

The company preferred water resources strategy is described below under each of these headings and is summarised in Table 10.22.

During AMP5 (2010-2015)

The supply demand balance will be satisfied in the Eastern Area for the AMP5 period through the following:

- A policy of universal metering throughout the area by 2015, which will give benefits in terms of demand savings and associated reductions in supply pipe leakage;
- The optimisation of inter-zonal transfers, namely from the Kent Medway to Kent Thanet and the Kent Medway to Sussex Hastings WRZs; and
- A series of groundwater source improvements, which could deliver up to 8.75 Ml/d for the annual average condition.

From AMP6 to the end of the planning period (2015-35) (company only)

For the company only least-cost solution, no strategic scheme has been selected for construction. Instead, there will be a series of small interventions over time, on both the demand and supply side, which will require a delicate balance to ensure that available headroom is kept to a minimum above target headroom. These interventions are as follows:

- A licence variation for the River Medway Scheme;
- A licence variation for Darwell Reservoir;
- A licence variation for the S271 groundwater source;
- The refurbishment of a currently disused groundwater source at S556; and
- A total further reduction in leakage of 7.1 Ml/d, which is equivalent to a reduction of 27% below the 2007-08 outturn figure.

It is assumed that the current inter-company bulk transfers to South East Water at C522 and Darwell reservoir, and to Folkestone and Dover Water at Deal reservoir will be renewed until the end of the planning period.

From AMP6 to the end of the planning period (2015-35) (company preferred regional solution)

Following the WRSE modelling results, Southern Water reaffirmed its commitment to the development of a regional solution. As a result of the preferred options identified from the WRSE modelling work, we have included the following options in our company preferred regional strategy, over and above the company only least-cost solution:

- Enhancement of the bulk supply to Folkestone and Dover Water from Deal reservoir, to provide an additional supply from January to August, of 2 Ml/d;
- Construction of Aylesford wastewater recycling scheme at the earliest start date of 2018; and
- Raising Bewl Water at the earliest start date of 2022.

The last two schemes are regional schemes that would provide bulk supplies to neighbouring companies. It is currently considered that the most likely recipients will be South East Water, although the timing, location and volumetric requirements are yet to be received and confirmed. Current assumptions within this plan are based on the latest published modelling work up to September 2009. Future modelling results will be considered at the time of the annual reviews of the WRMP

The inclusion of these regional schemes in the company preferred regional strategy will increase the 25-year NPV by £47.4 million above the company only least-cost strategy. However, in practice, this is likely to be an over-estimate, because both the Aylesford recycling and Bewl raising schemes are forced into the strategy at their earliest start dates. In practice, the schemes are likely to be required later in the planning period. The actual start date required for the regional solution will be refined following the results of the further regional modelling work. However, this approach demonstrates our continued commitment to the development of a regional solution.

The introduction of these schemes will lead to available headroom in excess of the Southern Water target headroom requirements, and thus will not represent a Southern Water least-cost strategy over the 25-year planning period. However, we believe that this will not contribute to any bill impact during AMP5 as the regional schemes will not be introduced until AMP6 and beyond.

The Water Resources Strategy for the Eastern Area is summarised in Table 10.22.

Water Resource Zone	Schemes During AMP 5	Schemes beyond AMP 5 – company only solution	Schemes beyond AMP 5 – Water Resources in the South East of England
Sussex Hastings	• Universal metering • Asset improvement schemes for groundwater sources (0.25 Ml/d peak only) • Optimisation of inter-zonal transfers (Bewl-Darwell transfer)	• Renewal of bulk supply to South East Water • Licence variation at Darwell reservoir • Re-introduction of the S556 source • 0.5 Ml/d leakage reductions	As previous column
Kent Medway	• Universal metering • Asset improvement schemes for groundwater sources (10.25 Ml/d peak, 8.75 Ml/d average) • Optimisation of inter-zonal transfers (to Kent Thanet)	• Renewal of the C522 scheme bulk supply to South East Water • Licence variation to the River Medway Scheme • Licence variation of S271 groundwater source • 6.5 Ml/d of further leakage reduction	As previous column, but additional schemes • Aylesford wastewater recycling scheme • Raising Bewl Water An the assumption that these will enable the following • Bulk Supply from Bewl Water to South East Water • Bulk Supply from Burham to South East Water
Kent Thanet	• Universal metering • Optimisation of inter-zonal transfers (from Kent Medway) • Renewal of the bulk Supply to Folkestone and Dover	• 0.1 Ml/d of further leakage reduction	As previous column, but additional schemes • Enhancement of the bu k Supply to Folkestone and Dover

Table 10.22 Summary of the Water Resources Strategy for the Eastern Area

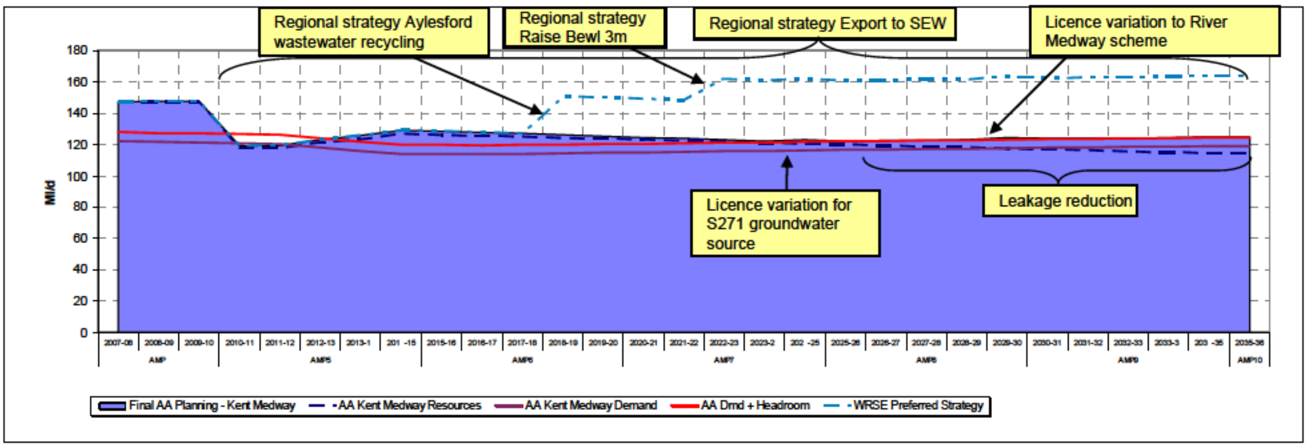


Figure 10.42 Kent Medway Company Preferred Regional Strategy (Scenario 4), ADO Solution

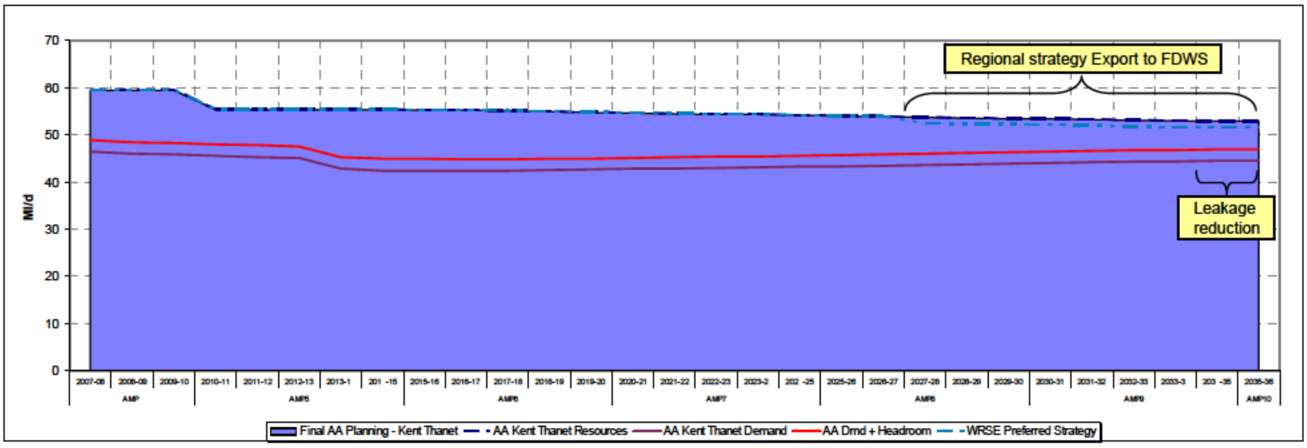


Figure 10.43 Kent Thanet Company Preferred Regional Strategy (Scenario 4), ADO Solution

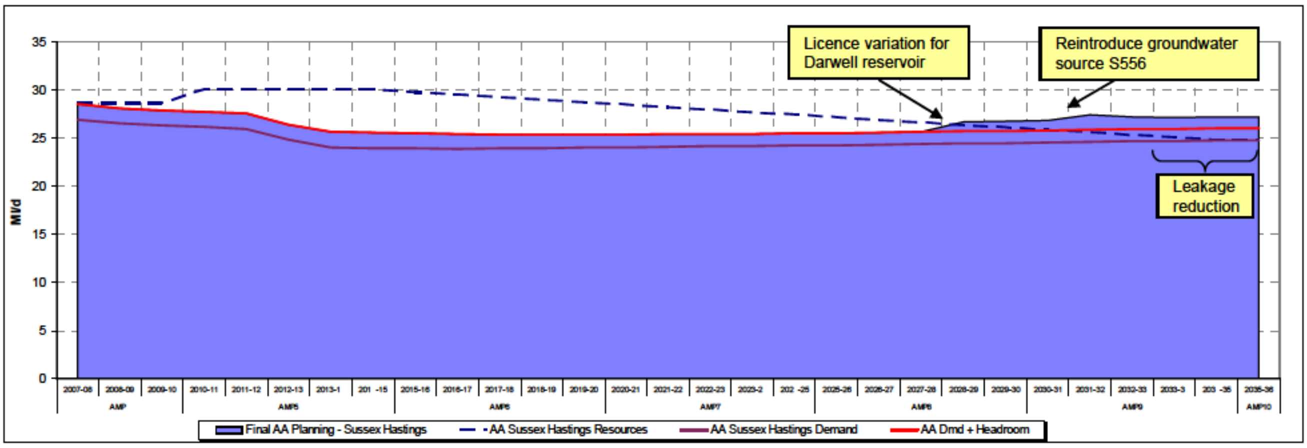


Figure 10.44 Sussex Hastings Company Preferred Regional Strategy (Scenario 4), ADO Solution

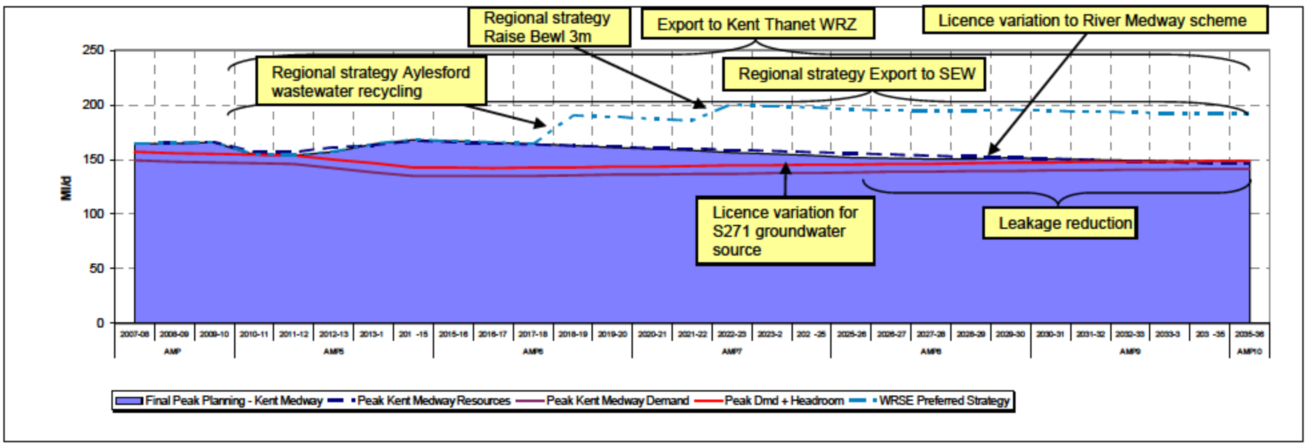


Figure 10.45 Kent Medway Company Preferred Regional Strategy (Scenario 4), PDO Solution

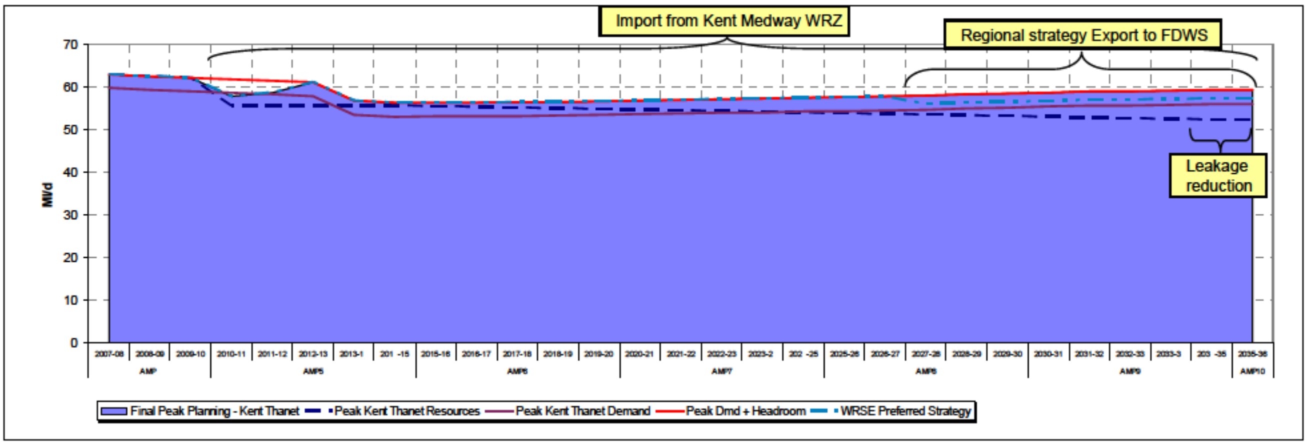


Figure 10.46 Kent Thanet Company Preferred Regional Strategy (Scenario 4), PDO Solution

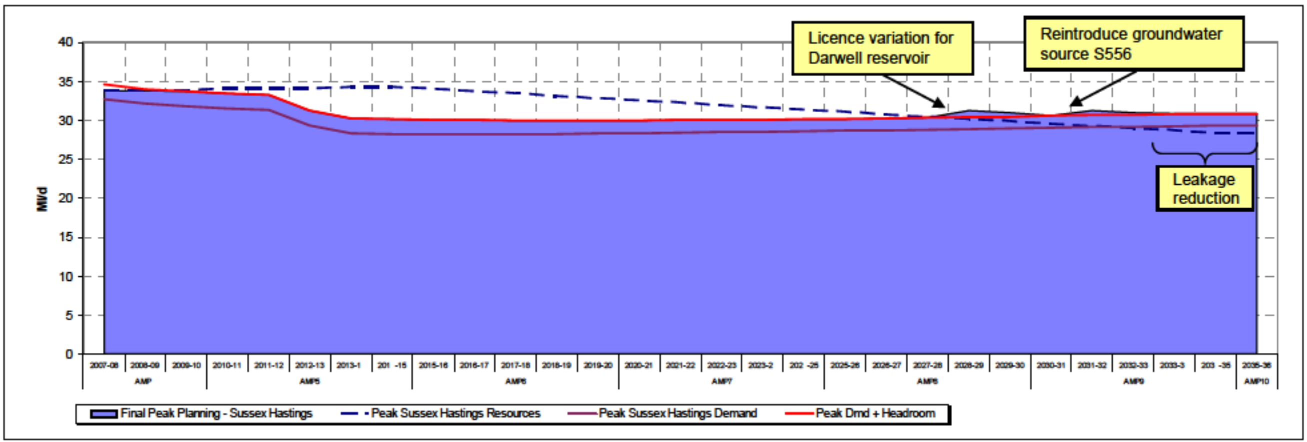


Figure 10.47 Sussex Hastings Company Preferred Regional Strategy (Scenario 4), PDO Solution

10.5.10.1 SEA Influence on Strategy

All options were assessed against 17 SEA objectives, and assigned an overall environmental risk (high, medium or low), based on the significance of potential long term effects.

Table 10.23 sets out the environmental risk of each resource development option. More details are given in Appendix I.

Option	Environmental Risk Score
Licence variation at S271	Medium
Licence variation for River Medway Scheme	Medium
Raise Bewl	High
Wastewater recycling at Aylesford WWTW	High
Darwell Licence Variation	Low
Re-introduce S556 borehole source	Medium
Medway Desalination (10 Ml/d)	High
Increase Capacity of Bewl-Darwell Transfer	Medium

Table 10.23 Environmental Risks of Resource Development Options Selected in the Eastern Area Strategy

The demand management options (metering; leakage reduction; and water efficiency) were also assessed against the SEA objectives. More detail is given in Appendix I. All three generic demand management measures are broadly compatible with the majority of SEA objectives due to the minimal amount of physical intervention required in implementing each measure. However, water efficiency measures have no potential conflicts with SEA objectives and are therefore the preferred demand management measure from an SEA perspective.

10.5.10.2 SEA preferred strategy

The options assessed as being likely to result in the lowest environmental risk are preferable from a SEA perspective and have been used to create the SEA preferred strategy. The low risk and therefore preferred water resource management options are set out below:

- Darwell Licence Variation; and
- Brede Abstraction to Powdermill.

However, the overriding objective of this WRMP is to identify a package of options that removes the risk of supply demand balance deficits over the whole of the planning period. It was therefore necessary to include within the SEA preferred strategy some options that had been assessed as having medium environmental risk. Employing the mitigation measures proposed for each option will enable the likely environmental damage from adopting these options to be reduced. The medium risk options from the SEA are:

- Licence variation at S271;
- Licence variation for River Medway Scheme;
- Duplicate Selling-Fleete Main;
- Re-introduce S556 borehole source; and
- Increase Capacity of Bewl-Darwell Transfer.

The company preferred regional strategy is therefore compatible with the SEA preferred strategy, with the exception of Bewl raising and Aylesford wastewater recycling. Both these schemes are required as part of the WRSE preferred strategy for a regional solution with bulk supplies to other companies. Bewl has strong negative effects on the landscape character within the AONB, but has limited opportunities for mitigation planting due to lack of space. Aylesford wastewater recycling has a high environmental risk due to high energy consumption. Renewable energy sources could be investigated to reduce the potential effect. A preliminary 'high-level' strategic assessment was undertaken of the possible impact of the proposed plan on the integrity of European and Ramsar sites under the Habitats Regulations. This concluded that sufficient safeguards are available to ensure that implementation of the plan will not adversely affect the integrity of any of the protected sites.

The company only least-cost strategy (scenario 3) does not require either Bewl raising or Aylesford wastewater recycling, and so is entirely compatible with the SEA preferred strategy.

10.5.11 Scenario Analysis

A number of scenarios have been modelled, in order to check the stability of the company only least-cost strategy to changes in some of the basic assumptions. Table 10.24 gives a summary of the different baseline assumptions for these scenarios, and the results in terms of scheme inclusion, scheme timing, and costs for the different investment strategies. The following points can be seen from the results:

- The company only least-cost strategy (3) assumes the baseline condition of universal metering by 2015;
- All scenarios assume the renewal of existing bulk supplies to other companies until the end of the planning period, at the rates which are appropriate at the time of renewal;
- The company only least-cost strategy (3) selects further leakage reductions of 7.1 Ml/d;
- Under the company only change of occupier metering scenario (2), the scheme options remain the same, but they are needed 1-2 years earlier, and includes further leakage reductions of 9.6 Ml/d;
- Under the company only optant and selective metering scenario strategy (1), the same schemes are selected, but at times ranging from 2 to 4 years before the company only universal metering scenario (3), but the scenario also requires the Medway desalination scheme at the end of the planning period. The scenario includes further reductions in leakage of 8.7 Ml/d;
- Under the company preferred scenario, but without any allowance for climate change impacts (11), no resource development options are necessary, and no further leakage reduction is required; and
- Under the scenario which allows leakage to rise up to the Ofwat target level in any WRZ currently operating below its target level, the same options are required as for the company only universal metering scenario (3). However, there are a large number of water efficiency schemes needed in AMP5 (over and above those already included to meet the Ofwat baseline water efficiency target), and further leakage reduction of 10.0 Ml/d is required from 2010. The cost of this strategy was £14.8 m. greater than for the company preferred least-cost scenario (3).
- The total cost of the resources strategy (including new resources, leakage reduction, and water efficiency) plus metering strategy, for the various company only scenarios can be summarised as follows:
    - Universal metering - £65.4 m.
    - Change of occupier - £72.7 m.
    - Optant and selective - £68.6 m.

- Hybrid metering policy – £65.4 m. This is the same cost as for the universal metering because of the supply demand balance deficits occur in AMP 5.

- The incremental cost of the company preferred regional strategy above the company only least-cost strategy is £47.4 m.

WRZ	Scenario	Company preferred Regional strategy	Company only Universal metering	Company only Change of occupier	Company only Optant	Company only Universal metering with no climate change	Company only Leakage rise to Ofwat target
	Number	4	3	2	1	11	8
	Metering policy	Universal	Universal	Change of occupier	Optant and selective	Universal	Universal
	Leakage policy	JR08, then SPL saving	JR08, then SPL saving	JR08	JR08	JR08, then SPL saving	Ofwat, then SPL saving
	WRSE preferred options & bulk supplies	Yes	No	No	No	No	No
WRZ	**Scheme**	**Earliest year required**					
Kent Medway	Licence variation at S271	2024	2024	2022	2020	-	2027
Kent Medway	Licence variation for River Medway Scheme	2029	2029	2028	2027	-	2030
Kent Medway	Medway desalination (10Ml/d)	-	-	-	2033		-
Kent Medway	Wastewater recycling at Aylesford	2018	-	-	-	-	-
Kent Medway	Raise Bewl reservoir	2022	-	-	-	-	-
Kent Medway	Leakage reduction	2026 reduction by 6.5 Ml/d	2026 reduction by 6.5 Ml/d	2023 reduction by 7.5 Ml/d	2013 reduction by 7.0 Ml/d	-	2010 reduction by 7.5 Ml/d
Kent Medway	Water efficiency kit (box)	-	-	2030	2030	-	2030
Kent Medway	Water efficiency low flow shower heads	-	-	2030	-	-	2010
Kent Medway	Water efficiency low use dishwasher subsidy	-	-	-	-	-	2010
Kent Medway	Water efficiency water butts	-	-	-	-	-	2010
Kent Medway	Water efficiency low use washing machine subsidy	-	-	-	-	-	2010
Kent Medway	Water efficiency trigger hoses	-	-	-	-	-	2010
Kent Thanet	Broadoak reservoir	-	-	-	-	-	2034
Kent Thanet	Leakage reduction	2034 reduction by 0.1 Ml/d	2034 reduction by 0.1 Ml/d	2031 reduction by 1.3 Ml/d	2031 reduction by 0.6 Ml/d	-	2010 reduction by 1.5 Ml/d
Kent Thanet	Water efficiency kit (box)	-	-	-	2030	-	2030
Kent Thanet	Commercial water audit	-	-	2030	-	-	2030
Kent Thanet	Water efficiency low use dishwasher subsidy	-	-	-	-	-	2010
Kent Thanet	Water efficiency water butts	-	-	-	-	-	2010
Kent Thanet	Water efficiency low use washing machine subsidy	-	-	-	-	-	2010
Kent Thanet	Water efficiency trigger hoses	-	-	-	-	-	2010
Kent Thanet	Water efficiency low flow shower heads	-	-	-	-	-	2010 (and 2030)
H a	Darwell licence variation	2028	2028	2026	2024	-	2026

Scenario Number		Company preferred Regional strategy 4	Company only Universal metering 3	Company only Change of occupier 2	Company only Optant 1	Company only Universal metering with no climate change 11	Company only Leakage rise to Ofwat target 8
	Re-introduce S556 borehole source	2031	2031	2030	2029	-	2030
	Leakage reduction	2033 reduction by 0.5 Ml/d	2033 reduction by 0.5 Ml/d	2032 reduction by 0.8 Ml/d	2028 reduction by 1.1 Ml/d	-	2029 reduction by 1.0 Ml/d
	Water efficiency commercial water audit	-	-	-	-	-	2030
Costs (£m)							
Total metering cost (£m)		60.83	60.83	65.57	55.60	60.83	60.83
Total resource, leakage reduction and water efficiency activity cost (£m)		51.95	4.52	7.12	13.01	0.21	19.35
Total cost of Strategy (£m)		**112.78**	**65.35**	**72.69**	**68.61**	**61.04**	**80.18**

Table 10.24 Results of Scenario Modelling for the Eastern Area

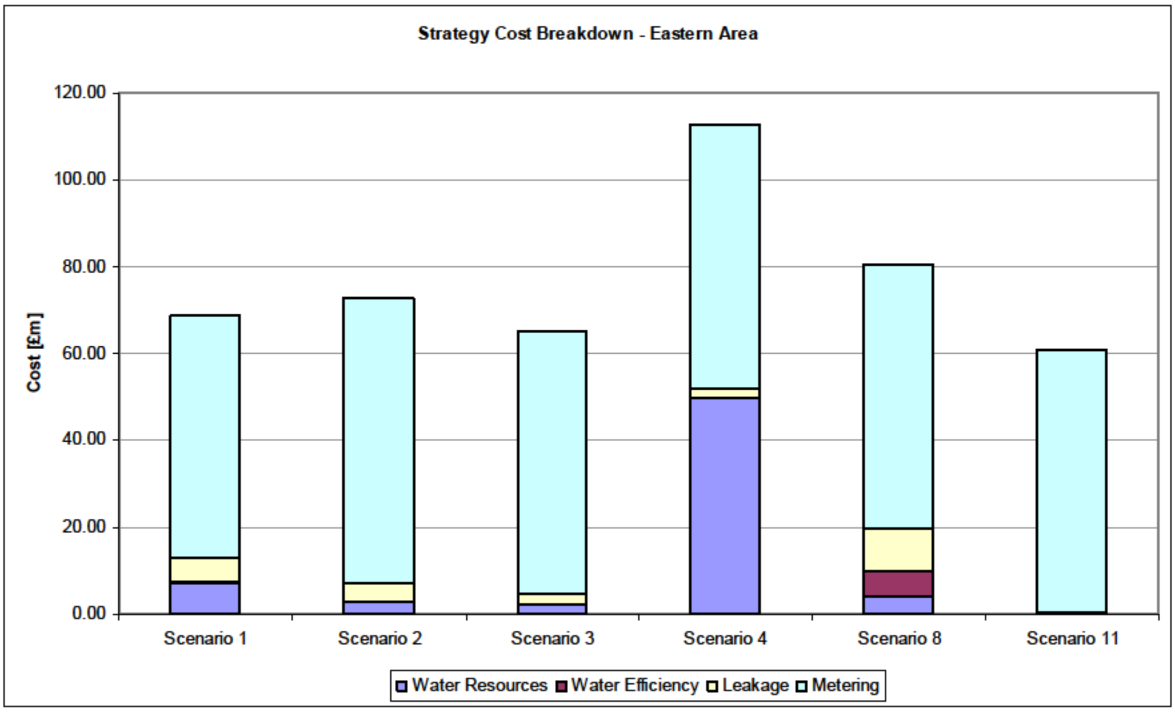


Figure 10.48 Eastern Area Scenario Cost Comparisons

10.5.12 Sensitivity Analysis

10.5.12.1 Range of Sensitivity Analysis

The "possible worst-case" focused on any changes in supply side or demand side factors which would worsen the supply demand balance. Any decrease in deployable output and/or increase in demands would mean that deficits occur earlier in the planning period and would be larger than those identified in the baseline conditions. This could pose a threat to the security of supplies if the selected schemes, and/or any others that might then be required, could not be commissioned quickly enough.

Following consideration of a number of such demand and supply side factors and the potential magnitude of each it was decided that a "global" change in the demand forecast of +/- 5%, would be assumed for the area. To put this sensitivity into context, at the end of the planning period, for the Eastern Area:

- A +/- 5% change in demand would result in a change in demand of +/- 9.0 Ml/d and +/- 11.3 Ml/d at the MDO and PDO condition respectively by the end of the planning period; and
- A +/- 5% change in demand would be equivalent to a change in the area deployable output +/- 3.7% and +/- 3.9% at the MDO and PDO condition respectively.

10.5.12.2 Results of sensitivity analysis

The results of the sensitivity analysis for the possible "best-case" and "worst-case" are presented in Table 10.25 and can be summarised as follows:

Under the "worst-case" sensitivity:

- The licence variation schemes in Kent Medway WRZ and Sussex Hastings WRZ are brought forward by 2-3 years;
- The re-introduction of S556 borehole in Sussex Hastings WRZ is also brought forward by three years;
- Two schemes are brought into the strategy at the end of the planning period; a desalination plant on the River Medway of 10 Ml/d capacity (in 2030), and an increase in the capacity of the Bewl-Darwell transfer;
- Further leakage reduction is required earlier, although the level of reduction is similar to the base case; and
- Water efficiency schemes are also required in Sussex Hastings WRZ.

In summary, the selection of schemes remains the same but the timings of the introduction of the schemes changes. Two additional schemes are required.

The different timings suggest that there would be sufficient time to bring forward schemes should they be required. The introduction of a new scheme at the very end of the planning period should be viewed with caution since, by the time the scheme is identified as being required, the target headroom will be less, and thus the scheme may not, in the event, be triggered. However, the revised glidepath for target headroom should reduce this effect.

Under the "best-case" sensitivity:

- Two schemes remain unchanged; the S271 licence variation in Kent Medway WRZ, and the Darwell licence variation in Sussex Hastings WRZ; however, the timing of the schemes is delayed by 6-7 years; and
- Further leakage reduction is only required late in the planning period in Kent Medway WRZ, but not in the other two WRZs.

In summary, the results suggest that the need for the Darwell and S271 licence variations remain unchanged.

	Scenario Number	Company preferred WRSE Regional 4	Company only Universal metering 3	Increase in demand of 5% by end of planning period "Worst case"	Decrease in demand of 5% by end of planning period "Best case"
	Metering policy	Universal	Universal	Universal	Universal
	Leakage policy	JR08, then SPL saving	JR08, then SPL saving	JR08, then SPL saving	JR08, then SPL saving
	WRSE preferred options & bulk supplies	Yes	No	No	No
WRZ	**Scheme**	**Earliest year required**			
Kent Medway	Licence variation at S271	2024	2024	2022	2029
Kent Medway	Licence variation for River Medway Scheme	2029	2029	2026	-
Kent Medway	Medway desalination (10Ml/d)	-	-	2030	-
Kent Medway	Wastewater recycling at Aylesford	2018	-	-	-
Kent Medway	Raise Bewl reservoir	2022	-	-	-
Kent Medway	Leakage reduction	2026 reduction by 6.5 Ml/d	2026 reduction by 6.5 Ml/d	2023 reduction by 6.5 Ml/d	2031 reduction by 3.0 Ml/d
Kent Thanet	Leakage reduction	2034 reduction by 0.1 Ml/d	2034 reduction by 0.1 Ml/d	-	-
Sussex Hastings	Darwell licence variation	2028	2028	2025	2031
Sussex Hastings	Re-introduce S556 borehole source	2031	2031	2028	-
Sussex Hastings	Increase capacity of Bewl-Darwell transfer	-	-	2032	-
Sussex Hastings	Leakage reduction	2033 reduction by 0.5 Ml/d	2033 reduction by 0.5 Ml/d	2030 reduction by 0.6 Ml/d	-
Sussex Hastings	Water efficiency kit (Box)	-	-	2030	-
Sussex Hastings	Water efficiency low flow shower heads	-	-	2030	-
Costs (£m)					
	Total metering cost (£m)	60.83	60.83	60.83	60.83
	Total resource, leakage reduction and water efficiency activity cost (£m)	51.95	4.52	17.54	0.93
	Total cost of Strategy (£m)	**112.78**	**65.35**	**78.37**	**61.76**

Table 10.25 Results of Sensitivity Analysis for the Eastern Area

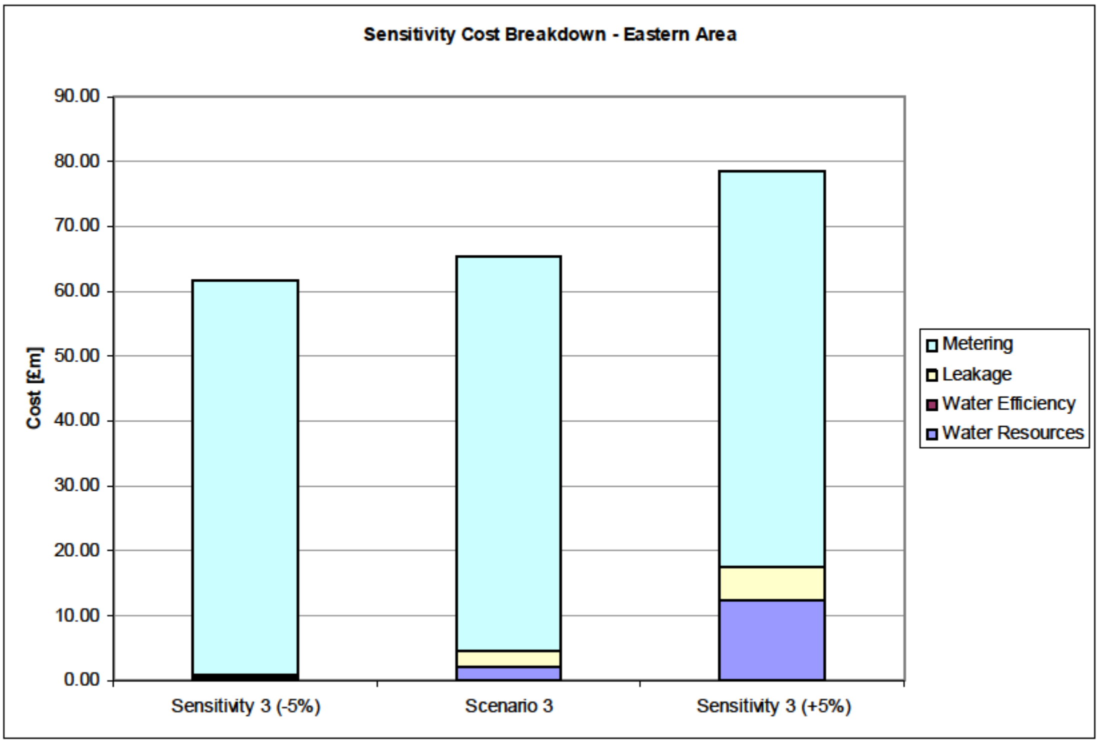


Figure 10.49 Eastern Area Sensitivity Analysis Cost Comparisons

10.6 Discussion of hybrid metering scenario

The hybrid metering scenario addressed the issue of whether it is more cost effective for Southern Water to only meter in those Water Resource Zones which have a supply demand deficit. This scenario tested whether it is more effective to install meters in an efficient and timely manner or continue with a less cost efficient optant metering policy. The comparison this scenario affords is key in that it allows a clear appreciation that it is more efficient to deliver a large scale metering plan than to install meters on a piecemeal basis across the region.

11 Summary of the Water Resources Strategy

This Water Resources Management Plan is the strategy document sets out our vision for the next 25 years. It looks in detail at our three main objectives of: achieving value for customers; resilience in a changing environment and facilitating growth in the South East of England. The WRMP takes into account consultation responses to the draft WRMP and joint discussions with regulators and others on how Sustainability Reductions might be implemented. We have also been an active member of WRSE whose outputs have informed the final WRMP.

The challenges to water resources in this region that we face are significant, but we believe that the options identified in this WRMP are robust and appropriate to meet these challenges. A summary of the components of the overall water resources strategy for the company is shown in Table 11.1. The balance of the various elements of the strategy given in the following summary will vary in the three different areas:

During AMP5

- Introduction of universal metering by 2015;
- Asset improvement schemes at a number of groundwater sources, as identified by the recent review of groundwater source performance;
- The optimum use of inter-zonal transfers, as identified by the investment model;
- Additional inter-zonal transfers, as identified by the investment model;
- The renewal of existing inter-company bulk supplies until the end of the planning period, at the rates at the time of contract renewal;
- New source development, if required, either to close any existing supply demand balance deficits, and/or to restore security of supplies as a result of Sustainability Reductions; and
- Any further investigation of new resource developments that were identified as part of the WRSE regional modelling work.

During the rest of the planning period to 2035

- It is currently envisaged that no further strategic resource developments will be required to meet Southern Water's needs under the company only universal metering strategy;
- The strategy will deliver the objective of keeping to the target headroom line, through a delicate balance of a number of factors, including the following; source maximisation through potential licence variations; the refurbishment of a few small, currently disused groundwater sources, which may require fairly advanced treatment solutions; progressive leakage reduction, up to 19% below the current outturn level to offset the need for the development of major strategic schemes; and the introduction of further water efficiency savings where it is economic to do so;
- It should be noted that we have included the effects of climate change on both supply and demand side elements. However, these have only been introduced after the end of AMP5, and thus their inclusion will not have any bill impact during AMP5; however
- Southern Water has reaffirmed its commitment to the WRSE modelling work, in the form of adopting the WRSE preferred regional options in its strategy in addition to those identified in the least-cost company only strategy. Whilst the

introduction of these schemes will lead to available headroom in excess of our target headroom requirements, we believe that this will not contribute to any bill impact during AMP5, and demonstrates our continued commitment to the development of a regional solution.

Water Resource Zone	Schemes During AMP5	Schemes beyond AMP 5 – company only solution	Schemes beyond AMP 5 – Water Resources in the South East of England
Isle of Wight	• Enhanced Metering • Asset improvement schemes for groundwater sources (1.55 Ml/d peak, 1.05 Ml/d average) • Optimisation of inter-zonal transfers (cross-Solent main)	• Water Efficiency kits • 1.1 Ml/d further leakage reduction • Refurbishment of L536 borehole • Refurbishment of K628 borehole	As previous column
Hants South	• Universal Metering • Asset improvement schemes for groundwater sources (12.00 Ml/d peak, 8.00 Ml/d average) • Increase Testwood WSW to licence limit • Development of the enabling Testwood to Otterbourne transfer • Optimisation of inter-zonal transfers (cross-Solent main)	• Candover & Alre augmentation schemes • 7.8 Ml/d of leakage reduction • R176 borehole rehabilitation And, subject to satisfactory completion of AMP5 schemes: • River Itchen Sustainability Reductions residual at end of AMP5	As previous column
Hants Kingsclere	• Universal Metering • Asset improvement schemes for groundwater sources (1.2 Ml/d peak only)		
Hants Andover	• Universal metering • Asset improvement schemes for groundwater sources (0.2 Ml/d peak & average)		
Sussex North	• Universal metering • Renewal of the existing bulk supply contract from Portsmouth Water • Asset improvement schemes for groundwater sources (0.30 Ml/d peak, 0.10 Ml/d average) • Optimisation of inter-zonal transfers (from Sussex Worthing) • River Arun Abstraction	• Renewal of the bulk supply of contract to South East Water	As previous column

Sussex Worthing	• Universal metering • Asset improvement schemes for groundwater sources (1.75 Ml/d peak, 4.25 Ml/d average) • Optimisation of inter-zonal transfers (to Sussex North and Sussex Brighton)		
Sussex Brighton	• Universal metering • Asset improvement schemes for groundwater sources (7.25 Ml/d peak & average) • Optimisation of inter-zonal transfers (from Sussex Worthing)		• Provision of a 4 Ml/d bu k supply to South East Water
Sussex Hastings	• Universal metering • Asset improvement schemes for groundwater sources (0.25 Ml/d peak only) • Optimisation of inter-zonal transfers (Bewl-Darwell transfer)	• Renewal of bulk supply to South East Water • Licence variation at Darwell reservoir • Re-introduction of the S556 source • 0.5 Ml/d leakage reductions	As previous column
Kent Medway	• Universal metering • Asset improvement schemes for groundwater sources (10.25 Ml/d peak, 8.75 Ml/d average) • Optimisation of inter-zonal transfers (to Kent Thanet)	• Renewal of the C522 scheme bulk supply to South East Water • Licence variation to the River Medway Scheme • Licence variation of S271 groundwater source • 6.5 Ml/d of further leakage reduction	As previous column, but additional schemes • Aylesford wastewater recycling scheme • Raising Bewl Water An the assumption that these will enable the following • Bu k Supply from Bewl Water to South East Water • Bu k Supply from Burham to South East Water
Kent Thanet	• Universal metering • Optimisation of inter-zonal transfers (from Kent Medway) • Renewal of the bulk Supply to Folkestone and Dover	• 0.1 Ml/d of further leakage reduction	As previous column, but additional schemes • Enhancement of the bu k Supply to Folkestone and Dover

Table 11.1 Summary of the Overall Water Resources Strategy

We have adopted a twin-track strategy that combines measures to reduce demand as well as increase supplies. We believe that both types of scheme are required to ensure that we meet future demands in the most resilient way.

We have only sought allowances in price limits for those schemes that need to be delivered in the AMP5 period from 2010 to 2015 and for the NEP schemes advised by the Environment Agency. Investigation of those options that will need to be delivered during 2015 to 2020, will be covered at the next price review. The cost of the company preferred regional strategy in AMP5 is shown in the table below in the form of:

- Indicative cost of constructing the schemes (Capex); and
- Indicative cost of running these schemes (Opex).

	Total Capex and Opex (undiscounted) **2010-15** £m
Universal metering programme	123.2
River Arun Tidal Abstraction	18.2
Testwood WSW improvements	58.3
Total	**199.70**

Table 11.2 Company Level Summary of Proposed Company Capital and Operating Cost Investment Programme for Company Preferred Regional Strategy in AMP5

Table 11.3 presents the company level total cost (NPV) over the planning period for both the company only least-cost strategy and for the company preferred regional strategy. Under the company preferred regional strategy, there would be an additional £47.4 million over the planning period. However, we believe that this will not contribute to any bill impact during AMP5 as the regional schemes will not be introduced until AMP6 and beyond.

Component	**Company Only Least-Cost Strategy (Scenario 3)** **Total NPV cost over planning period** £m	**Company Preferred Regional Strategy (Scenario 4)** **Total NPV cost over planning period** £m
Leakage reduction	5.24	5.24
Water efficiency	0.06	0.06
Water savings	-0.08	-0.09
Metering	170.35	170.35
Resource development	60.38	107.81
Total	**235.95**	**283.37**

Table 11.3 Company Level Summary of Proposed NPV Cost for Company Only Least-Cost Strategy

Carbon footprint

The development of these solutions will have an impact on our energy use. Figure 11.1 shows the change in carbon use as a result of demand management and resource development activity in each year over the planning horizon. It is important to note that this is based solely on operational carbon usage. This suggests that there is unlikely to be a net increase in carbon emissions until AMP7.

The carbon use shown assumes that each year is a dry year, although in reality this is unlikely. Thus, in practice these are overestimates, and it is expected that less energy would be required to balance supply and demand.

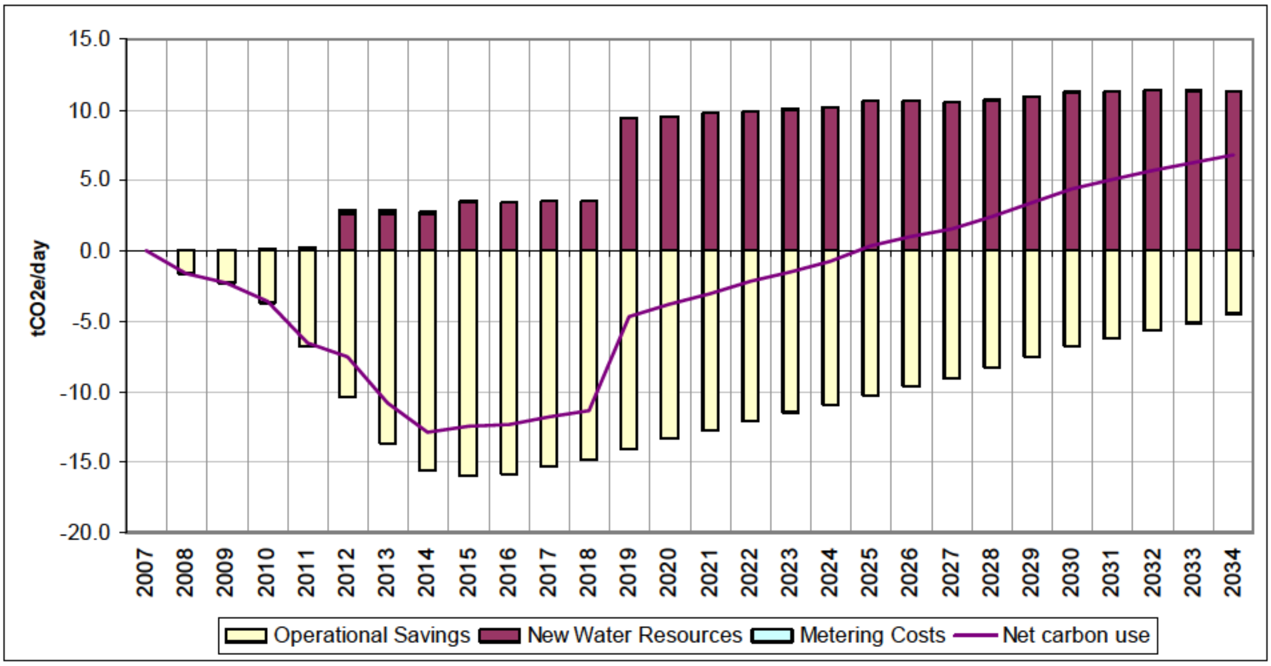


Figure 11.1 Average Change in Carbon Use Due to Company Only Least-Cost Strategy (scenario 3)

Figure 11.2 presents the total operational daily carbon footprint on average, under dry year conditions, for two scenarios: the optant metering scenario (1), and the universal metering scenario (3), which is also the company only least-cost strategy. The total operational carbon footprint in the base year (2007-08) is 211 tCO_2e/day which decreases mainly due to operational savings, before new resources are required. This is most noticeable in 2019, the year in which the Sustainability Reductions are enacted in full.

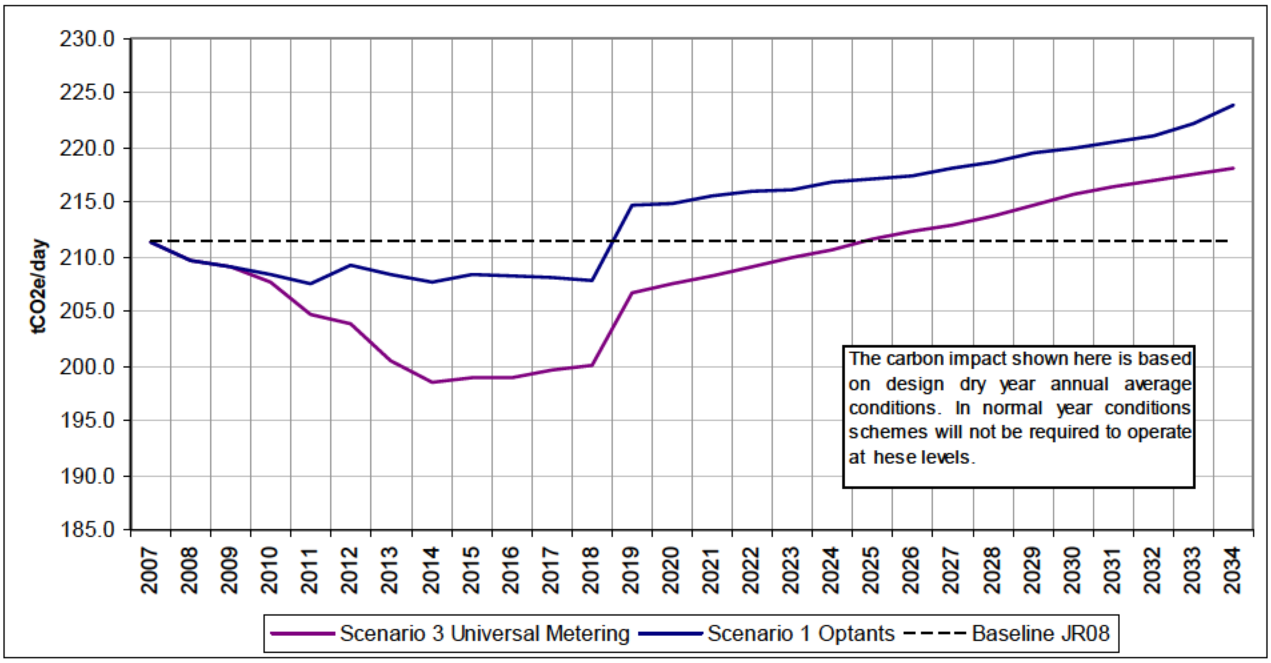


Figure 11.2 Operational Carbon Use Under DYAA Conditions

Summary

Developing a water resources strategy for the future always involves choices, but it is essential that we maintain the investment in our supply system today to ensure that it continues to deliver today, tomorrow and in the future. The subtle balance between reducing demand and ensuring resilience has been a central issue when developing this strategy, primarily because of the vulnerability of a significant number of our sources to prolonged droughts, which was highlighted during the recent drought of 2004 to 2006.

In summary, we believe that, through a combination of a demand management-led approach, with new resource developments as appropriate, we have achieved the best balance to produce a least-cost, environmentally sustainable strategy.

Title: Kingsnorth

SPN Regional Development Plan

Author: URS / C Winch

Version: 2.0

Date: March 2014

All of the cost numbers displayed in this document are before the application of on-going efficiencies and real price effects.

Document History

Version	Date	Revision Class	Originator	Section Update	Details
1.7	26/02/2014	ED1 Resubmission	Matt White	Cover page	Version and date update
1.7	26/02/2014	ED1 Resubmission	Matt White	Contents	Updated
1.7	26/02/2014	ED1 Resubmission	Matt White	1.1	Updated Wording
1.7	26/02/2014	ED1 Resubmission	Matt White	1.2	Updated Costs
1.7	26/02/2014	ED1 Resubmission	Matt White	1.3	Updated table 1 and text
1.7	26/02/2014	ED1 Resubmission	Matt White	2.2	Updated Embedded generation table 2
1.7	26/02/2014	ED1 Resubmission	Matt White	2.3	NAMP table update and additional text
1.7	26/02/2014	ED1 Resubmission	Matt White	4.4	NAMP table update
1.7	26/02/2014	ED1 Resubmission	Matt White	5.3	Updated document history
2.0	27/03/2014	Minor	Regulation	All	Final publication

Contents

All of the cost numbers displayed in this document are before the application of on-going efficiencies and real price effects.

1 Introduction

1.1 Executive Summary

This Regional Development Plan (RDP) reviews UK Power Networks (UKPN) (SPN) HV and EHV network supplied from Kingsnorth Grid Supply Point. The plan forms the basis for investment to support replacement of assets and to reinforce the network to cater for increased demand criteria.

The areas covered by these distribution assets are geographically condensed and comprise the Hoo peninsular and the Eastern Medway towns of Chatham and Strood. A mesh substation at Medway supplies the balance of the Medway towns demand via the 33kV distribution system. The system comprises predominantly underground cable assets at 132kV with mixed underground cables and overhead lines at 33kV.

Within the GSP area of supply there are two grid substations at Chatham and Medway. These supply a further fifteen primary substations. Of these seventeen substations, it is predicted that fourteen will have equipment that reaches Health Index 4 or 5 within the review period. These will require interventions to replace network equipment, or refurbishment to increase the lifespan.

It is further noted that two substations are predicted to exceed firm capacity within the study period, thus requiring reinforcement interventions.

From the regional development plans circulated by local and country councils, it has been noted that 5600 new dwellings will be built in the next ten years. Although these will be subject to the usual connection arrangements, it is anticipated that further network reinforcement will be required to sustain this development and the expected increased demand of 14MW, especially to the EHV system.

There are two large embedded generation assets in the area, both of which are associated with paper mills. These are at Townsend Hook and Medway and have a total output of 96MW. These are run at base load providing process steam/heat and electrical power. In total 105.5MW of generation is embedded within the UKPN network fed by Kingsnorth GSP

With the substation being located close to the coast it is envisaged that additional renewable generation will be connected; whilst the majority will be connected to the super-grid system operated by National Grid, some onshore generation may be connected to the SPN system.

The Thames Estuary has seen a huge increase in the connection of offshore wind farms, and it is likely that further renewable energy generation will be connected in the near future, to support the governments and industry's low carbon targets. Further wind farms and tidal generation facilities are expected to be connected. The region also has a high solar energy density and it is envisaged that new solar farms will be connected into the distribution network.

The system generally has high fault level in-feeds with the many of the substations having split running arrangements to ensure that equipment remains within their fault level rating. This will only be exacerbated by the expected connection of new renewable energy generation to the distribution network.

There is limited interconnection between the two GSP's of Kingsnorth and Northfleet East. However these two are normally operated split to avoid pre and post fault through flows affecting the UKPN network.

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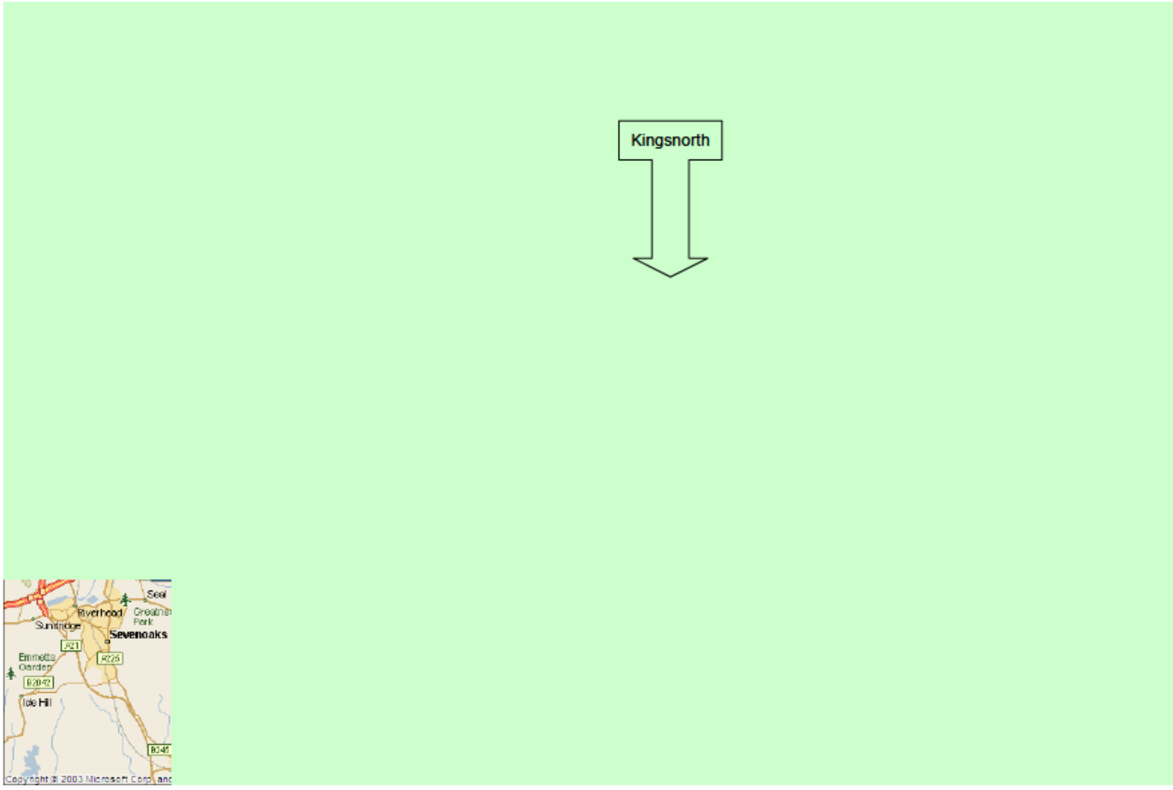


Figure 1: General GSP area of supply

1.2 Proposed projects>£1M

Asset Replacement:

- Chatham Hill Primary - Replace 11KV Switchgear £1.5m
- Kingsnorth Grid-Strood 132kV FFC Replacement (Circuit 2-3) £2.6m

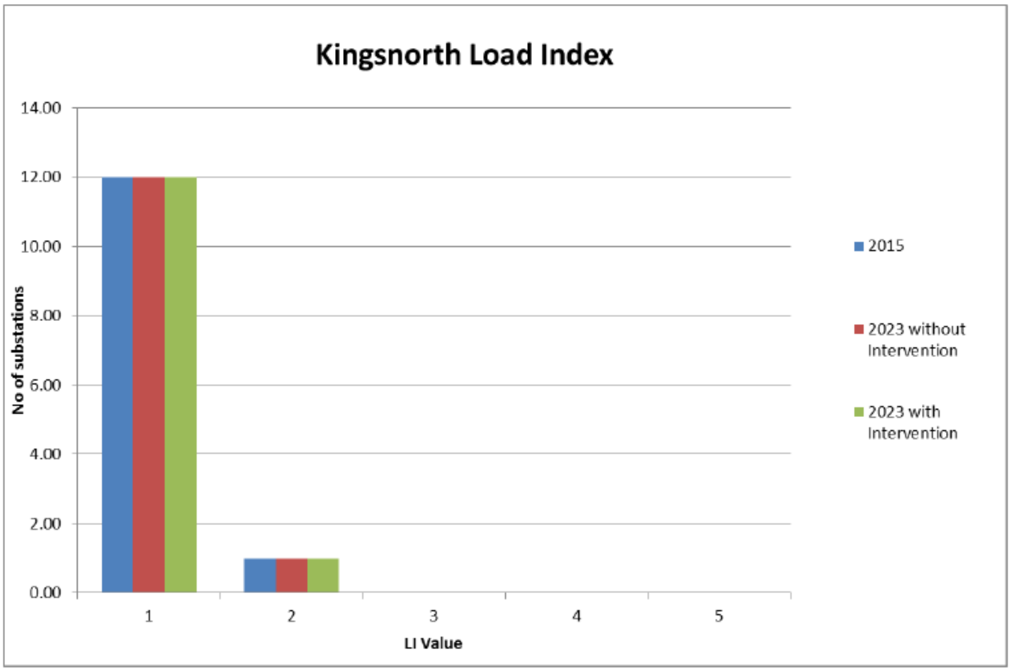
1.3 Costs profile

Table 1 below provides the forecast aggregate NAMP cost for network expenditure under this RDP during the last two years of DPCR5 and the ED1 period subject to project feasibility studies and final approval.

SR_Table J - S&R - Baseline_Final ED1 Re-submission_19th February 2014_15:15 (£)													
Description		2013/2014	2014/2015	2015/2016	2016/2017	2017/2018	2018/2019	2019/2020	2020/2021	2021/2022	2022/2023	DPCR5 Total	ED1 Total
A & H	Total Asset Replacement	99,325	0	0	577,102	1,756,286	1,026,119	253,711	89,349	644,317	1,932,952	99,325	6,279,836
Q & R	Total Reinforcement	148,723	0	0	0	0	0	0	0	0	0	148,723	0
	Grand Total	248,048	0	0	577,102	1,756,286	1,026,119	253,711	89,349	644,317	1,932,952	248,048	6,279,836

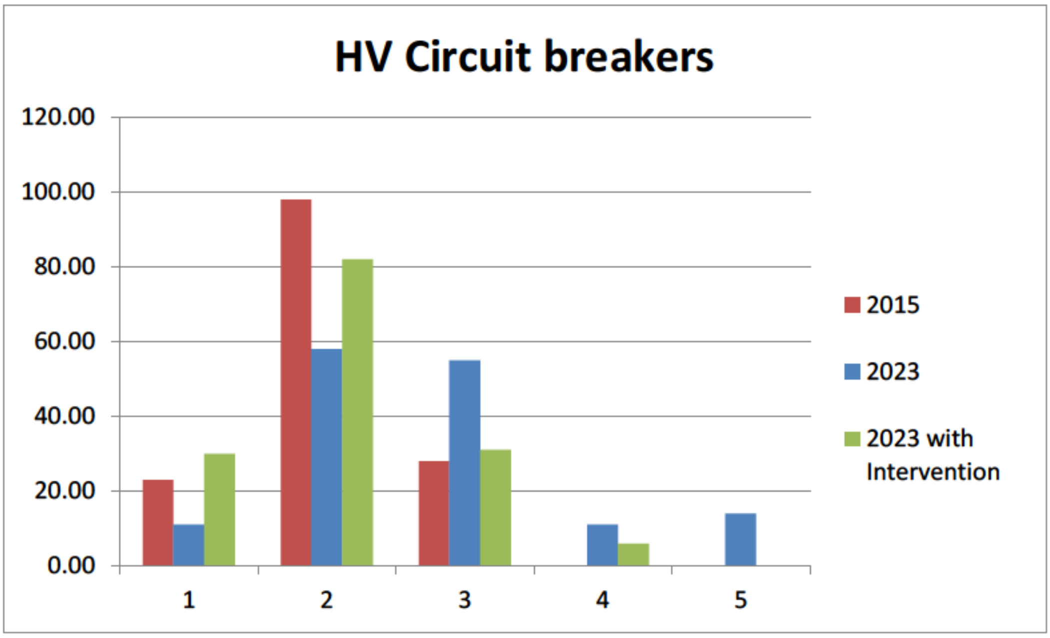
1.4 Output Measures Load Index

The chart below provides the expected Load Indices in 2015 and then again in 2023 both with and without interventions for all substations covered in this RDP.

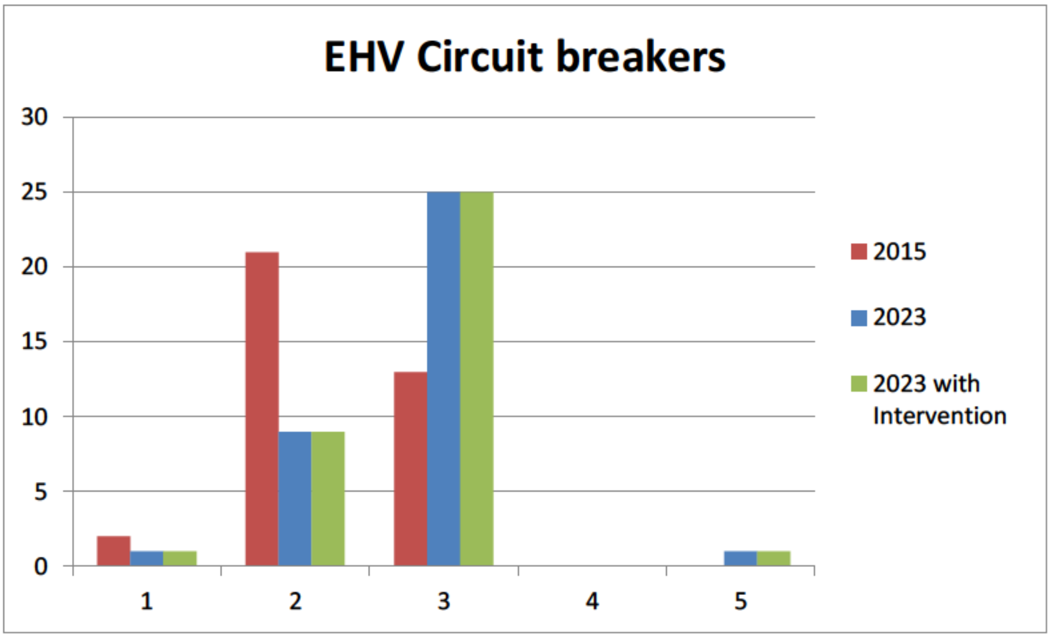


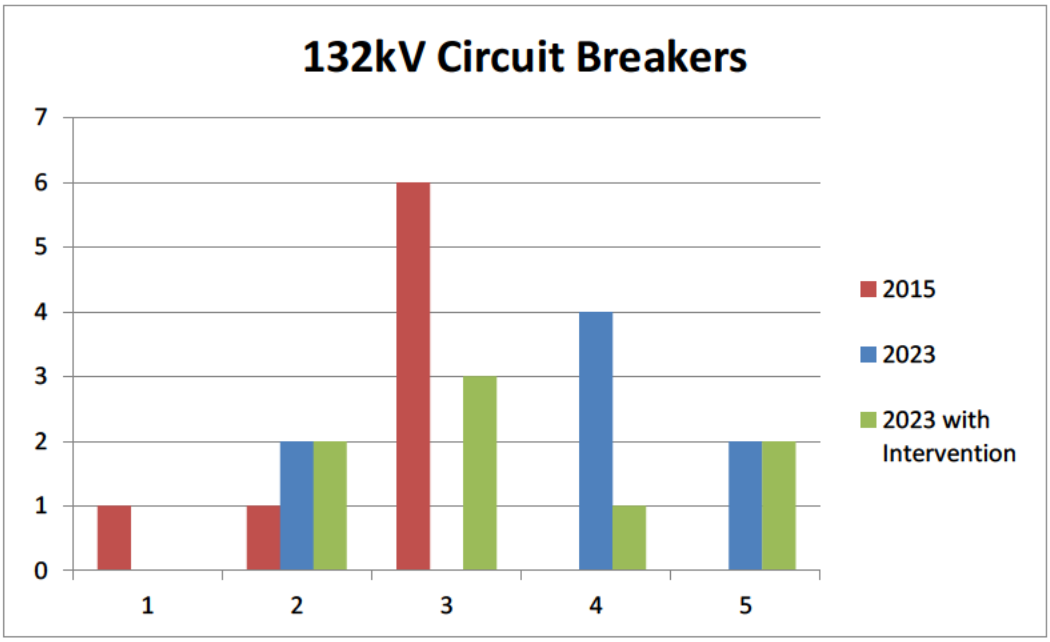
1.5 Output Measures Health Index

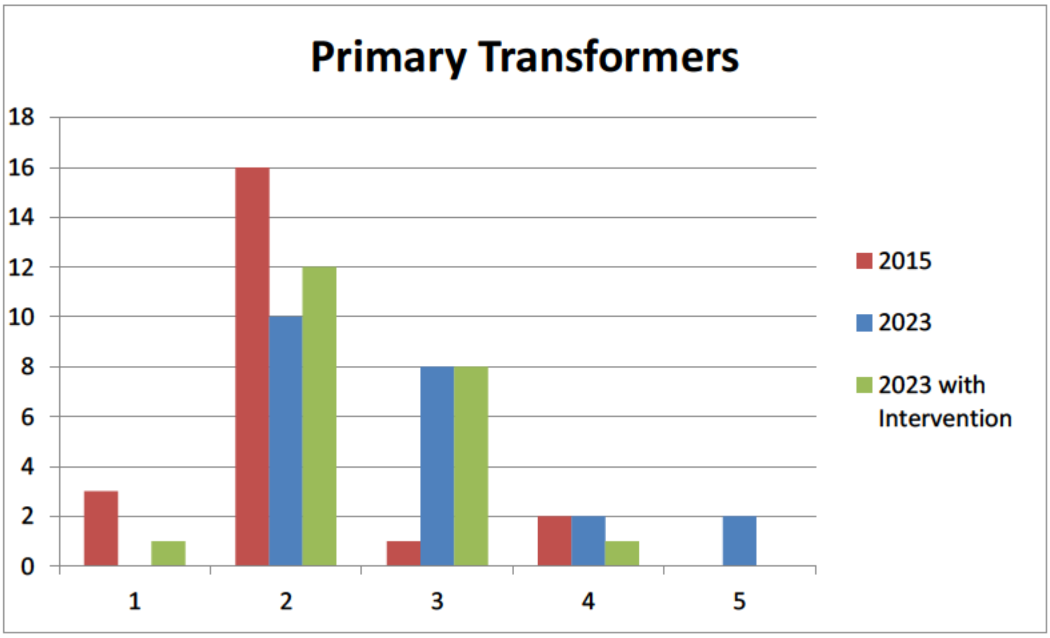
The charts below provide the projected health index status of various assets covered in this RDP by 2023. Without interventions it is predicted that there will be 10 substations with HI5 apparatus by the year 2024.

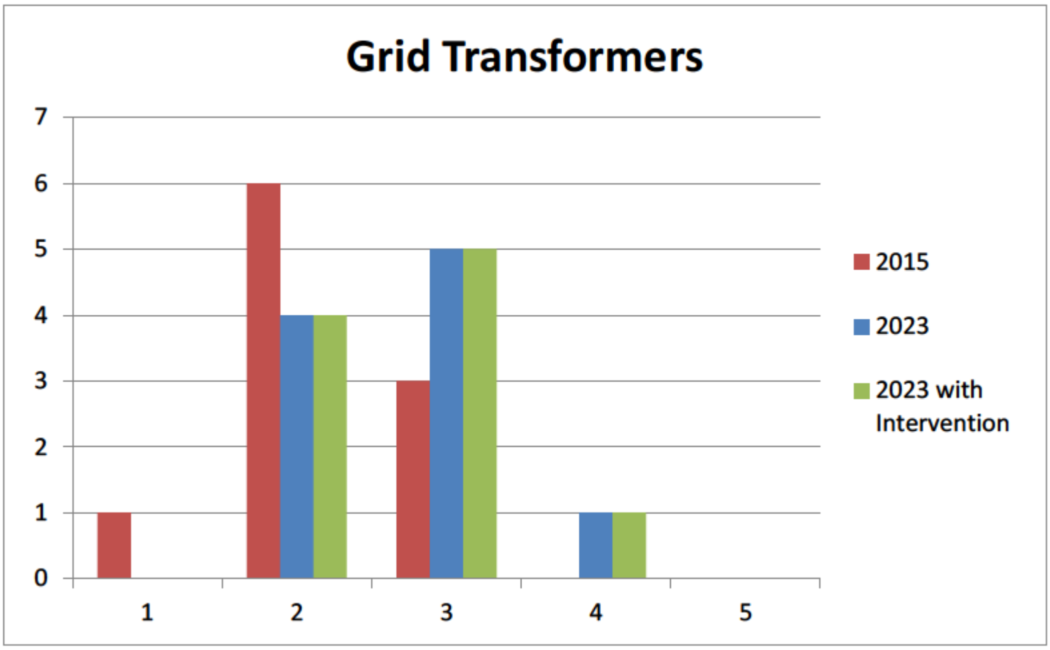


All of the cost numbers displayed in this document are before the application of on-going efficiencies and real price effects.









1.6 Principal Risks and Dependencies

The schemes covered in this RDP have been planned based on the planning load estimates 2013 with the 2011/12 maximum demand. The load forecasts are based on the element energy model. If the economic situation improves there is a risk that there will be shortfall of reinforcement schemes in the plan.

The load forecasts also include an assumed level of embedded generation being connected to the network. Should this generation not materialise, then a larger than forecast load growth could be realised.

Where Demand Site Response has been included at a substation, this is based on an assumption that customers will be willing to accept the scheme. In most cases these customers have not as yet been identified.

All of the cost numbers displayed in this document are before the application of on-going efficiencies and real price effects.

2 Network configuration

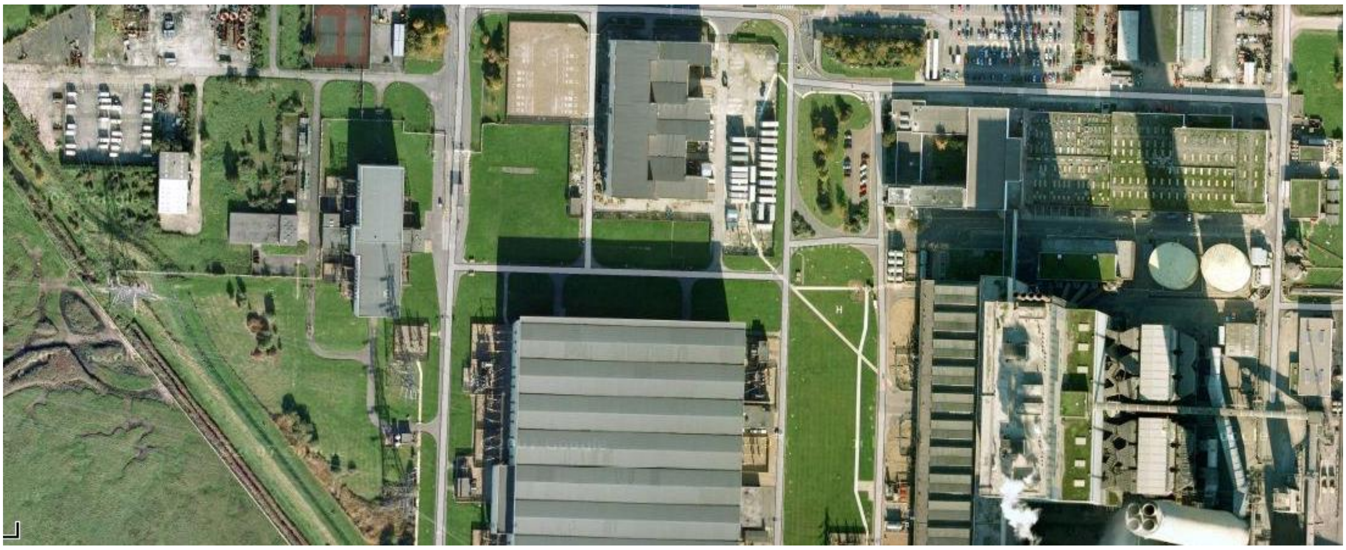
2.1 Existing Network

The Kingsnorth supply area is centred along the River Medway estuary including the towns of Strood, Chatham and Dickensian Rochester. It is supplied by 2x240MVA super grid transformers located at Kingsnorth 400/132kV grid supply point (GSP).

From Kingsnorth 132kV circuits connect to Strood, Chatham and Medway with interconnection available via Burham to the adjacent Northfleet, Kemsley and Canterbury GSP's (a geographical diagram is shown in Appendix A).

The aggregated group demand is 210MW which is forecast to increase to 248MW by 2023 (August 2012 PLE refers).

Figure 2: Aerial view of Kingsnorth 132kV Substation (top centre)



The group substation hierarchy is detailed in Table 2, below:

Table 2. Group Substations

Substation & Voltage	
Kingsnorth 132kV	**Medway 132kV**
Kingsnorth 132/11kV	**Medway 132/33kV**
Strood 132/11kV	Cobham (Kent) 33/11kV
Chatham 132kV	Chatham West 33/11kV
Chatham Grid 132/33kV	Townsend Hook 33/6.6kV
Chatham Hill 33/11kV	Wrotham Heath 33/11kV
Rainham Mark 33/11kV	Medway Local 33/11kV
Lordswood 33/11kV	Halling 33/11kV

All of the cost numbers displayed in this document are before the application of on-going efficiencies and real price effects.

Kingsnorth 132kV

Kingsnorth 132kV GSP is an indoor AIS (air insulted substation) located within the ex-Kingsnorth Power Station boundary. It is a wrap-around double busbar configuration equipped with Reyrolle OBYR14 circuit breakers. National Grid owns a number of spare bays that were previously utilised for power station service supplies.

Strood 132kV & Chatham 132/33kV

From Kingsnorth, double circuit cable connections are routed to Strood Primary equipped with 2x 60MVA double wound 132/11kV transformers and Chatham Grid equipped with 2x 90MVA 132/33kV transformers.

Chatham Grid supplies three 33/11kV primary substations at Chatham Hill, Rainham Mark and Lordswood.

Medway 132/33kV

The two 132kV feeders from Kingsnorth connect to a three switch mesh with each corner supplying two banked 45MVA 132/33kV transformers with a third transformer, rated at 60MVA, supplying generation at a local Paper Mill.

Medway 33kV switchboard consists of a Reyrolle L42 double-busbar configuration equipped with one bus section and two bus coupler circuit breakers. The site is normally operated with the bus coupler open to maintain fault levels within the equipment ratings. An auto-close facility is installed to maintain supplies for an (n-1) condition.

Medway Grid supplies six primary 33/11kV substations including the Halling, the new replacement for Rugby.

2.2 Embedded Generation (G59/2)

There is a total of 105MVA of G59/2 embedded generation within group with the principal contribution from Medway Power Station and Townsend Hook Paper Mill, detailed in Table 5, below.

Table 3. List of G59/2 Embedded Generators Connected to the Network covered by this RDP

Site Name	Type	Mode of Operation	Installed DG (MW)	No. of Generators	Operating Voltage (kV)	Substation Name	Grid Group	GSP/BSP
WHITE LADIES	Landfill gas	LONG TERM PARALLEL	1 200	1	11.000	Medway 11kV	Medway Grid	Kingsnorth SGT
OFFHAM QUARRY LANDF LL SITE	Landfill gas	LONG TERM PARALLEL	2 000	1	11.000	Medway 11kV	Medway Grid	Kingsnorth SGT
AYLESFORD PAPER M LLS PHS 3 (SCA AYLESFORD)	CHP	LONG TERM PARALLEL	43.000	1	33.000	Medway Grid	Medway Grid	Kingsnorth SGT
AYLESFORD PAPER M LLS PHS 2 (SCA AYLESFORD)	CHP	LONG TERM PARALLEL	20.000	1	33.000	Medway Grid	Medway Grid	Kingsnorth SGT
AYLESFORD PAPER M LLS PHS 1 (SCA AYLESFORD)	CHP	LONG TERM PARALLEL	38.340	1	33.000	Medway Grid	Medway Grid	Kingsnorth SGT
PAPER M LL	CHP	LONG TERM PARALLEL	56.000	1	33.000	Medway 11kV	Medway Grid	Kingsnorth SGT
BURNHAM TREATMENT WORKS	Biogas	LONG TERM PARALLEL	1.700	1	11.000	Medway 11kV	Medway Grid	Kingsnorth SGT
HAM H LL WTW	Diesel	LONG TERM PARALLEL	0 342	1	11.000	Townsend Hook 6 6kV	Medway Grid	Kingsnorth SGT
SHAKESPEARE FARM	Diesel	LONG TERM PARALLEL	0 330	1	11.000	Kingsnorth 11kV	Kingsnorth Grid	Kingsnorth SGT
MEDWAY MARITINE HOSPITAL	CHP	LONG TERM PARALLEL	1.400	1	11.000	Chatham Hill 11kV	Chatham Grid	Kingsnorth SGT
K NGSFERRY COACH STATION	PV	LONG TERM PARALLEL	0.050	1	0.400	Rainham Mark 11kV	Chatham Grid	Kingsnorth SGT
RSPB	PV	LONG TERM PARALLEL	0.006	2	0.230	Strood 11kV	Strood Grid	Kingsnorth SGT
EXTRA CARE BLOCK, FLATS 1-41, BELLEROPHON HSE	PV	LONG TERM PARALLEL	0.020	2	0.400	Chatham West 11kV	Medway Grid	Kingsnorth SGT

2.3 Projects in Progress

DPCR5 Projects in Progress There are two Reinforcement Projects; 3047 and 3099 outlined below:

Table 4. NAMP Extract for DPCR5 Kingsnorth Projects

Project ID	Description	2013/2014	2014/2015	2015/2016
8469	Kingsnorth Grid 132kV: ABCB Refurbishment	99,325	0	0
3047	Halling Primary (Replacement for Rugby Substation) - Relocation & Increased Capacity	5,403	0	0
3099	Medway - Burham - 132kV Interconnector	143,320	0	0

Scheme 8469: Kingsnorth Grid 132kV: ABCB Refurbishment

Kingsnorth Grid 132kV is a shared site with National Grid supplied by 2 x 240MVA transformers via the National Grid owned busbars. There are four UK Power Networks 132kV circuit breakers installed at the site with a fifth currently being installed to feed a new 132/11kV transformer at the new Kingsnorth Grid 11kV site. Of the four circuit breakers one was recently replaced in 2010.

The three remaining breakers are all Reyrolle OBYR air blast circuit breakers. There have been numerous failures of Reyrolle OB/OBYR type CB nationally as well as within UK Power Networks. Four main potential failure modes have been identified in examination of post failure investigations and all result through long term degradation of some element of the overall CB structure or components.

The aim of this project is to refurbish the three Reyrolle OBYR air blast circuit breakers at Kingsnorth substation.

Scheme 3047: Establish Halling Primary

This project involves relocation of Rugby primary substation to a new location at Halling together with associated asset replacement and reinforcement. The timing of the work was initiated by termination of the existing site to facilitate the landowner to redevelop his site

The existing Rugby Local 33/11kV transformers are equipped with obsolete tap changers which do not have remote control facilities and are required to be replaced due to deteriorating condition. Furthermore the demand is forecast to exceed firm capacity and it is therefore necessary to increase the rating of the replacement transformers and replace the switchboard to remove a continuous rating constraint.

Halling Primary is now commissioned with only minor remedial works outstanding.

Scheme 3099: Route PE - Establish permanent 132kV double circuit OHL connection between Medway and Burham

Medway is supplied at 132kV from Strood and Burham via single circuit cable and overhead line (Route PE) connections respectively. Route PE is 132kV double circuit construction with 1 circuit operated at 132kV and the other at 33kV.

Under abnormal operating conditions it is possible to re-jumper the tower line connections to operate both circuits at 132kV thereby providing additional support to Medway. Due to the switching and physical re-connections this contingency takes approximately 12 hours to implement. It has been utilised three times in the last five years following third party damage to the cables from Kingsnorth GSP. This project is designed to upgrade the contingency arrangement to become a fully switchable connection.

To achieve this it is proposed to transfer the 33kV circuit from Route PE to the redundant ex-Reeds No3 33kV cable connection and permanently reconfigure the tower line 'jumpers' to establish a 132kV double circuit connection between Burham and Medway.

3 Network Development Considerations

3.1 District / Local Development Plans

The majority of the Kingnsorth network is contained within Medway Council boundary.

The Medway Local Development Framework identifies Lodge Hill and Chattenden on the Hoo peninsular as locations for new housing development with a combined forecast of up to 5,000 domestic units. Another area identified for redevelopment is the disused Halling Cemex cement factory at Halling where provision for 624 residential units is proposed.

It is recognised that timescales for these developments will be influenced by economic factors however the Local Development Framework forecasts a peak of housing delivery between 2015 and 2021.

The Medway Local Development Framework quotes the 2010 population as 255,000 for the year 2010, with a predicted increase of 25,000 to 280,000 by the year 2028.

Table 5. Forecast housing increase

Area	*Dwellings*	*Average increase in MW*	*Substation*
Chattenden	5000	12.5	Strood
Halling	624	1.6	Halling
Total	**5624**	**14**	

All of the cost numbers displayed in this document are before the application of on-going efficiencies and real price effects.

3.2 Asset Health

It should be noted that HIs presented in the RDP will not align with the RIGS. The HIs presented in the RDP are the outcome of our ARP model on an asset by asset basis. Different rules are applied for the RIGs reporting, as agreed with Ofgem, where assets may be grouped and all assets in the group take the same HI.

The existing and forecast health indices 2015-2023 without intervention are detailed below:

Table 6. HV Circuit breakers

	2015					2023				
Substation	**No. HI1**	**No. HI2**	**No. HI3**	**No. HI4**	**No. HI5**	**No. HI1**	**No. HI2**	**No. HI3**	**No. HI4**	**No. HI5**
CHATHAM HILL 33/11KV		5	14				5			14
CHATHAM WEST	1	23	4			1		24	3	
COBHAM (KENT) 33/11KV		7	1					7	1	
HALLING 33/11KV	9					9				
KINGSNORTH GRID 11KV			5						5	
KINGSNORTH GRID 132/11KV			1						1	
LORDSWOOD 33/11KV	9						9			
MEDWAY LOCAL 33/11KV		7	3					9	1	
RAINHAM MARK 33/11KV	3	10				1	12			
STROOD 132 KV		4					4			
STROOD 132/11KV		25					25			
TOWNSEND HOOK 33/6.6KV		8					2	6		
WROTHAM HEATH 33/11KV	1	9					1	9		

Table 7. 33kV Circuit breakers

	2015					2023				
Substation	**No. HI1**	**No. HI2**	**No. HI3**	**No. HI4**	**No. HI5**	**No. HI1**	**No. HI2**	**No. HI3**	**No. HI4**	**No. HI5**
CHATHAM GRID 132 KV		2					2			
CHATHAM GRID 33 KV	2	8				1	2	7		
MEDWAY GRID 132 KV		5					1	4		
MEDWAY GRID 33KV		6	13				4	14		1

Table 8. 132kV Circuit Breakers

	2015					2023				
Substation	**No. HI1**	**No. HI2**	**No. HI3**	**No. HI4**	**No. HI5**	**No. HI1**	**No. HI2**	**No. HI3**	**No. HI4**	**No. HI5**
KINGSNORTH 132 KV	1		3				1		3	
MEDWAY GRID 132 KV		1	3				1		1	2

Table 9. Primary Transformers

	2015					2023				
Substation	**No. HI1**	**No. HI2**	**No. HI3**	**No. HI4**	**No. HI5**	**No. HI1**	**No. HI2**	**No. HI3**	**No. HI4**	**No. HI5**
CHATHAM HILL 33/11KV	1	2					2	1		
CHATHAM WEST		4						4		
COBHAM (KENT) 33/11KV		2					2			
HALLING 33/11KV	2						2			
LORDSWOOD 33/11KV		2					1		1	
MEDWAY LOCAL 33/11KV		2						2		
RAINHAM MARK 33/11KV		1	1	1			1		1	1
TOWNSEND HOOK 33/6.6KV		1		1				1		1
WROTHAM HEATH 33/11KV		2					2			

Table 10. Grid Transformers

	2015					2023				
Substation	**No. HI1**	**No. HI2**	**No. HI3**	**No. HI4**	**No. HI5**	**No. HI1**	**No. HI2**	**No. HI3**	**No. HI4**	**No. HI5**
CHATHAM GRID 132 KV		2					2			
KINGSNORTH GRID 132/11KV	1						1			
MEDWAY GRID 132 KV		2	3				1	3	1	
STROOD 132 KV		2						2		

All of the cost numbers displayed in this document are before the application of on-going efficiencies and real price effects.

All of the cost numbers displayed in this document are before the application of on-going efficiencies and real price effects.

3.3 Security of supply and load index analysis

Table 11. P2/6 Assessment Table

Sub-station	P2/6	Secondary Voltage	Firm Capacity (MW)	Transfer (MW)	Winter 12/13 Summer 2012 (MW)	Winter 13/14 Summer 2013 (MW)	Winter 14/15 Summer 2014 (MW)	Winter 15/16 Summer 2015 (MW)	Winter 16/17 Summer 2016 (MW)	Winter 17/18 Summer 2017 (MW)	Winter 18/19 Summer 2018 (MW)	Winter 19/20 Summer 2019 (MW)	Winter 20/21 Summer 2020 (MW)	Winter 21/22 Summer 2021 (MW)	Winter 22/23 Summer 2022 (MW)
Chatham Grid	YES	33kV	113.20	0.00	65.90	65.89	66.18	66.55	66.92	66.99	67.09	67.19	67.31	67.78	68.24
Chatham Grid	YES	33kV	89.10	0.00	51.13	51.10	51.34	51.65	51.96	52.01	52.09	52.17	52.26	52.62	52.97
Chatham Hill	YES	11kV	45.10	0.00	32.54	32.43	32.39	32.40	32.45	32.48	32.52	32.57	32.62	32.88	33.13
Chatham Hill	YES	11kV	32.40	0.00	23.05	22.95	22.90	22.91	22.94	22.96	22.99	23.02	23.06	23.23	23.40
Chatham West	YES	11kV	55.86	0.00	41.81	41.65	41.58	41.58	41.65	41.68	41.73	41.79	41.86	42.22	42.55
Chatham West	YES	11kV	55.86	0.00	34.80	34.64	34.57	34.57	34.62	34.65	34.69	34.74	34.79	35.08	35.35
Cobham (Kent)	YES	11kV	13.00	0.00	7.80	7.84	7.99	8.16	8.30	8.33	8.36	8.39	8.43	8.54	8.65
Cobham (Kent)	YES	11kV	9.70	0.00	3.93	3.95	4.02	4.10	4.17	4.18	4.20	4.22	4.23	4.29	4.34
Halling	YES	11kV	23.00	0.00	5.75	5.75	5.75	5.75	5.75	5.75	5.75	5.75	5.75	5.75	5.75
Halling	YES	11kV	17.30	0.00	5.23	5.23	5.23	5.23	5.23	5.23	5.23	5.23	5.23	5.23	5.23
Kingsnorth	NO	11kV	6.30	0.00	7.98	7.99	8.03	8.08	8.13	8.14	8.16	8.18	8.20	8.25	8.29
Kingsnorth	NO	11kV	3.80	0.00	5.49	5.50	5.52	5.55	5.58	5.59	5.60	5.61	5.62	5.65	5.68
Kingsnorth SGT	YES	400kV	276.50	0.00	200.21	200.26	201.39	202.78	204.14	204.38	204.72	205.09	205.51	207.08	208.61
Kingsnorth SGT	YES	400kV	244.20	0.00	144.30	144.23	145.02	146.03	147.01	147.19	147.43	147.69	147.99	149.11	150.21
Lordswood	YES	11kV	22.90	0.00	9.62	9.62	9.62	9.62	9.62	9.62	9.62	9.62	9.62	9.62	9.62
Lordswood	YES	11kV	22.90	0.00	6.94	6.94	6.94	6.94	6.94	6.94	6.94	6.94	6.94	6.94	6.94
Medway 132kV	NO	132kV	0.00	0.00	86.98	87.13	87.97	88.92	89.78	89.90	90.05	90.23	90.43	91.17	91.91
Medway 132kV	NO	132kV	0.00	0.00	62.83	62.89	63.45	64.12	64.73	64.80	64.91	65.03	65.18	65.71	66.23
Medway Grid	YES	33kV	168.50	0.00	86.25	86.40	87.23	88.18	89.05	89.16	89.32	89.49	89.70	90.44	91.17
Medway Grid	YES	33kV	129.60	0.00	62.83	62.89	63.45	64.12	64.73	64.80	64.91	65.03	65.18	65.71	66.23
Medway Local	YES	11kV	21.90	0.00	11.90	12.11	12.69	13.29	13.79	13.84	13.91	13.98	14.06	14.28	14.51
Medway Local	YES	11kV	16.56	0.00	8.78	8.93	9.35	9.78	10.15	10.19	10.23	10.28	10.34	10.50	10.67
Medway Scottish Hydro	NO	132kV	19.20	0.00	30.43	30.43	30.43	30.43	30.43	30.43	30.43	30.43	30.43	30.43	30.43
Medway Scottish Hydro	NO	132kV	19.20	0.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00
Medway Townsend Hook Wrotham Group	YES	kV	34.70	0.00	18.76	18.82	19.01	19.20	19.35	19.36	19.37	19.38	19.40	19.46	19.52
Medway Townsend Hook Wrotham Group	YES	kV	34.70	0.00	13.22	13.28	13.45	13.63	13.78	13.79	13.80	13.81	13.83	13.89	13.95
Rainham Mark	YES	11kV	46.56	0.00	23.42	23.51	23.85	24.22	24.54	24.58	24.63	24.69	24.76	24.98	25.19
Rainham Mark	YES	11kV	34.92	0.00	19.73	19.81	20.08	20.38	20.64	20.68	20.72	20.77	20.83	21.00	21.18
Strood 132/11	YES	11kV	74.10	0.00	37.58	37.48	37.45	37.48	37.57	37.61	37.68	37.76	37.84	38.15	38.45
Strood 132/11	YES	11kV	57.00	0.00	27.14	27.03	27.01	27.03	27.09	27.12	27.17	27.22	27.28	27.50	27.71
Townsend Hook	YES	6.6kV	14.40	0.00	5.51	5.57	5.76	5.95	6.11	6.12	6.13	6.14	6.16	6.22	6.28
Townsend Hook	YES	6.6kV	10.60	0.00	5.41	5.47	5.64	5.83	5.98	5.99	6.00	6.01	6.02	6.08	6.15
Wrotham	YES	11kV	16.60	0.00	13.84	13.84	13.84	13.84	13.84	13.84	13.84	13.84	13.84	13.84	13.84
Wrotham	YES	11kV	13.00	0.00	7.90	7.90	7.90	7.90	7.90	7.90	7.90	7.90	7.90	7.90	7.90

Key

Compliant with P2/6

Approaching limit of P2/6 compliance

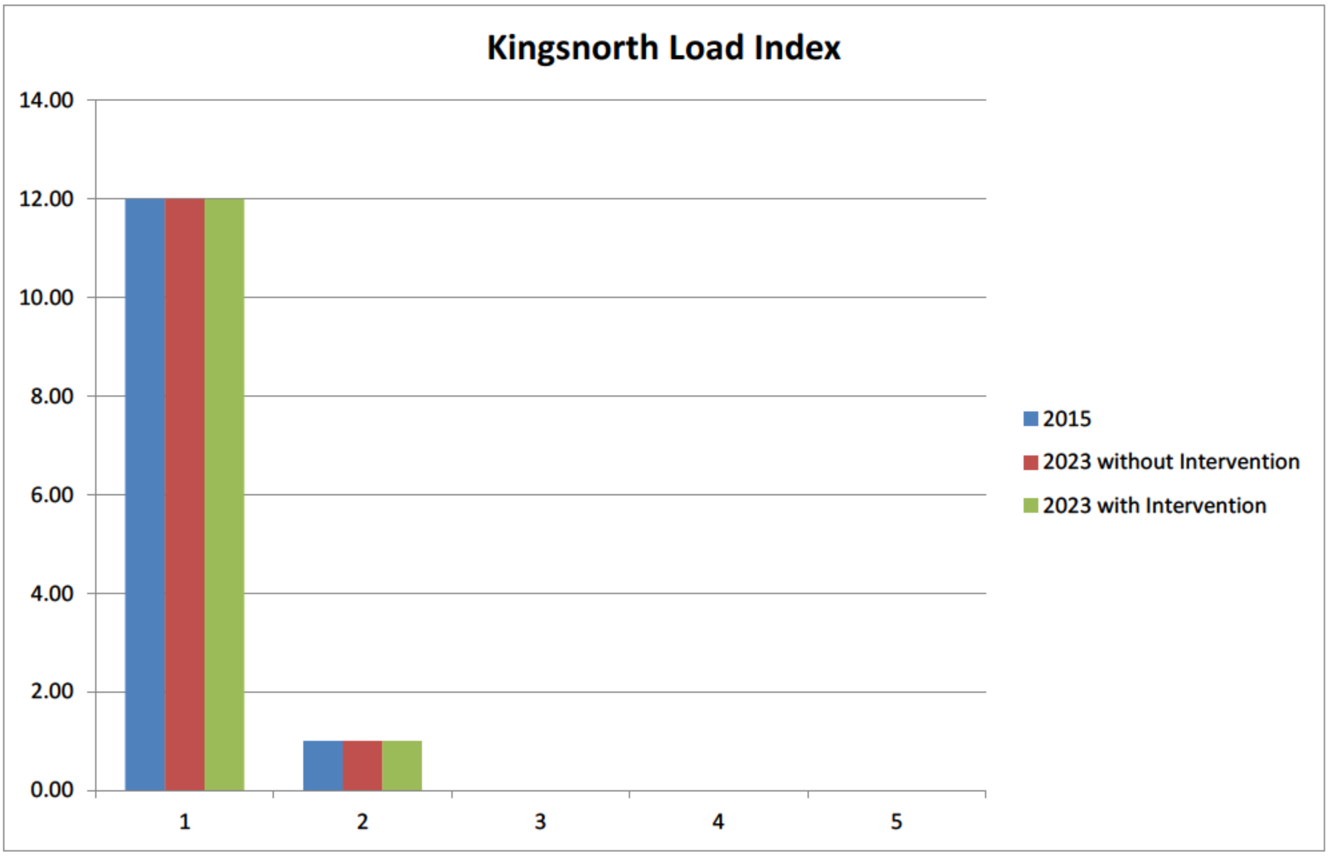
Table 12. LI Profile

All of the cost numbers displayed in this document are before the application of on-going efficiencies and real price effects.

LI Profile (Without Intervention)

Substation	Voltage kV	Load Index 2015	Load Index 2023
Kingsnorth 132kV			
Kingsnorth 132/11kV	11	1	1
Strood 132/11kV	11	1	1
Chatham Grid 132/33kV	33	1	1
Chatham Hill 33/11kV	11	1	1
Rainham Mark 33/11kV	11	1	1
Lordswood 33/11kV	11	1	1
Medway Grid 132/33kV	33	1	1
Cobham (Kent) 33/11kV	11	1	1
Chatham West 33/11kV	11	1	1
Townsend Hook 33/6.6kV	6.6	1	1
Wrotham Heath 33/11kV	11	2	2
Medway Local 33/11kV	11	1	1
Halling 33/11kV	11	1	1

Table 13. Forecast LI Profile without intervention



3.4 Operational and technical restrictions

No operational or technical restrictions have been identified.

3.5 National Grid

There is no scheduled works at Kingsnorth 400kV substation with the National Grid Seven Year Statement identifying one major infrastructure project in the Kent area which is the re-conductoring of the Canterbury - Sellindge overhead line during 2013.

The RWE Kingsnorth Power Station may be decommissioned during ED1, Should this occur, UK Power Networks would become the 'sole user' of the 132kV substation and it is expected that ownership of the building and electrical equipment would be transferred from National Grid to UK Power Networks.

3.6 Network Constraints

There is a 132kV cable constraint cited for this group associated with circuits crossing north and south drains on the Kingsnorth site.

4 Recommended strategy

The recommended network strategy for the network is designed to ensure:

- Continued adherence to security of supply criteria defined in Engineering recommendation P2/6
- Maintaining reliable network operation by replacement or refurbishment of poorly performing equipment or assets approaching the end of their operational life identified by the use of condition monitoring (HI) techniques

Wherever possible, reinforcement and asset replacement works are to be harmonised to achieve an efficient economic and resourced solution.

4.1 Asset Replacement

4.1.1 Transformers

7900: Rainham Mark 33/11kV - Refurbish Primary Transformer (T1, T2)

Rainham Mark is supplied by three 33/11 kV 12/24MVA transformers. The condition assessment of the 1982 Hawker Siddeley Primary Transformers with ATL AT tap changers installed has identified a risk of failure due to degradation. It is therefore proposed to refurbish both units in situ.

The site has a firm capacity of 46.6MVA during the winter, which is not forecast to be exceeded within the study period.

7913: Townsend Hook 33/6.6kV - Replace Primary Transformer (T2)

Townsend Hook is fed by two 7.5/15MVA 33/6.6kV transformers. The condition assessment of the 1972 Ferranti Primary Transformer with Ferranti DS2 tap changer installed at has identified a risk of failure due to degradation. This project therefore recommends replacement. Completion of the project will see 1 Primary Transformer replaced with a 15MVA unit.

The firm capacity of the site is not due to be exceeded within the study period.

4.1.2 Switchgear

7924: Chatham Hill - Replace 11kV Switchgear

The condition assessment of the 1984 GEC VMX vacuum switchgear installed at Chatham Hill has identified a risk of failure due to degradation. Of the 19 circuit breakers 14 will become HI5 by 2023. It is therefore proposed to asset replace the switchboard. Completion of the project will see 19 circuit breakers replaced with new circuit breakers.

Note: Chatham Hill 11kV substation is supplied by three 33/11kV transformers. T2 is rated at 12/24MVA, T3 is rated at 11.5/23MVA and T4 is rated at 12/18/24MVA to give a site firm capacity of 45MVA. The firm capacity is not forecast to be exceeded within the study period.

4158: Chatham West Primary - Retrofit 11KV Switchgear (part)

The 11kV switchboard consists of a double busbar arrangement with two bus coupler and three bus section circuit breakers. The site is split via the bus couplers for fault level constraint purposes. The existing Reyrolle C 11kV switchboard (1964) at Chatham West Primary 33/11kV is to become HI4 by 2024 (four circuit breakers). The switchboard is therefore being partially retrofitted as part of the plan.

The site is fed by four 33/11kV transformers, each rated at 16/20MVA. The firm capacity of the site is 55.9MVA winter. The site is predicted to remain within the firm capacity during the study review period.

7927: Cobham (Kent) 33/11kV - Retrofit 11kV Switchgear

The 11kV switchboard consists of a single busbar with one bus section. The condition assessment of the 1967 Reyrolle LMT oil switchgear installed at Cobham (Kent) 33/11kV has identified a risk of failure due to degradation. One of the circuit breakers is due to reach HI4 by 2023. It is therefore recommended to retrofit the 8 circuit breakers.

The site is supplied by two transformers each rated at 10MVA and is due to exceed firm capacity by 2020 with an associated reinforcement project proposed during ED1. To obtain the most economical delivery solution it is proposed that delivery of these two projects is coordinated.

7830: Medway Local 33/11kV - Retrofit 11kV Switchgear

Medway Local consists of a single busbar switchboard with a single bus section switch. The condition assessment (HI4 by 2024) of the 1972 Reyrolle LMT Oil Switchgear installed at Medway Local 33/11kV has identified a risk of failure due to degradation. It is therefore proposed to refurbish the 5 circuit breakers.

The switchboard is supplied by two 12/24MVA transformers, and the site has a firm winter capacity of 21.9MVA. This firm capacity is not forecast to be exceeded within the review period.

4.1.3 Circuits

7962: PE Route Burham Grid to Medway Grid 132kV Tower Line – 132kV tower line refurbishment

The condition assessment of the Burham Grid to Medway Grid 132kV Tower Line (PE) has identified the need to undertake selective refurbishment of fixtures, fittings and painting of the 10km route.

8173: Medway Grid 33kV – Wrotham Heath No 33kV Pole – 33kV Pole replacement

Condition assessment of the Medway Grid 33KV - Wrotham Heath No 2 33KV Pole has identified the need for selective replacement and refurbishment of the 11 km of 33KV pole route.

8652: Kingsnorth – Strood 132KV FFC

Condition assessment of the fluid filled cable has identified the requirement to undertake selective section replacement due to deteriorating condition.

4.2 Reinforcement

P2/6 analysis confirms that the existing network capacity is well matched to the forecast maximum demands and no reinforcement projects are proposed for ED1.

Strood substation capacity headroom will be regularly monitored due to the Local Development Framework predicted increase of new residential development.

All of the cost numbers displayed in this document are before the application of on-going efficiencies and real price effects.

4.3 Summary of Proposed Interventions

Substation	Driver	Commissioning Year	Scope of works	New Firm capacity
Chatham Hill	Asset Replacement	2017	Replacement 11kV switchgear	Remains at 45MVA
Burham to Medway (Route PE) 132kV Tower Line	Asset Replacement	2017	132kV tower line refurbishment	N/A
Rainham Mark 33/11kV	Asset Replacement	2018	Refurbish primary transformers T1 & T2	N/A
Medway – Wrotham Heath No2 Wood Pole 33kV Line	Asset Replacement	2018	33kV Pole replacement	N/A
Medway Local 33/11kV	Asset Replacement	2019	Retrofit 11kV switchgear	N/A
Chatham West Primary	Asset Replacement	2019	Retrofit 11kV switchgear	N/A
Townsend Hook 33/6.6kV	Asset Replacement	2019	Replace transformer (T2)	N/A
Cobham (Kent) 33/11kV	Asset Replacement	2020	Retrofit 11kV switchgear	N/A
Kingsnorth-Strood 132kV FF cable	Asset Replacement	2023	Cable section asset replacement	No change

4.4 Costs and Phasing

Table 14. NAMP Table (2014-2023)

SR_Table J - S&R - Baseline_Final ED1 Re-submission_19th February 2014_15:15													
Cat	Namp Line	Project ID	Description	2013/2014	2014/2015	2015/2016	2016/2017	2017/2018	2018/2019	2019/2020	2020/2021	2021/2022	2022/2023
A	1.55.02	8469	Kingsnorth Grid 132kV: ABCB Refurbishment	99,325	0	0	0	0	0	0	0	0	0
A	1.51.11	7900	Rainham Mark 33/11kV - Refurbish Pr mary Transformer (T1, T2)	0	0	0	0	113,672	187,958	0	0	0	0
A	1.51.03	7913	Townsend Hook 33/6.6kV - Replace Primary Transformer (T2)	0	0	0	0	82,574	492,054	0	0	0	0
A	1.50.01	7924	Chatham Hill - Replace 11kV Switchgear	0	0	0	411,608	1,086,210	0	0	0	0	0
A	1.50.01	4158	Chatham West Primary - Retrofit 11kV Switchgear	0	0	0	0	0	101,848	152,484	0	0	0
A	1.50.01	7927	Cobham (Kent) 33/11kV - Retrofit 11kV Switchgear	0	0	0	0	0	0	29,783	89,349	0	0
A	1.50.01	7830	Medway Local 33/11kV - Retrofit 11kV Switchgear	0	0	0	0	0	0	71,444	0	0	0
A	1.02.03	7962	PE - Burham Grid - Medway Grid - Conductor Replacement	0	0	0	165,494	343,423	0	0	0	0	0
A	1.09.01	8173	100913314 - 33kV Medway Grid/Wrotham Heath No2 - OHLReplacement	0	0	0	0	130,407	244,259	0	0	0	0
H	1.29.02	8652	Kingsnorth Grid-Strood 132kV FFC Replacement (C rcuit 2-3)	0	0	0	0	0	0	0	0	644,317	1,932,952
R	1.33.07	3047	Halling Primary (Replacement for Rugby Substation) - Relocation & Increased Capacity	5,403	0	0	0	0	0	0	0	0	0
R	1.37.06	3099	Medway - Burham - 132kV Interconnector	143,320	0	0	0	0	0	0	0	0	0

All of the cost numbers displayed in this document are before the application of on-going efficiencies and real price effects.

4.5 HI / LI Profile Post Intervention

HI profile (all substations) pre and post intervention at the end of the review period - 2023

Table 15. 11kV Circuit Breakers

	2015					2023 with Intervention				
Substation	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5
CHATHAM HILL 33/11KV		5	14			19				
CHATHAM WEST	1	23	4			1	16	11		
COBHAM (KENT) 33/11KV		7	1				8			
HALLING 33/11KV	9					9				
KINGSNORTH GRID 11KV			5						5	
KINGSNORTH GRID 132/11KV			1						1	
LORDSWOOD 33/11KV	9						9			
MEDWAY LOCAL 33/11KV		7	3				5	5		
RAINHAM MARK 33/11KV	3	10				1	12			
STROOD 132 KV		4					4			
STROOD 132/11KV		25					25			
TOWNSEND HOOK 33/6.6KV		8					2	6		
WROTHAM HEATH 33/11KV	1	9					1	9		

Table 16. 33kV Circuit Breakers

	2015					2023 with Intervention				
Substation	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5
CHATHAM GRID 132 KV		2					2			
CHATHAM GRID 33 KV	2	8				1	2	7		
MEDWAY GRID 132 KV		5					1	4		
MEDWAY GRID 33KV		6	13				4	14		1

Table 17. 132kV Circuit Breakers

	2015					2023 with Intervention				
Substation	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5
KINGSNORTH 132 KV	1		3				1	3		
MEDWAY GRID 132 KV		1	3				1		1	2

Table 18. Primary Transformers

	2015					2023 with Intervention				
Substation	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5
CHATHAM HILL 33/11KV	1	2					2	1		
CHATHAM WEST		4						4		
COBHAM (KENT) 33/11KV		2					2			
HALLING 33/11KV	2						2			
LORDSWOOD 33/11KV		2					1		1	
MEDWAY LOCAL 33/11KV		2						2		
RAINHAM MARK 33/11KV		1	1	1			3			
TOWNSEND HOOK 33/6.6KV		1		1		1		1		
WROTHAM HEATH 33/11KV		2					2			

All of the cost numbers displayed in this document are before the application of on-going efficiencies and real price effects.

Table 19. Grid Transformers

	2015					2023 with Intervention				
Substation	**No. HI1**	**No. HI2**	**No. HI3**	**No. HI4**	**No. HI5**	**No. HI1**	**No. HI2**	**No. HI3**	**No. HI4**	**No. HI5**
CHATHAM GRID 132 KV		2					2			
KINGSNORTH GRID 132/11KV	1						1			
MEDWAY GRID 132 KV		2	3				1	3	1	
STROOD 132 KV		2						2		

Table 20. Load Indices Post-intervention

Substation	Voltage kV	Load Index	
		2015	2023
Kingsnorth 132kV			
Kingsnorth 132/11kV	11	1	1
Strood 132/11kV	11	1	1
Chatham Grid 132/33kV	33	1	1
Chatham Hill 33/11kV	11	1	1
Rainham Mark 33/11kV	11	1	1
Lordswood 33/11kV	11	1	1
Medway Grid 132/33kV	33	1	1
Cobham (Kent) 33/11kV	11	1	1
Chatham West 33/11kV	11	1	1
Townsend Hook 33/6.6kV	6.6	1	1
Wrotham Heath 33/11kV	11	2	2
Medway Local 33/11kV	11	1	1
Halling 33/11kV	11	1	1

5 Alternatives considered

3285: Medway Grid - Replace 33kV Switchgear

Medway Grid is equipped with 23 panels of Reyrolle L42 double busbar switchgear. The highest health index at this site is 5 by 2024. This solution attempts to rectify the fault by replacing the contact fixed portion leak oil onto the circuit breakers through the spout seals. A programme of inspection and topping up is in hand - however replacement is deemed necessary.

Newhaven Grid had a similar leak and was routinely monitored and topped up. Despite regular monitoring, in 2000 there was a flashover and explosion which badly damaged the switch-house wall and roof which collapsed on the switchgear.

The increased risk to the system and the health and safety of personnel has rendered this solution as rejected.

All of the cost numbers displayed in this document are before the application of on-going efficiencies and real price effects.

5.1 References

References	Description
Reference 1	Planning Load Estimates SPN Area 2011 – 2023 (20 August 2012)
Reference 2	SPN 132kV System Diagram East
Reference 3	SPN 132kV System Diagram West
Reference 4	SPN LTDS Network Schematics
Reference 5	NAMP SPN Table J Less Ind 1 Sept 2012
Reference 6	ED1 Update September 2012 v10.3.1

5.2 Appendices

Appendix	Description
Appendix A	Geographical diagram
Appendix B	Single Line Diagram – Existing Network
Appendix C	Single Line Diagram – Recommended Strategy

5.3 Document History

Version	Date of Issue	Author	Details
1.0	December 12	URS	
1.1-1.4	27/02/13	C Winch	Amendments incorporating feedback
1.5	17/06/12	C Winch	Final revisions
1.6	25/06/13	Z Musanhi & T Matiringe	Updated with PA's firms review comments
1.7	26/02/14	M White	ED1 Resubmission
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6 Document Approval

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APPENDIX A: GEOGRAPHICAL DIAGRAM

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APPENDIX B: SINGLE LINE DIAGRAM – EXISTING NETWORK

APPENDIX C: SINGLE LINE DIAGRAM EXISTING 132KV NETWORK

TA 12.WW05 Wastewater Growth

Business Case

September 2018
Version 1.0

Contents

1. Executive Summary

Name of business case	WW05 Wastewater Growth		
Context	The rate of growth has increased in AMP6 and we are forecasting over 100,000 new connections in AMP7, in line with Local Area Plans. We need to ensure we have appropriate capacity in our drainage and treatment network to support the delivery of new homes and businesses, minimising any impact on existing customers.		
Customer and stakeholder views	Customers are concerned with the level of development and the impact on infrastructure in the region. They expect us to ensure that future generations have access to the same level of wastewater and water services as we do today and are willing to invest now to provide no deterioration in services in the future.		
Our aim	Our aim is to transform the way we deliver additional capacity, working more collaboratively with developers, local authorities and the Environment Agency. We will plan more proactively, deliver quickly and efficiently, while protecting our existing customers from increased flooding and pollution risk and maintaining our treatment works compliance.		
Scope of this business case	Enhancement expenditure providing on-time investment to support growth while protecting our existing customers and the environment.		
	Enhancement	Contributions	Total
Totex (£'m)	£271.9m	£89.1m	£182.8m
Opex (£'m)	£4.5m	£0m	£4.5m
Capex (£'m)	£267.4m	£89.1m	£178.3m
Residual, post-AMP7 capex (£'m)	Growth investment will be ongoing		
20-year Whole life totex	£176.0m		
Materiality (% of the wholesale wastewater plan)	11.5% (Wastewater Network+)		
Relevant business plan table lines	WWS18: 1,25,26	N/A	N/A
Enhancement			
Need for enhancement / investment	The rate of growth has increased in AMP6 and we are forecasting over 100,000 new connections in AMP7, in line with Local Area Plans. Our plans are based on our network models, Drainage Area Plans and a robust assessment of treatment works capacity.		
Overview of AMP7 proposals	Our investment proposals contained within this investment area are summarised in the below table.		

	AMP7 Totex (£k)				
	Wastewater Network Reinforcement and Growth	Section 101A projects	Wastewater Flooding new additions	Wastewater Treatment Capacity Increase	Total
Gross Totex	127,990	4,577	11,294	128,086	271,947
Contributions	-89,093	0	0	0	-89,093
Net Totex	38,897	4,577	11,294	128,086	182,854

Why the proposals are the best programme-level option for customers	Within our two major programme areas of Wastewater Network and Wastewater Treatment growth we have considered various options. For networks, our plan is based on specific catchment solutions with a programme level efficiency applied. The programme level efficiency of £70 million is based on re-engineering our planning and delivery process to take much greater account of innovative and collaborative approaches. This efficiency is in addition to our initial cost efficiency and calibration applied to all programmes Options within the Wastewater Treatment programme are site and catchment based. The option selection process has been based on lowest whole life cost Further information can be seen in Section 5.2.
Customer and stakeholder support	Maintaining the health of our water and wastewater assets is a high priority for customers. They expect us to ensure we can deliver the same level of services in an environmentally friendly manner for future generations. Developers and Planning Authorities want us to work more collaboratively to develop shared approaches and facilitate housing and growth targets.
Need for a CAC (if relevant)	There is a Cost Adjustment Claim associated with growth. This is related to the extraordinary costs associated with provision of a new treatment works for the Whitfield development in Dover.
Extent of management control (if relevant)	Growth is largely driven by external factors, but we are adapting our processes to work more collaboratively with various stakeholders. This enables integrated forward plans to be developed, reducing risks to stakeholders and providing greater resilience in the round.
Robustness and efficiency	Our proposals are based on specific catchment needs and include significant efficiencies at scheme and at programme level.
Customer protection (if relevant)	To protect customers, our Cost Adjustment Claim for Whitfield includes an ODI to return outperformance to customers, reflecting our ongoing work to explore more innovative options and the wider risk of growth occurring more slowly than anticipated in local plans.
Affordability considerations	We have applied a further £70m efficiency to our network proposals, recognising the expected benefits from re-engineering our growth planning processes and opportunities from Sustainable Drainage 2030 approaches.
Board assurance (if relevant)	This enhancement business case has been externally reviewed by Jacobs, with no material exceptions identified.

Performance Commitments supported by this business case			
PC	How relevant is this business case?	Comment	
Growth (Cost adjustment claim)	High	This PC protects customers against delivering the solution at a lower cost than the claim value	
Surface water Management (no Properties)	High	The PC is a key measure of a mechanism we propose to use to free up capacity in our existing wastewater network to accommodate growth	
D-Mex	High	The PC will measure our successful implementation of many of our new approaches for supporting growth from a customer and stakeholder perspective	
Schemes and options			
Schemes over £20m	Options		
	Description	Cost	Selected option and rationale
Aylesford Network	Option B – catchment solution	£33.6m	Option B – Lowest whole life cost
Budds Farm Network	Option A – catchment solution	£41.6m	Option A – Lowest whole life cost
Ebbsfleet Network	Option B – catchment solution	£20.8m	Option B – Lowest whole life cost
Whitfield Combined solution	Option D – New WTW coastal discharge	£35.7m	Option D – Lowest whole life cost

2. Scope of business case

Our wholesale plan for PR19 totals £3.9b. This business case relates to £271.9m (gross) planned investment in Wastewater Growth or £182.8m including contributions from developers and other customers. How this investment relates to our wider wholesale plan is detailed within Figure 1 below.

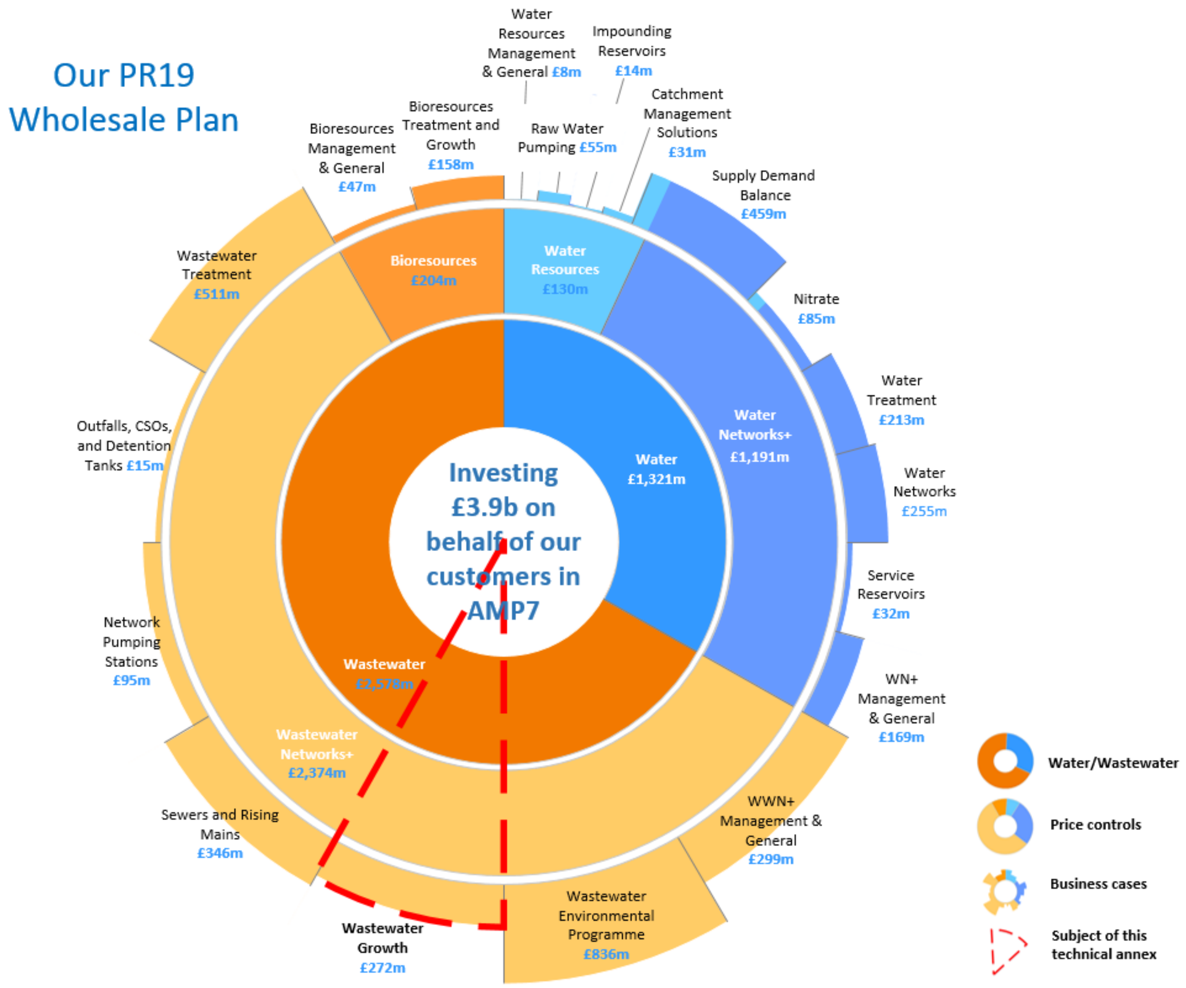

Figure 1: Southern Water PR19 Wholesale Plan

This business case focusses on the key areas of:

- Wastewater network reinforcement (sewers, rising mains, pumping stations)
- Wastewater treatment
- New sewerage and treatment via s101a
- Strategic growth for significant new towns and large-scale developments

As population grows, so does demand for our wastewater services. To ensure resilient services for our customers, protect the environment and meet demand from growth we need to secure additional capacity. Schemes are categorised as growth if the investment need is driven through an increase in population in AMP7. Sites with existing effluent compliance risks due to historic growth are excluded and are considered within the base capital maintenance case for wastewater treatment.

Failure to provide additional capacity can have adverse impacts for customers and the environment by increasing flooding and pollution with potential detriment to water quality.

We propose three growth-specific performance commitments in AMP7. The primary one relates to the new D-Mex measure, one relates to removing surface water from our sewers to create additional capacity, and the other is specific to our proposed Cost Adjustment Claim at Whitfield.

Our transformational programme **Sustainable Drainage 2030** is driving new ways of working to adopt more collaborative, environmentally sustainable approaches to address capacity limitations.

3. AMP6 Strategy

3.1. Investment Strategy

The growth rate has increased during AMP6 over AMP5. For wastewater, the rate of growth is broadly in line with our PR14 predictions.

Our investment strategy for wastewater treatment has focused on:

- Maximising existing process and Dry Weather Flow (DWF) permit headroom to accommodate growth, reducing need for growth expenditure. Action plans were created for sites with risks of exceeding their DWF permit to identify the most cost-effective solution
- Optimising the import of cess waste to make sure of existing capacity in our wider network
- Including growth investment within existing quality schemes to deliver long-term efficiencies
- Putting forward specific growth schemes where growth at a treatment works was causing a high risk of permit non-compliance

Our investment strategy for wastewater networks has focused on:

- Delivery of the majority of network growth through developer requisitions once the need is confirmed, with the use of Grampian Conditions on developments to allow time for appropriate network reinforcement
- Planned investment of £17m for a new strategic main in Chichester
- Surface water separation projects to reduce pressure on the existing network and unlock capacity for growth
- Reduction of properties at risk of internal flooding due to hydraulic overload, where the schemes are cost beneficial based on our customers' willingness to pay for improvements

Our approach has been heavily influenced by two factors, resulting in network growth investment not starting until a late stage in the planning process

- We were criticised at PR09 about our inability to attain the levels of developer contributions seen by other companies. This contributed to a greater focus on the use of developer requisitions to deliver network growth schemes
- Significant investment in new trunk sewers for Ashford in AMP4 resulted in premature expenditure when development was stopped at a late stage

Recognising a growing dissatisfaction from developers we undertook a thorough review of our approach in autumn 2017, working with developers and planning authorities to better understand their needs and concerns. We identified the following improvements required in AMP6:

- The need for a more forward-looking approach to meeting growth needs in our wastewater networks:
  - Planners and developers stressed the need for us to become more proactive in planning for growth to avoid delays to development. This includes reducing our reliance on Grampian Conditions, where developments are delayed until sewer capacity is available – a significant source of developer dissatisfaction (see T.A.4.4 Customer Engagement Deliverables for Developer and Stakeholder

feedback). Planning authorities are under increasing pressure to deliver their housing targets so are reluctant to delay construction – meaning we must be more proactive

  - The new charging mechanism, introduced in April 2018, is helping reduce barriers to investing proactively to support new developments. Firstly, the clear rules and guidance outline expectations for improved accountability, customer service and delivery timeframes. Secondly, removing the requirement for network capacity improvements to be development specific (costs now being aggregated across all connections) supports greater use of catchment management

- A comprehensive, forward-looking review of wastewater treatment growth, reducing risks to compliance and minimising operational action plans

In AMP6, responding to the challenges, commitments and pressures outlined above, we took a more medium-term strategic view of growth needs. We completed 103 Drainage Area Plans, each providing outputs to support growth and reduce flooding, with several areas brought forward for outline design, allowing for construction in AMP7. These adaptive plans and solutions ensure a risk-appropriate, resilient approach to meeting the challenges of growth, climate change and environmental protection.

Additionally, we improved the visibility and accessibility of our capacity modelling to developers. We reduced our modelled flows from new developments, due to our success in reducing per capita consumption, and reviewed modelling on factors such as urban creep to reduce the parameters used to assess capacity.

Our standards are now resulting in lower capacity improvements being required for many developments. This will reduce the costs and complexity of network reinforcement by reducing both the frequency of when additional capacity is needed, and the scale when it is.

During AMP6 we also implemented an extensive internal and external flooding mitigation strategy. This, along with our wider programme, has successfully reduced flooding frequency – we are on track to deliver our customer promise of reducing internal flooding by 25%. For further information on our flooding strategy please see TA.12.WW07 Flooding and Pollution Strategies.

In AMP6 we developed a more comprehensive understanding of capacity, headroom and bottlenecks at our Wastewater Treatment Works (WTWs). For each WTW we developed an AM410 tool, which forms part of our Asset Management Manual. The AM410 provides a comprehensive capacity assessment, enabling us to make informed judgements as to when the capacity of each process stage will be exceeded.

Combining this with greater business as usual forward planning activities allows a longer-term assessment of likely growth investment triggers. This includes DWF permit exceedances, hydraulic bottlenecks or treatment capacity limitations. It is now possible to model and predict when growth triggers will occur, enabling a more strategic, efficient approach to growth investment, including alignment with other projects and drivers.

All WTWs in the AMP7 growth plan have been assessed using the AM410s. The assessment identified where key permit conditions, hydraulic or treatment capacity is predicted to exceed beyond an acceptable level of risk during AMP7. The sites identified move into our Asset+ process for detailed assessment and engineering development. For more information TA.14.4 Bottom-Up Cost Estimation technical annex.

In addition to working to improve our internal processes, we are increasing our collaboration with developers, planning authorities and the Environment Agency. We have successfully trialled "Charettes" in two locations – Paddock Wood, Kent and Lidsey, West Sussex. Charrettes are joint workshops to review and shape our proposals for growth. By sharing our plans, we can take better account of local issues and priorities, achieving a more integrated set of proposals. Stakeholders welcomed the early engagement and the insight has allowed us to address key concerns at the earliest stages of our design and development work.

We are working with Kent County Council on innovative methods to separate surface water and highway drainage from sewers. We are also working closely with the master planning team for the Otterpool development in Kent to identify innovative, and more sustainable, approaches to manage flow from large scale developments and garden cities in advance of planning approval.

Many of these new approaches have informed of the key focus areas within **Sustainable Drainage 2030**. This will promote a completely new way of thinking and drive a new approach of how we support growth. Further details can be found in Section 5.

Table 1: AMP6 Actuals (Yr. 1&2) & Forecast (Yrs 3-5) Gross Figures (17/18 Prices) – Wastewater Growth

AMP6 Actual						
(£'k)	**2015/16**	**2016/17**	**2017/18**	**2018/19**	**2019/20**	**AMP6 Total**
TOTEX	**11,619**	**23,516**	**46,271**	**44,791**	**46,308**	**172,504**
CAPEX	**11,619**	**23,516**	**46,271**	**44,791**	**46,308**	**172,504**
101A Schemes Capex	891	3,209	5,913	2,163	4,362	16,537
Infrastructure capacity increase (infra) Capex	6,194	16,110	24,361	27,543	32,182	106,391
Internal Flooding new additions Capex	2,669	1,180	3,261	3,255	615	10,979
Infrastructure capacity increase and New treatment capacity (non-infra) Capex	1,864	3,017	12,737	11,830	9,150	38,598
OPEX	**Opex is within Sewers & Wastewater Treatment Opex**					

Expenditure to meet network growth requirements is not fully covered by external contributions, largely due to the incorporation of a degree of income-offsetting in the redefined Infrastructure Charge. This means some costs must be provided through the revenue price control. Further AMP7 reforms mean residual income offset from site-specific work will be transferred into the Infrastructure Charge. This is included within our income projections associated with network reinforcement, detailed within the App 28 Data Table.

3.2. Customer Benefits and Resilience

Investment is usually triggered by modelled impact on serviceability or resilience. Furthermore, network investment is only designed to maintain existing levels of serviceability due to the regulations on network reinforcement. Any further enhancements must be, fully or partially, funded from alternative sources. Where possible, we use existing network and WTW headroom to accommodate growth, with minimal impact on serviceability targets. We will invest to reduce risk against the following key measures:

- Not increasing the number of internal flooding incidents in customers properties due to hydraulic limitations
- Protecting the environment for our customers by not increasing the number of pollution incidents due to hydraulic limitations
- Protecting the environment for our customers by maintaining DWF Compliance at wastewater treatment works

Our strategy to optimise use of existing headroom has secured capacity for growth to date, but it means we have more limited options to defer investment in network and WTW capacity.

3.2.1 Internal Flooding due to Hydraulic Capacity

An important metric for the wastewater network regarding growth is the number of internal flooding events due to hydraulic limitations.

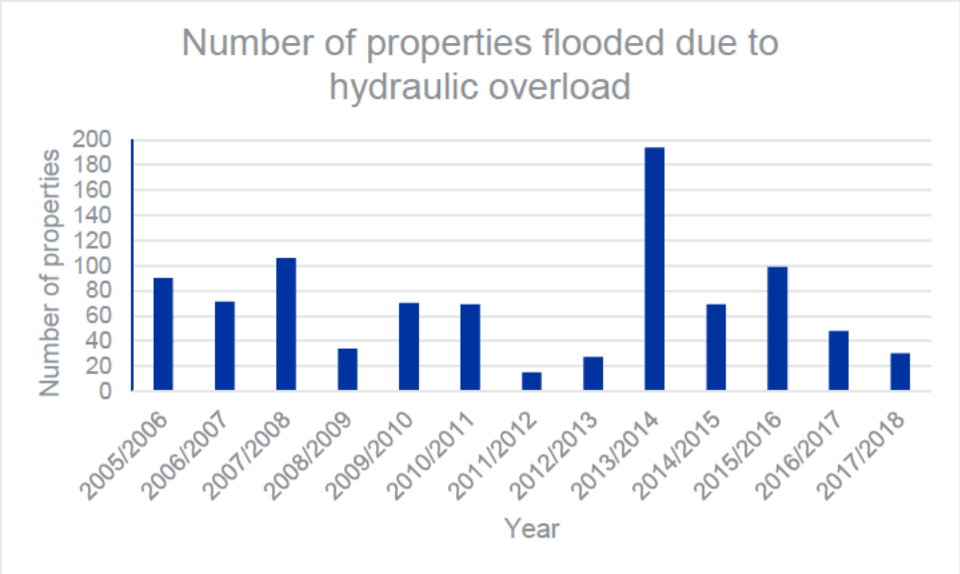

Figure 2: Number of Internal Flooding incidents due to Hydraulic Overload

Flow from new developments can contribute to increased risk of flooding by adding further volume into existing sewers.

Aside from the peaks in 2013/14 and 2015/16 performance has remained stable. The high levels of hydraulic flooding in 2013/14 and 2015/16 align to extremely wet years with high groundwater levels. As a result, our investment case TA.12.WW04 Sewers and Rising Mains includes additional expenditure to reduce infiltration.

3.2.2 Pollution due to Hydraulic Capacity

The likelihood and severity of pollution incidents may increase due to additional foul and surface water entering our network or increased groundwater infiltration due to an enlarged sewerage network.

The number of pollution incidents has reduced since AMP5 as shown below in Figure 3.

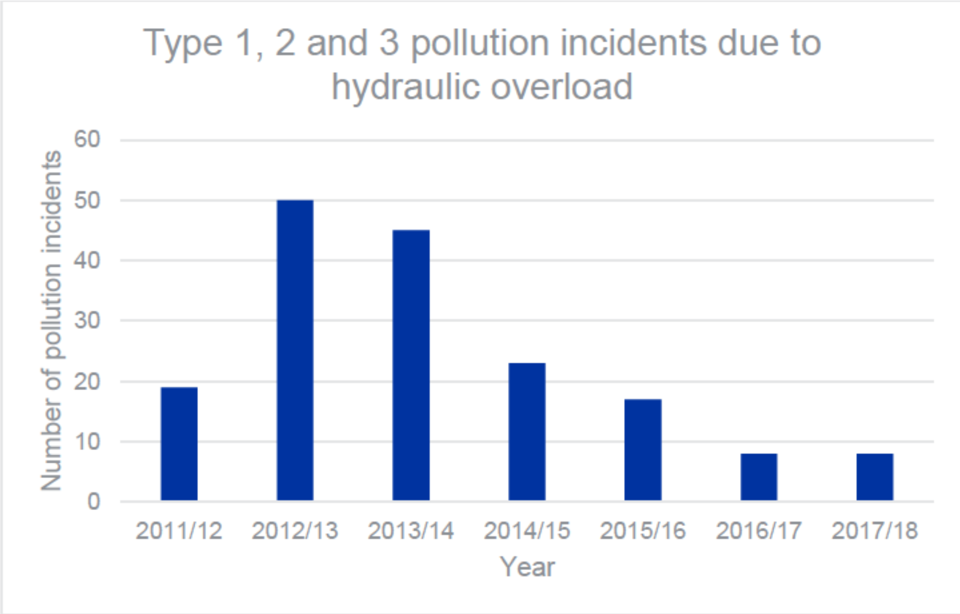

Figure 3: Number of Pollution Incidents due to Hydraulic Overload

Avoiding increased risk of spills due to reduced capacity is a key element of our growth expenditure. Common techniques for increasing capacity include upsizing sewers, pumping stations and rising mains and transferring wastewater flows to other wastewater treatment works or points within the same catchment with spare capacity.

3.2.3 DWF Compliance

Wastewater treatment works have a limit on the dry weather flow for the influent sewage received. Increased flow due to growth and increased trade discharge can lead to more frequent operation of overflows therefore increasing the potential for an adverse impact on the water environment.

The performance of wastewater treatment works with regards to growth is indicated below in Figure 4 through the number of sites that are exceeding dry weather flow consents.

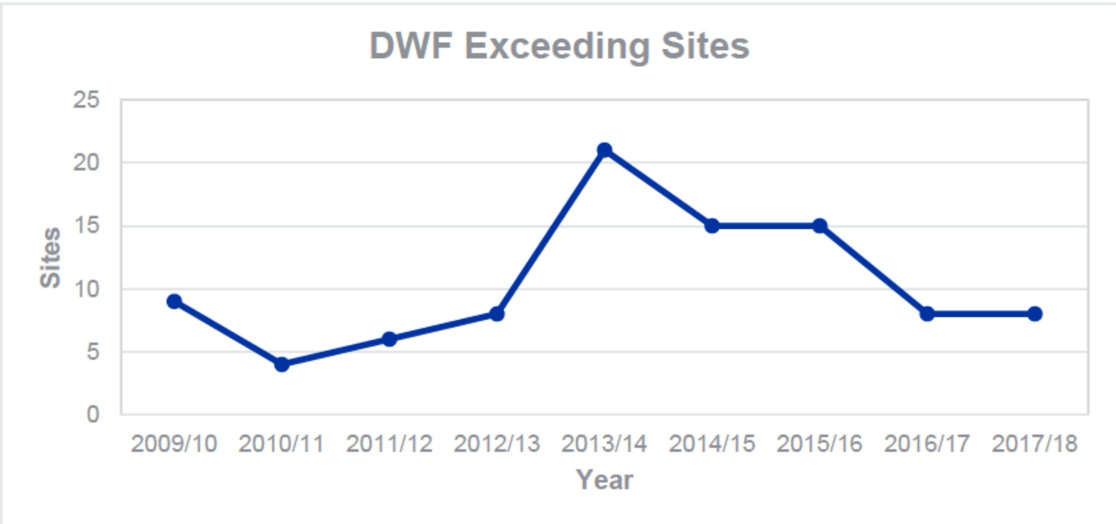

Figure 4: Number of wastewater treatment sites exceeding DWF consents

Figure 4 indicates a slight rise in dry weather flow exceedances over this period, resulting in a number of proposed capital maintenance schemes within the TA.12.WW01 Wastewater Treatment business case.

Compliance is usually maintained by providing additional capacity as required or developing storage tanks and balancing tanks to reduce high flows. If cost effective, growth can also be managed by transferring wastewater to other treatment works with spare capacity.

We intend to upgrade a number of sites with current descriptive consents to comply with future numeric permits. This is due to the size of the population served by the sites increasing above the 250 population equivalent threshold.

3.2.4 Developer Services Customers

Customers of our Developer Services have specific demands and expectations of what they should receive. We have often not met developers' needs and expectations and, as a result, feedback has been negative.

To better understand the frustrations of developers, NAVs and Self Lay Practitioners (SLPs) we held a workshop in October 2017 with representatives from developers and the planning community. From this, we developed a number of plans to significantly improve four key areas identified as priorities:

- Greater forward planning
- Clear and consistent charges
- Transparency, communication and accountability
- Fast and efficient delivery

We are working to improve our capabilities in the above areas and have a much deeper understanding of the challenges AMP7 holds. A wider, organisational transformation and improvement plan has been initiated to build an aligned organisation with well-defined and developed capabilities.

As a direct result of feedback from key stakeholders about confused accountabilities and difficulties securing information, we are implementing a new account management approach.

The largest 30 developers now have dedicated Account Managers, along with specific leads for the NAV, SLP and planning communities. This will deliver stronger customer support, improved customer outcomes and a platform for improved engagement and collaborative approaches into AMP7.

The introduction of D-Mex, and associated financial penalties and rewards, will continue to incentivise and drive improvements.

4. Drivers for change

Levels of growth increased between AMP5 and AMP6 and we forecast that these will continue to accelerate into AMP7. Housebuilding is subject to national levels of scrutiny and policy and in 2017 the government released its white paper 'Fixing our Broken Housing Market'[1]. The primary goal is accelerating rates of housebuilding, particularly in areas where demand is currently outstripping supply.

This is particularly relevant within the South East region. Many local authorities are responding with updated plans that include for large scale development that, while securing the opportunity for desirable levels of housebuilding, provide a major demand on our capacity and infrastructure.

4.1 Customer and stakeholder views

As outlined in **Chapter 4 – Customer & Stakeholder Engagement**, we used insight from our extensive programme of customer & stakeholder engagement to develop a deep understanding of their views and priorities. From an environmental perspective, we have also drawn on the views of a diverse range of non bill-paying customers who utilise water across our region through stakeholder panels, workshops and audits, including the Environment Agency, Natural England and local authorities. All insight gathered from our customer and stakeholder engagement programme can be found in **Chapter 4 – Customer and Stakeholder Engagement** and its technical annexes.

Our customers believe we have a duty to protect and enhance the environment. 'Doing no harm to the environment' has been outlined as a minimum requirement for customers, whilst protecting and enhancing the natural environment is the level of service that customers expect. Customers want water and wastewater services to be delivered in an environmentally friendly way now and in the future.

Maintaining the health of our water and wastewater assets is a high priority for customers. They expect us to ensure we can deliver the same level of services in an environmentally friendly manner for future generations. The focus of our customers of the future is on protecting and enhancing the environment in the short and long term. They relate treatment works compliance to protecting the environment, and as such, generally rank this measure higher other customer groups.

Customers generally put more priority on current issues that have a direct impact on their daily lives. However, customers are concerned that in the future an increase in rainfall, due to climate change, and an increasing population / number of homes will mean the current sewer network will not be able to cope. Furthermore, they recognise that the sewer system is old and requires investment to avoid pollution and flooding.

Customers expect us to ensure that future generations have access to the same level of wastewater and water services as we do today, and are, themselves, willing to invest now to ensure that there is no deterioration in services in the future.

Moreover, developers have outlined that they want us to work more closely with them and the planning authorities to better predict the impact of future growth on the network. They believe this will help to ensure the necessary infrastructure is in place ahead of time and will

[1] Department for communities and Local Government – Fixing our Broken Housing Market, 2017. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/590464/Fixing_our_broken_housing_market_-_print_ready_version.pdf

allow them to provide the public with confidence that development will not cause issues such as flooding.

Government expects utility companies to play their part in supporting economic growth by "ensuring timely connections of new developments[2]" and want to see strategic plans for wastewater which deliver long-term resilience. The House Builders Federation has criticised the support we provide their members in meeting government housing targets. Many stakeholders, particularly local authorities, feel we should be more proactive and visible in the planning process.

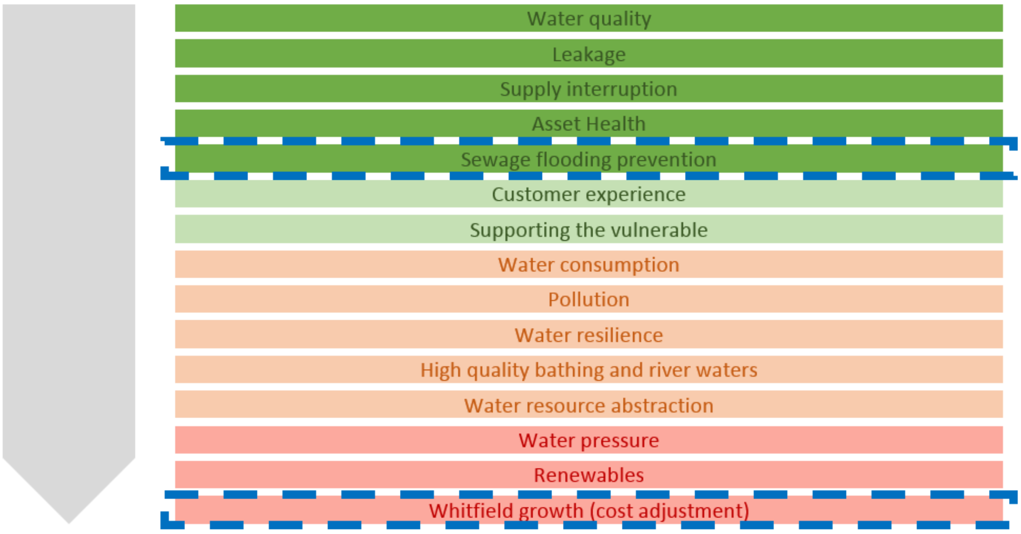

Figure 5: Relative priority of services according to our customers

We have used this understanding of our customers' priorities to define a set of performance commitments and investment proposals, validated then refined these over the course of our programme of customer engagement. Our success at delivering on these priorities for our customers will be measured by the performance commitments outlined in this business case.

When tested across our wider customer base, the Whitfield growth Cost Adjustment Claim Performance Commitment scored as a relatively low priority, primarily due to the highly localised nature of the investment requirement. Feedback from customers within the Dover area who understood the nature of the development was more supportive.

4.2 Future trends & pressures

Growth in the South East region is predicted to be higher than the UK average. In addition to the increase in population, climate change is expected to magnify peak flows.

In order to forecast growth in population and properties, we engaged an external consultant (Experian Ltd) as part of a group project with other water companies in the South East. The other companies in the group were Affinity Water, Portsmouth Water, South East Water and Sutton & East Surrey Water (now SES Water). The benefit of this project is to have an aligned view of growth in the South East. These forecasts were produced in line with the recommended UKWIR methodology[3] and Environment Agency guidelines[4]. The

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[2] Department for communities and Local Government – Fixing our Broken Housing Market, 2017. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/590464/Fixing_our_broken_housing_market_-_print_ready_version.pdf

[3] UKWIR, 2016. Population, household property and occupancy forecasting. Report no. 15/WR/02/8.

[4] Environment Agency and Natural Resources Wales, 2016. Final Water Resources Planning Guideline, Bristol.

Environment Agency's guidelines state that water companies should base their forecasts on Local Authority local plans.

Figures 6 and 7 show the historic growth of the Southern Water region as well as our forecast projection of growth.

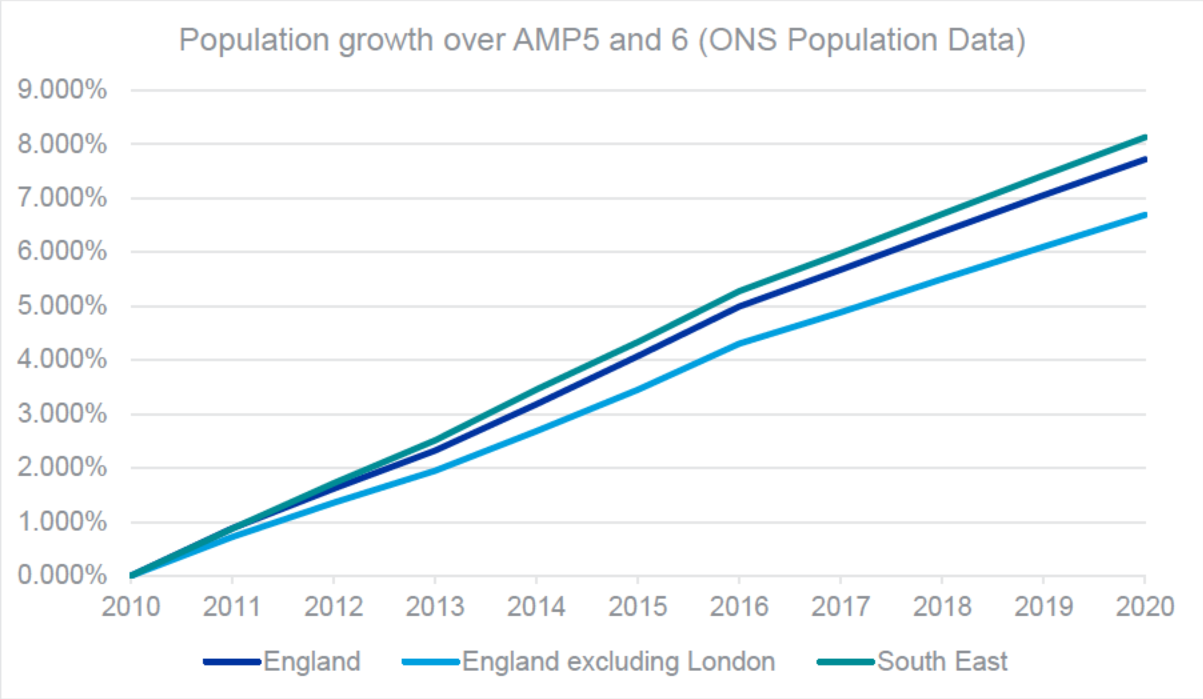


Figure 6: Population growth over AMP5 and 6[5]

[5] ONS Analysis of Population Estimates tool. https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/datasets/analysisofpopulationestimatestool

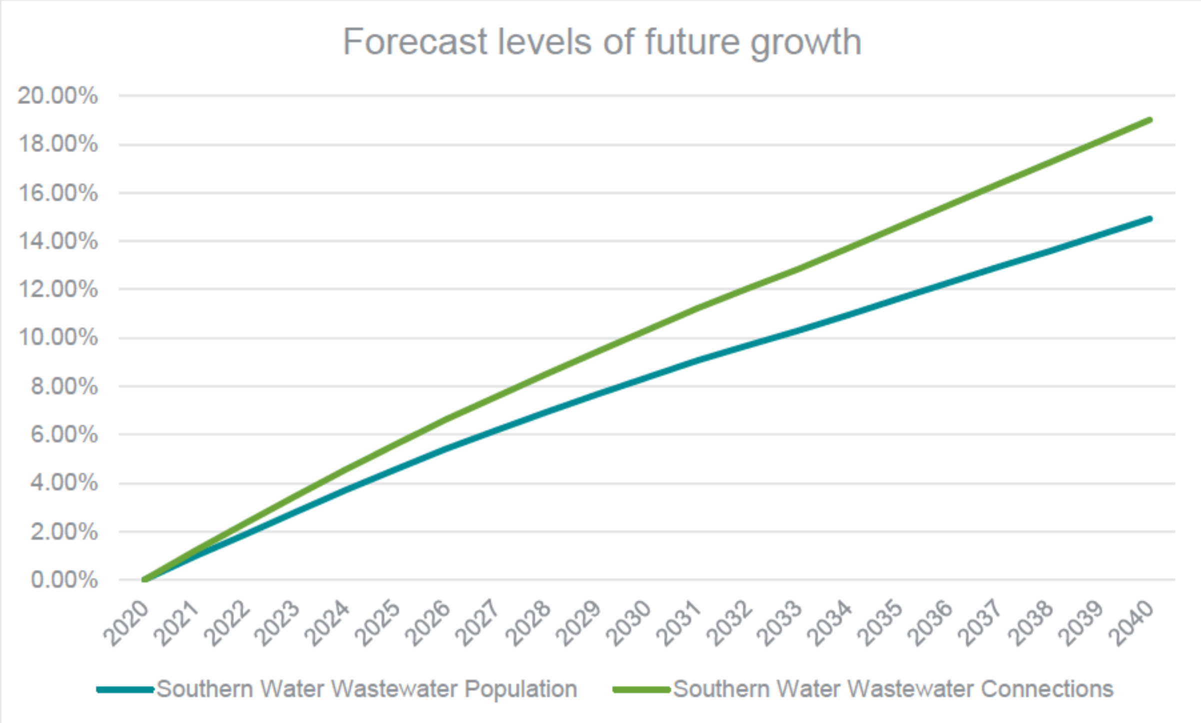


Figure 7: Future forecast population and connections growth[6]

Providing additional capacity in our region is often costly due to the constrained nature of the urban areas. Most of the population live on the South Coast, situated between the sea and the South Downs National Park, leading to congested, densely populated urban areas, often necessitating more expensive solutions with a smaller footprint, covered or underground treatment works and expensive pipeline routes.

Due to historic levels of growth, development within the South East is increasingly on large scale Greenfield sites on the outskirts of existing towns and catchments. Serving these developments is particularly difficult as local infrastructure is usually small with low available capacity and not suited to receiving additional flow from large developments.

In addition to the pressures discussed above, customers, stakeholders and regulators expect improved operational and customer service performance. Government has ambitious targets of building an annual average of 300,000 new homes by the mid-2020s and has specific expectations of utility providers[7]. We fully support government's ambitions and will ensure we become more proactive and forward-looking to plan and deliver additional capacity for growth.

Our **Sustainable Drainage 2030** transformation programme combines collaboration, new technology and sustainable practices to optimise the capacity of our existing infrastructure. Growth considerations inform the cross-cutting themes of compliance and resilience ensuring we at least maintain performance. Details of **Sustainable Drainage 2030** are below and in **Chapter 3 – Our Ambition**.

[6] ONS Population Projections for Regions.
https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationprojections/datasets/regionsinenglandtable1

[7] Department for communities and Local Government – Fixing our Broken Housing Market, 2017.
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/590464/Fixing_our_broken_housing_market_-_print_ready_version.pdf

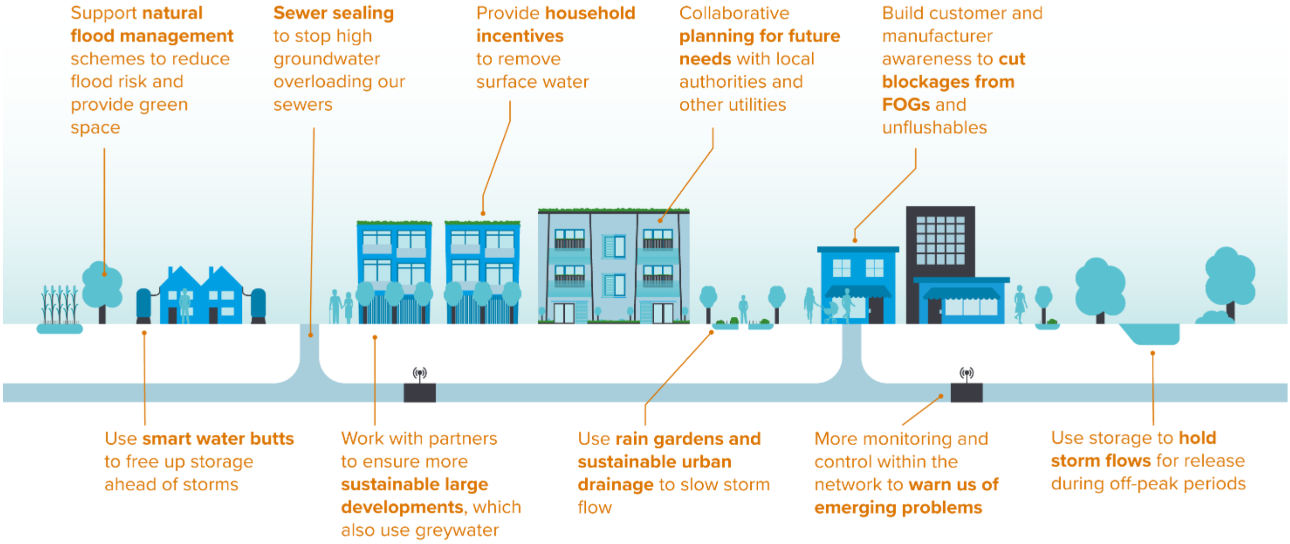


Figure 8: Sustainable Drainage 2030

Sustainable Drainage 2030

Creating capacity across the sewer network by implementing surface water solutions, building smart networks and increasing customer awareness.

We are trialling some of the approaches within Sustainable Drainage 2030, including a pilot of Smart Water Butts in Lewes, East Sussex. The Smart Water Butts effectively disconnect the properties roof surface water drainage from the sewer network and drain them into water butts. The butts automatically maintain capacity for storm events by trickle releasing water during ‘off peak periods’ (for example dry nights) if full or near capacity. This could have a significant effect by unlocking capacity for growth previously used by surface water run-off.

We are developing partnership approaches with various stakeholders to remove excess surface water from the sewer system. In Folkestone, we are working with Kent County Council to remove highway drainage from the sewer network by building rain gardens which allow surface water to discharge to ground naturally. These approaches could be used to both reduce flooding and increase capacity for growth, dependent upon catchment need.

We are also collaborating closely with the master planning team for The Otterpool Garden City in Kent, one of the largest developments expected in to start in AMP7, continuing over multiple AMPs. It is in the early stages of development and we are exploring various approaches to minimise water consumption, such as recycling of grey water. Innovative approaches at the development level must be designed in as early as possible, and our close relationships are allowing a multi-organisational approach to delivering the best possible outcomes for customers and the environment.

We will assess the cost and benefits of these projects and learn from our successes and challenges to continually develop our strategy and embed it into business as usual ways of working. In addition to financial measures, we will review customer and environmental outcomes to ensure we take a balanced approach.

To meet stakeholders', customers' and regulators' expectations about how we support growth we are developing further innovative approaches, detailed in Section 5.

5. AMP7 Strategy

5.1 Investment Strategy

Our AMP7 strategy is to become more proactive in addressing growth requirements for both our networks and WTWs to ensure timely provision of services – meeting both our statutory duties and developers' expectations.

It is vital we provide the best value solutions for customers, both direct bill payers and developers, maintain services which are fit for the future and ensure new developments do not have any negative impact on existing customers or the environment. Investment is required to ensure we strike this balance.

Opportunities to use existing headroom are limited, and we are increasingly exposed to the full cost of delivering infrastructure for new growth. This pressure is greater than for many other companies as the population of our region is predicted to grow faster than the England and Wales average[8], as it has over the past 2 AMP periods[9]. The ONS forecasts national average population growth at below 3%[10], however our population forecasts incorporating local developer projections suggest the Southern Water region will experience average growth above 4% – a significant differential compared to the rest of the country.

There are several strategic developments creating growth hotspots and representing significant planning, resourcing, engineering and environmental challenges that need to be addressed in AMP7. Two garden cities, Ebbsfleet and Otterpool, and strategic developments such as Whitfield, Kent and Welbourne, Hampshire, will significantly increase the population we serve and require the construction of end-to-end wastewater infrastructure. There are little synergies available with existing networks or treatment capacity to cater for these new large-scale developments therefore, due to dense high levels of population growth, the above requirements are not well represented by historic Ofwat revenue models.

In AMP6 we focussed on operational and incident management strategies, successfully outperforming industry averages for internal flooding and pollution incidents – and heading towards upper quartile performance. We will continue building on this performance in AMP7, further details are in the TA.12.WW07 Flooding and Pollution Strategies technical annex.

Key elements of our AMP7 strategy include:

- Increased use of catchment approaches to secure capacity and deliver social and natural capital benefits
- Maximising synergies with other future investment drivers to deliver outcomes as cost-effectively as possible
- Phasing and planning of engineering and construction works over multiple AMPs to reduce overall costs
- Using temporary or operational approaches to defer capital works to align with our wider strategies

[8] ONS Population Projections for Regions. https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationprojections/datasets/regionsinenglandtable1
[9] ONS Analysis of Population Estimates tool. https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/datasets/analysisofpopulationestimatestool
[10] ONS Population Projections for Regions. https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationprojections/datasets/regionsinenglandtable1

- Identifying innovative approaches to unlocking capacity, based around the principles for:
  - Sustainable Drainage 2030
  - Target 100
  - Collaborative planning with local authorities, developers and the EA

We will transform our approach to growth, particularly relating to customer services and make the most of the opportunities from the new connection charging mechanism. This reform is a crucial enabler for the key pillars of our strategy, along with our customer service and performance improvement activities detailed within the following section. A more detailed breakdown of how we intend to deliver this transformation is detailed in Section 5.2 below.

Our AMP7 performance commitments for growth are detailed below:

Table 2: Performance commitments directly associated with growth

PC	Definition	Outcome
Developer services measure of experience (D-Mex)	The developer services measure of experience (D-Mex) is a mechanism to incentivise water companies to provide an excellent customer experience for developer services (new connections) customers. These customers include small and large property developers, self-lay providers (SLPs), and new appointments and variations (NAVs).	By working together, we can secure a resilient economy for the south east.
Growth (Cost Adjustment Claim)	This measure is designed to monitor and assure the delivery of one enhancement scheme related to population growth in Whitfield. The measure ensures that customers are protected in the event that the scheme is delivered at a lower cost or if the scheme is not delivered in AMP7.	The services we provide are effective and fit for the future
Surface water management	This is a co-delivery measure with our customers to reduce the amount of surface water entering our combined or surface water sewerage network including through the use of SuDS, soakaways and other innovative methods. Removing surface water from the sewer network can help alleviate flooding and pollution.	We innovate to create sustainable communities

Southern Water

Table 3: Performance commitments that can be impacted by growth

PC	Definition	Outcome
Internal sewer flooding	The performance commitment is Internal Flooding Including Severe Weather.	The services we provide are effective and fit for the future
Pollution incidents (categories 1, 2 and 3)	The total number of pollution incidents (categories 1 to 3) in a calendar year emanating from a discharge or escape of a contaminant from a company sewerage asset affecting the water environment. Incidents affecting amenity of the water environment, e.g. Bathing Waters, are included.	The services we provide are effective and fit for the future
Risk of sewer flooding in a storm	Risk of sewer flooding in a storm is a new risk-based resilience metric for wastewater. It is measured by the percentage of population at risk of sewer flooding in a 1 in 50-year storm.	The services we provide are effective and fit for the future
External Sewer Flooding	The number of external flooding incidents. External sewer flooding is defined as per Ofwat's guidance.	The services we provide are effective and fit for the future
Asset Health: Treatment works compliance	Measured using the Environment Agency Environmental Performance Assessment (EPA) methodology.	The services we provide are effective and fit for the future

The summary of our AMP7 expenditure is detailed in the following table.

Table 4: AMP7 Forecast Post-Efficiency Figures (17/18 Prices) – Wastewater Growth

	AMP7					
	Price Control	QBEG	Ofwat Table	AMP7 Total	Contributions	AMP7 Net
TOTEX				**271.947**	**-89.093**	**182.854**
CAPEX				**267.458**	**-89.093**	**178.365**
101A Schemes	Wastewater networks +	Growth	WWS2 1	4.577	0	4.577
Infrastructure Capacity increase and networks	Wastewater networks +	Growth	WWS2 25	127,950	-89.093	38,857
New treatment capacity (non-infra)	Wastewater networks +	Growth	WWS2 26	123.637	0	123.637
Internal Flooding new additions	Wastewater networks +	Growth	WWS2 30	11.294	0	11.294

OPEX				**4.489**	**0**	**4.489**
Infrastructure capacity increase	Wastewater networks +	Growth	WWS2 72	0.040	0	0.040
New treatment capacity (non-infra)	Wastewater networks +	Growth	WWS2 73	0.164	0	0.164
AMP6 Enhancement Opex Adjustment	Wastewater networks +	Growth		4.285	0	4.285

5.2 Plan Options

Our plan options are based upon base solutions derived from our engineering development work. This section discusses options at programme level for network growth and at project level for treatment growth. This is due to network projects being far greater in number, generally of a lower value and more difficult to forecast as they are highly dependent on development specific demands that arise within the AMP. The projects are largely required to support localised development and are less predictable and foreseeable than treatment growth needs.

5.2.1 Programme Options - Wastewater Network Growth

Option 1 – Base plan including challenged scope on named catchments Chickenhall, Peel Common and Aylesford.

Detailed reviews and enhanced modelling work were undertaken on these catchments to test how far we could push efficiency through more innovative solutions, using the principles from **Sustainable Drainage 2030**, localised storage and updated modelling criteria. Significant savings of 30% were generated utilising this updated approach (see table below).

Table 5: Savings from the scope challenge in 3 target catchments (pre-efficiency values)

	Pre-challenge capex value (£k)	Post challenge capex value (£k)	Saving
Peel Common	7,622	2,827	63%
Chickenhall	23,285	12,390	47%
Aylesford	44,124	37,444	15%
Total	**75,031**	**52,661**	**30%**

This exercise resulted in a saving of approximately **£22m**. These values are incorporated into the base plan as the projects have been through the Asset+2 governance process. This option is lowest risk in terms of delivery, however it is the costliest.

Option 2 – Extrapolation of Option 1

Taking the results from Option 1 above and extrapolating across the remaining programme of strategic projects. This resulted in a potential additional savings of **£32m**.

This option is slightly higher risk than Option 1, however we are confident that the opportunity for savings is achievable. This would represent a higher efficiency saving (manifested in lower customer charges) at a lower level of risk. This is preferable to Option 1.

Option 3 – Transformational change of how growth is managed

This option involves a complete overhaul of our AMP7 approach to delivering growth solutions as detailed in Section 5.3. Although many areas of the transformation plan are focused on service improvement, financial savings can be predicted in several areas. The full details of the benefits will need to be developed as part of the programme definition phase although an early assessment is summarised in the following table.

Table 6: Projected financial savings as a result of the implementation of the transformation programme

Efficiency	Notes and assumptions	Gross Value
Extrapolated efficiencies	As option 2	£32m
Site specific sewers	Allowance for elements of the strategic catchments to allow for site-specific sewers (funded separately and differently from AMP7)[11]	£8m
Commercial properties	Development of a new approach to align more closely with billing and metering data on actual water usage, reducing predicted flow rates and anticipated scope	£4m
Updated modelling standards	Changes to modelling standards will reduce modelled flow rates for developments and reduce storage scope (only relates to element of costs that are based on AMP6 extrapolation – not bottom up estimates)	£7m
Supply chain	Improvements to the supply chain for delivering WW network activities (only relates to element of costs that are based on AMP6 extrapolation – not bottom up estimates)	£4m
Forward planning	Improved forward planning optimising AMP7 investment timing based on more comprehensive risk and resilience understanding (predominantly profiling into AMP8)	£15m
Total		**£70m**

This option is higher risk than both Option 1 and Option 2 as it is a fundamentally different approach for delivering growth investment. We believe the above activities have clear financial savings and the likelihood of delivering the savings is acceptable – therefore, the higher risk is also acceptable.

This option has significant savings over both Option 1 and Option 2, and results in a slight price increase in the infrastructure charge between our current charge and the forecast AMP7 charge (on a like for like calculation basis). We believe our customers and stakeholders will find this acceptable, especially as our water charge is likely to reduce significantly (see App 28 – Infrastructure Charge Income).

[11] New connections charges rules from April 2020. Ofwat, 2017. https://www.ofwat.gov.uk/wp-content/uploads/2017/11/New-connections-charges-rules-from-April-2020-–-England-Decision-Document.pdf

Option Selection

Our option selection matrix is detailed below.

Table 7: Option selection matrix for network growth

Option No.	Description	AMP7 Totex (£m)	Full Whole Life Cost (20 years) (£m)	Willingness to pay support	Ofwat Priority	Other regulator priority	Customer priority	Business strategic alignment	Is this option recommended?
1	Updated base plan including results from Chicken Hall, Peel Common and Aylesford detailed reviews	**£183**	£65	🔴	🔴	🟡	🔴	🟡	**No** – this plan is least risky however does not allow for recent solution and standard developments, transformation activities or future supply chain additions
2	Extrapolating the above results across the remaining programme of strategic catchments	**£151**	£51	🟡	🟡	🟡	🟡	🟡	**No** – this plan includes for the extrapolation of modelled solution savings but does not include the benefit from the transformation activities, standards improvements or supply chain additions
3	As option 2 but also including forecasted benefits from improved forward planning, updated model standards and supply chain improvements	**£113**	£35	🟢	🟢	🟡	🟢	🟢	**Yes** – this option increases the level of risk but within an acceptable tolerance. This keeps charges at a similar level to today and incorporates key transformational activities that will be delivered ahead of AMP7

As well as being the lowest cost option, Option 3 is most likely to meet the requirements of key stakeholders. The proposal has financial benefits, both in the value of income offset implied within the overall programme, and the costs to developers and other customers associated with the Infrastructure Charge. These costs are summarised in the following table.

Table 8: Income and infrastructure charges for the programme options

Option	AMP7 Capex	Income from customers*	Residual income offset*	Redefined Infrastructure Charge*
WNR1	£183m	£95m	£88m	£835
WNR2	£151m	£83m	£68m	£736
WNR3	£113m	£70m	£43m	£619

* Including the accommodation of the residual AMP6 income offset from requisitions

Option 3 has therefore been selected as our preferred option.

5.2.2 Scheme options - Wastewater Treatment Growth

Within the overall treatment programme, we have developed options at an individual project basis. The options for the process only solutions are summarised in the below table. The totex values for WLC comparisons are the pre-efficiency, project estimates.

Table 9: Wastewater treatment project level options*

Scheme	Description	Totex (£k)	WLC (£k) 20 yr. NP	Preferred	Reason
Park Rd Hancross WTW	Option 1	2,042	1,865	Y	WLC
Sandown WTW	Option 1	3,317	3,259	Y	WLC
Sittingbourne WTW	Option 1	23,583	21,117		WLC
	Option 2	23,233	20,340	Y	WLC
Bishops Waltham WTW	Option 1	3,121	3,750	Y	WLC
Faversham WTW	Option 1	11,453	11,019	Y	WLC
	Option 2	10,151	11,231		
Hurst Green WTW	Option 1	4,138	3,589	Y	WLC
Goddards Green WTW	Option 1	22,069	21,515	Y	WLC
Forest Green WTW	Option 1	2,025	2,047	Y	WLC
Stonegate WTW	Option 1	3,615	3,351		
	Option 2	3,603	3,393		
	Option 3	2,475	2,009	Y	WLC
Warninglid	Option 1	3,502	3,162	Y	WLC
Westwell WTW	Option 1	5,046	3,702		
	Option 2	3,213	2,202	Y	WLC
	Option 3	3,868	3,398		
	Option 4	3,207	2,564		
Gravesend WTW	Option 1	34,900	30,052		
	Option 2	20,165	18,373	Y	WLC
Northfleet WTW	Option 1	11,019	10,590	Y	WLC
Ford WTW	Option 1	19,394	15,515	Y	WLC
Otterpool WTW	Option 1	19,983	19,516		
	Option 2	13,194	11,174	Y	WLC
	Option 3	24,426	23,250		
Peel Common WTW	Option 1	18,955	19,356	Y	WLC
Lenham WTW	Option 1	10,104	9,571	Y	WLC

* These option totex values are pre-efficiency, pre-overhead, pre-synergy values as this is the basis that the option selection is made. Efficiency, QBEG, Q synergy and overhead values are only applied to the selected projects within the plan

The preferred option for Whitfield is based on the 20-year Whole Life Cost assessment for the combined network and process solution, as this is an integrated solution. Given the exceptional costs and circumstances surrounding this scheme, this has been developed into a Cost Adjustment Claim. The Whole Life Cost assessment is detailed below. This is explained in more detail within the technical annex TA.14.3 CAC03 Growth - Whitfield. The below option costs are detailed as post-efficiency, post QBEG allocation, post overhead to align with the content of the Cost Adjustment Claim.

Table 10: Whitfield combined solution options

Scheme	Description	Totex (£k)	WLC (£k) 20 yr. NP	Preferred	Reason
Whitfield Growth	Option 1	39,743	29,863		
Whitfield Growth	Option 2	48,102	39,844		
Whitfield Growth	Option 2a	46,211	36,588		
Whitfield Growth	Option 3	34,122	28,681		
Whitfield Growth	Option 4	35,713	29,385	Y	Viable and WLC
Whitfield Growth	Option 5	35,959	30,229		

We have carried this programme level option into the business plan and Cost Adjustment Claim.

5.2.3 Other Programme Investment

We have estimated costs of £4.6m for Section 101A schemes in AMP7. These schemes are related to a potential 3 sites where we believe that we may have AMP7 obligations. These sites are not currently confirmed therefore our estimate is based upon historic spend data.

We are forecasting £14.9m of investment in Wastewater Requisitions. This is based on our historic assessment of the proportion of requisitions that we delivered in AMP6 that were considered 'Site-Specific' under the new definitions within the New Connection Charging rules[12].

We are forecasting £11.3m of investment to protect customers from flooding associated with new growth. Although our larger developments and larger catchments will have detailed modelling work undertaken, smaller developments and catchments often don't due to the inefficiencies in modelling all developments. There is therefore an increased risk to customers in areas where smaller developments can have a cumulative impact. This estimate is to manage heightened customer risk from flooding and resolve as and when this becomes apparent. These costs are based on our AMP6 levels of activity but include our AMP7 efficiency targets.

5.2.4 General Optioneering

Many of the sites and catchments we have selected have been through a rigorous optioneering and challenge process to drive innovation and efficiency.

A significant number of the initial solutions we developed were high cost / low risk approaches to delivering the outcomes required. We challenged these solutions through our Asset+ process to explore innovative approaches and ultimately lower costs. These alternative solutions often increased some form of risk, however for each site our Asset+ process allowed for an objective level of risk to be agreed. For both Wastewater Treatment and Network projects we identified and secured considerable savings at multiple sites.

We have undertaken several challenge and review sessions focused on the growth portfolio, designed to place targeted efforts on key catchments, sites or asset types to drive efficiencies. These sessions have generally been successful and allowed greater confidence in the extrapolated efficiencies.

[12] Charging rules for new connections. Ofwat, 2016. https://www.ofwat.gov.uk/wp-content/uploads/2016/12/Charging-rules-for-new-connections-%E2%80%93-decision-document.pdf

5.3 Innovation

Given the high level of growth predicted for the South East, we face significant challenges to providing the capacity required for development whilst maintaining, and improving, current levels of service, compliance and performance. Innovative ways of working and technology are critical to meeting demand whilst keeping bills affordable.

5.3.1 Growth Transformation Plan

Our plan to transform how we support growth is centred on key capabilities which we will develop to ensure our approach becomes more forward-looking, collaborative and integrated. Our initial thinking, detailed below, will be complemented with external support to build a holistic strategy which meets the needs of future growth investment.

We are working with a business change specialist to fully review our end to end organisational approach to supporting growth, and the below areas will be key pillars and considerations when building our long-term model. Our recent work with customers and stakeholders highlights several areas requiring, and a clear mandate for, substantial change.

5.3.1.1 Treating customers as customers

Feedback from developers, NAVs and SLPs is that they do not feel treated as customers (see T.A .4.4 Customer Engagement) despite the fact they often fund large elements of work or have significant engagement with us. A perceived lack of accountability, disjointed service provision, poor quality information and lack of ability to work within development schedules are all issues they have raised.

We propose moving from a transactional approach focussed on discrete services to focussing on the whole customer journey, including investigating building an integrated service for all developer customers' requirements. New connection charging creates an opportunity for development-specific estimating and planning to be implemented, creating integrated, specific proposals and options for customers.

By creating Account Managers, we have started to address this. However, we need to ensure they have access to technical support to provide customers with the quality and speed of service they expect. All members of our team must be able to deliver high quality customer service, in line with the aspirations of our transformational programme and wider customer engagement strategy.

We will work collaboratively with customers and stakeholders to build a stronger understanding of the development and growth picture. We will develop shared plans and strategies to ensure our delivery proposals align more closely with development schedules, promoting growth and reducing delays and disruption.

5.3.1.2 Creating a transparent, performance driven culture

Stakeholders highlighted the need to improve accountability, timeliness and certainty of costs for growth schemes. While the new charging rules will address many issues around certainty, some of our charges (particularly wastewater) are amongst the highest in the industry whereas others (water) are relatively low.

While we have improved performance against the Water UK performance measures[13], developers have made it clear this is not always indicative of their experience. Currently, there are no reference time targets to deliver network reinforcement projects, resulting in a lack of certainty. A consistent, clear and open set of performance metrics will be designed to increase certainty, drive delivery of solutions in line with customers' expectations and reduce costs, at an acceptable level of risk, in the long term.

[13] Water UK Developer Services Level of Service Report. https://developerservices.water.org.uk/latest-reports

5.3.1.3 Stronger upfront planning capability; aligned with Local Area Plans and development schedules

Developers and local authorities have commented our planning is often reactive and utilises tactics which, from their perspective, slow development, with Grampian Conditions[14] being one of their biggest frustrations. We have committed to significantly reduce our use of Grampian Conditions.

We propose to align our planning approach with Local Authority Local Area Plans. This provides a longer-term planning horizon, moving our approach away from localised, development specific solutions to catchment-based approaches.

To become more effective at forward planning, we propose consolidating our various planning functions into an integrated team, responsible for planning related outputs across the organisation. This will include conceptual design of growth schemes, sponsoring work through delivery, responses to local authorities' plans and investigating catchment schemes that deliver multiple benefits to multiple sites.

We will collaborate with a range of stakeholders to co-create plans that meet the needs of all involved. These include local planning authorities, developers, suppliers and other water companies.

5.3.1.4 Adoption of more creative, innovative, risk-appropriate solutions

Much of the network growth construction activities are relatively traditional. When developing solutions, we will undertake a series of best practice reference approaches. For larger, catchment-based solutions these will include considering surface water removal, infiltration reduction, smart water butts, smart pumping stations and both online and offline localised storage.

These are key to **Sustainable Drainage 2030** and will be embedded in our business as usual approaches. Our surface water removal performance commitment will be aligned and targeted with growth management.

For smaller more localised developments, simpler, more straightforward solutions will be adopted, eliminating disproportionate effort on detailed modelling and solution development. We anticipate significant cost and time savings can be secured using alternative approaches that are embedded as industry best practice.

We have identified peak flows reaching wastewater treatment works can largely be diluted through groundwater infiltration. Network infiltration reduction options have been assessed along with alternative approaches at WTWs. The use of simpler, cost-effective side stream processes can be better suited to these dilute flows rather than a traditional approach of upsizing treatment processes – allowing for savings and maintaining high final effluent compliance.

5.3.1.5. Development of an aligned supply chain, incentivised and rewarded to deliver excellent customer outcomes

The AMP7 delivery model is currently under review and it is likely there will be opportunities for performance improvements within this area. Early proposals for our AMP7 model include procuring aligned delivery partners that specialise in network construction. Performance standards, timeframes for delivery and integrated working will be established as part of implementation. Effective incentive mechanisms, designed to align with our overall growth strategy, will be developed. These will include measures to promote strong customer

[14] 'Grampian Conditions' are planning conditions that are placed on developments to request progress does not begin until the supporting infrastructure is constructed

outcomes, such as timely delivery and strong customer services, in addition to traditional financial measures.

5.3.1.6 Build truly effective delivery processes

Following the review of our organisational structure and model, there is an opportunity to review the supporting processes. Inputs, outputs and processes (including content and quality standards) will be comprehensively mapped to ensure effort is undertaken in the right place, capabilities are maximised, and risk is managed by the appropriate roles.

5.3.2 General Innovation in Supporting Growth

Strategic, catchment-based growth schemes will be included in AMP7 in growth hotspots. These solutions will look across catchments at both network and WTW capacity to determine the most cost-effective way to collect and treat wastewater. This will build on refined and updated Drainage Area Plans.

We will be piloting a co-creation approach to catchment plans in 2018, with the aim to develop joint investment plans where there is significant growth. Working with planning authorities, developers and the EA we intend to:

- identify potential synergies
- identify innovative solutions
- maximise wider benefits from planned investment

If successful, this will be adopted for business as usual planning, and form part of the forward planning element of our transformation plan detailed above.

Catchment First and **Sustainable Drainage 2030** will improve how we manage our existing wastewater networks – including separation of surface water, creating smart networks to manage peak flows and increasing customers' awareness to reduce demand on the system.

Advancements in these areas will result in more affordable and sustainable approaches to providing additional capacity, resolving internal flooding incidents whilst helping to ensure affordable bills and charges.

We will explore opportunities to work more effectively with developers SLPs and NAVs to better align activities and ensure cost-effective delivery of infrastructure. This could include agreements to construct various elements utilising each other's capabilities and supply chains to select the most efficient, integrated and least disruptive approaches to support growth.

5.4 Customer Benefits and Resilience

Through planned investment in AMP7 on growth for wastewater assets, we are confident of accommodating the additional population with no deterioration in service levels provided.

The industry standard is to design additional capacity able to accommodate rainfall from 1 in 30-year events. In response to Ofwat's new resilience metric, we will consider options to increase new infrastructure's capacity to 1 in 50-year events.

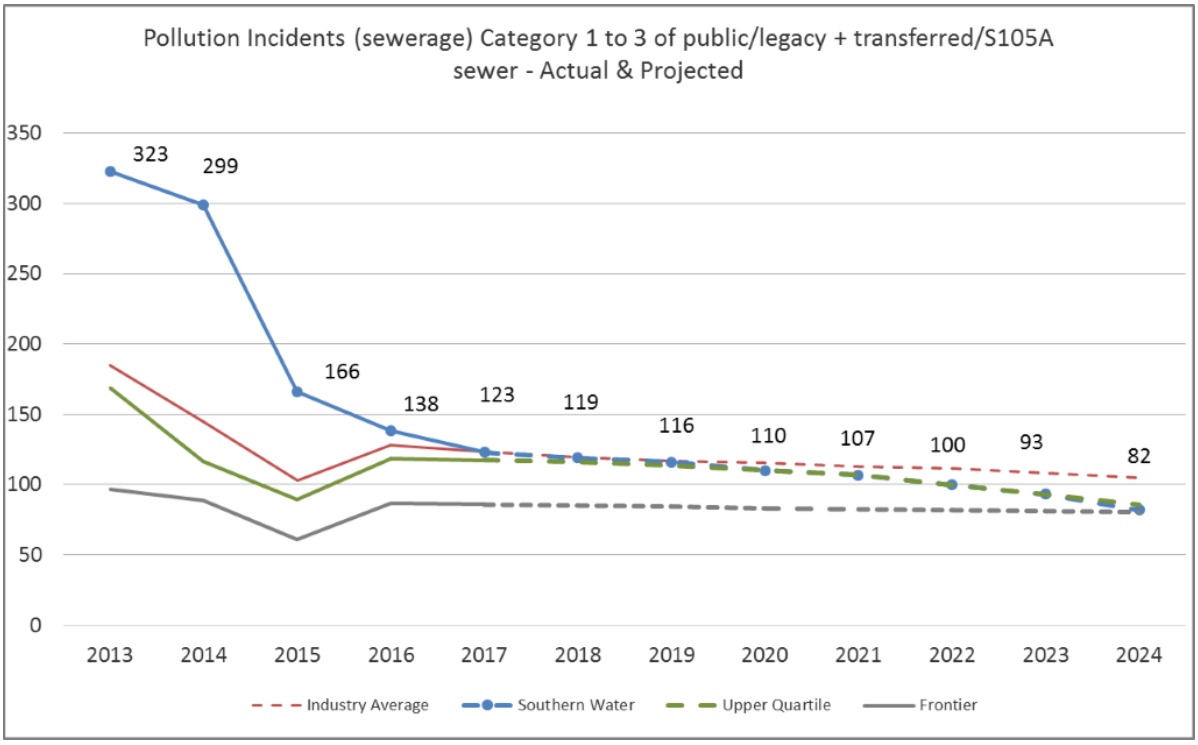
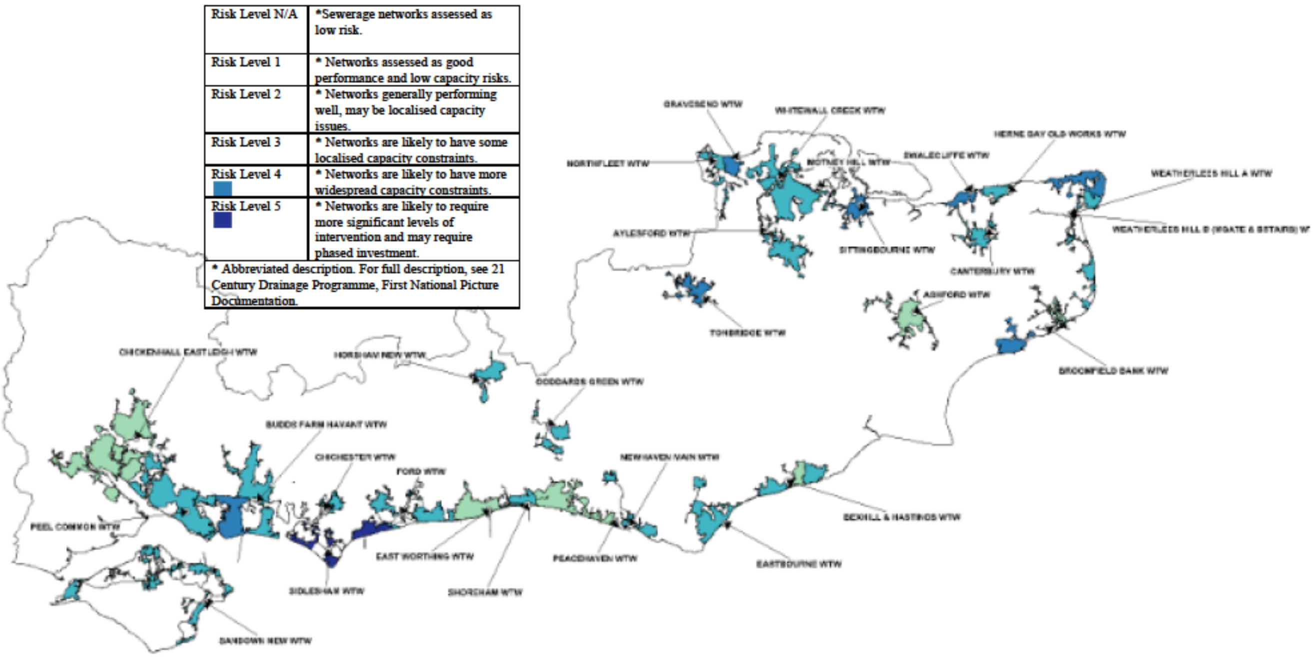


Figure 9: Projected Cat 1, 2 and 3 pollution incidents through AMP7

Supporting growth is fundamentally about maintaining a resilient asset base which meets the needs of current and future customers. Understanding resilience, particularly redundancy in the existing asset base is crucial to understanding the investment required to maintain existing serviceability. Understanding capacity and redundancy will become a critical part of our forward planning process, ensuring resilience is understood, balanced and not compromised as part of our plans.

As part of the 21st Century Drainage[15] project we have started to map out available capacity as part of the Capacity Assessment Framework. This is designed to provide a consistent approach for the indication of available capacity throughout our network. This work is starting to inform wider resilience and investment plans and is also useful in understanding and communicating current levels of available capacity. Figure 10 indicates relative levels of capacity in our key catchments.

[15] Water UK. https://www.water.org.uk/policy/improving-resilience/21st-century-drainage

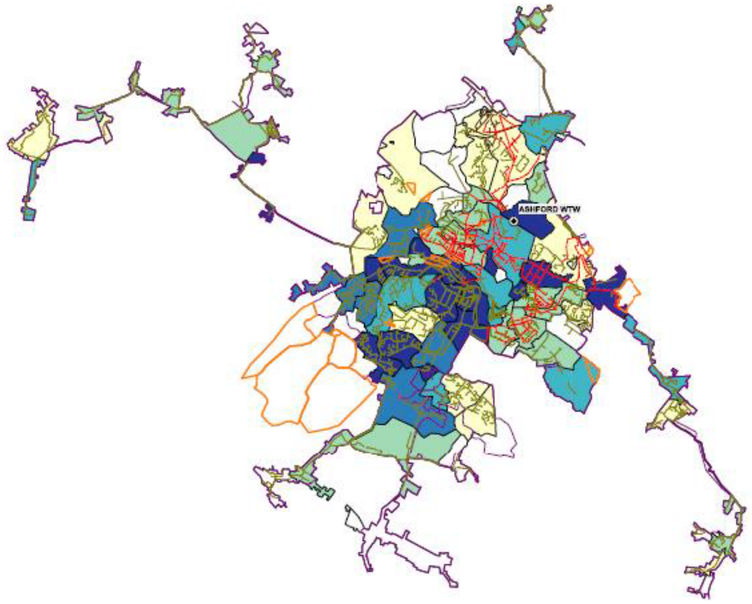


Risk Level N/A	*Sewerage networks assessed as low risk.
Risk Level 1	* Networks assessed as good performance and low capacity risks.
Risk Level 2	* Networks generally performing well, may be localised capacity issues.
Risk Level 3	* Networks are likely to have some localised capacity constraints.
Risk Level 4	* Networks are likely to have more widespread capacity constraints.
Risk Level 5	* Networks are likely to require more significant levels of intervention and may require phased investment.
* Abbreviated description. For full description, see 21 Century Drainage Programme, First National Picture Documentation.	

Figure 10: 21st Century Capacity Assessment Framework – Southern Water Catchments

Whilst this gives visible understanding of capacity constraints at an overall level, within catchments capacity constraints are often localised. This means although the overall catchment may appear to have available capacity, localised constraints mean network reinforcement is required to facilitate development.

An example is our Ashford catchment as detailed in Figure 11. At an overall catchment level, the risk is categorised as Level 2, however the location of proposed AMP7 developments (detailed in the orange polygon) are in areas of limited capacity. The map demonstrates the need for network reinforcement to avoid exacerbating existing capacity issues and further increasing risk to customers and the environment.



Risk Level N/A	*Sewerage networks assessed as low risk.
Risk Level 1	* Networks assessed as good performance and low capacity risks.
Risk Level 2	* Networks generally performing well, may be localised capacity issues.
Risk Level 3	* Networks are likely to have some localised capacity constraints.
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Risk Level 5	* Networks are likely to require more significant levels of intervention and may require phased investment.
* Abbreviated description. For full description, see 21 Century Drainage Programme, First National Picture Documentation.	

Figure 11: 21st Century Capacity Assessment Framework – Ashford Local Area Catchment

These tools can assist in the understanding and communication of capacity restrictions with key stakeholders. Proposals to improve resilience will need to take account of the rules for network reinforcement expenditure (with contributions from developers), which can only be made to maintain serviceability, not to enhance existing serviceability or network capability.

5.5 Value for Customers

The customer performance commitments that are impacted by investment in a resilient water future for the South East are consistently shown to be high priority for stakeholders and generally medium priorities for customers. We found that customers place the highest priority on commitments that impact their daily lives, and lower priority on areas that will affect them in the future. In contrast, our diverse range of stakeholder groups generally place high priority on investing in ensuring the resilience of our networks for future generations in an environmentally friendly manner.

Our triangulation of the relative priority of our proposed PCs highlighted internal sewer flooding as the highest priority for customers and stakeholders. External sewer flooding is also a high priority for customers and reported as a medium priority for our stakeholders. The number of pollution incidents and river water quality are reported as medium priorities for our customers and a high priority for stakeholders.

Relative to the PCs outlined above, Surface Water Management was highlighted as a medium priority for customers and a high priority for stakeholders. D-Mex was reported as a low priority for customers and a medium priority for stakeholders. Our growth specific Cost Adjustment Claim was reported as a low priority for customers and stakeholders.

Customers are highly averse to accepting reductions in service in exchange for lower bills, and in general are willing to pay for improvements in service levels for our proposed wastewater measures:

- the total amount that SW customers would be willing to pay for a reduction of 1 in the number of cases of '**Sewer flooding inside customers' properties'** was **£100,207** per property per year.
- the total amount that SW customers would be willing to pay for a reduction of 1 in the number of cases of '**Sewer flooding outside customers' properties'** was **£6,899** per property per year.
- the total amount that SW customers would be willing to pay for a reduction of 1 in the number of **'Pollution incidents'** was **£708,481** per incident per year.

Our additional ODI research into willingness to pay for service level improvements indicated that our customers demand and are willing to invest in significant improvements to internal sewer flooding and pollution incidents. Customers reported willingness to pay for significant improvement to external sewer flooding and surface water management, and for minimal service level improvements to improve river water quality, to reduce risk of sewer flooding in a storm and in growth. Full detail on our customer engagement findings can be found in **Chapter 4 – Customer and Stakeholder Engagement**.

Table 11: Willingness to pay for Wastewater measures

Service Attribute	Unit	WTP [£/Unit/Year]		
		Central	Low	High
SEWER FLOODING INSIDE CUSTOMERS' PROPERTIES	Case/prop	£100,207	£75,641	£124,773
SEWER FLOODING OUTSIDE CUSTOMERS' PROPERTIES	Case/prop	£6,899	£5,237	£8,562
POLLUTION INCIDENTS	Incident	£708,481	£539,656	£877,305

There are different revenue models for wastewater treatment and network growth. Wastewater treatment is delivered within the wholesale revenue control, with the revenue assessed through Ofwat's models likely to be based on historic expenditure. Our forecast spend is significantly higher than the likely revenue model, even with our plans to deliver significant performance improvements in this area

Funding for network capacity improvements is shared, with the majority of funding coming from developer contributions through the redefined infrastructure charge. The remainder comes from residual income offsetting, incorporated within the infrastructure charge during the transition to the current approach. Developers are therefore a key customer as they directly contribute towards network capacity improvements.

The above means there is a strong degree of customer protection in terms of investment levels. There is limited scope for further significant reduction to the Wastewater Treatment growth portfolio as the investment is required to meet our statutory duties. With network reinforcement, customers' contributions through the Infrastructure Charge aligns with a rolling five-year average of expenditure. As such, if investment is lower (through efficiency or delayed investment), customers' charges will fall.

Whilst our wider customer base has a strong desire to support growth, many developers feel our wastewater infrastructure charges are high, particularly compared to other companies. Our plans include significant levels of efficiency when compared to more recent expenditure. Building strong, effective relationships with developers is a key goal for AMP7 so they do appreciate the value of the infrastructure and support investment to build a resilient water future for the South East.

A primary aim of the transformation plan will be to stabilise and optimise developer customers' satisfaction and build stronger relationships. This will ensure we have a deeper understanding of our customers' needs and they have a strong appreciation of our investment plans and proposals. Achieving these will support strong D-Mex performance, reducing the risk of financial penalties.

5.6 Use of Market Mechanisms

Part of our transformational approach is to investigate alternative delivery mechanisms for elements of the growth portfolio. We are exploring collaborating with developers, especially where they are in control of, and manage elements of, site-specific works. It could be possible to construct storage on their sites or allow their suppliers to construct elements of network reinforcement. If greater value, or more efficient delivery, could be achieved through this approach it could be a key area to drive value for customers.

We are also investigating working closely with NAVs to provide appropriate long-term solutions for customers. The increasing prevalence of large-scale developments means collaborative approaches with NAVs may be the best long-term value proposition for customers. We are currently looking to work with NAVs on case studies, including Whitfield where we have a Cost Adjustment Claim, to understand the best value option for provision in the market.

6. Costing Strategy

Costing for AMP7 investment in wastewater growth has used both historic expenditure and bottom up estimates for schemes to resolve the highest growth risk sites.

Costing for wastewater treatment is based on site-specific solutions targeting main growth risks.

The network growth schemes were compiled from prioritised Drainage Area Plan growth position statements.

The solutions developed have been costed in accordance with our standard cost estimating approach for PR19. An allowance has been made for routine network reinforcement based upon historic spend rates which have been subjected to our PR19 efficiency targets.

The project-based solutions have been developed in line with the standard PR19 Asset+ scoping and CET estimating models. Further details can be found in our TA.14.4 Bottom-Up Cost Estimation technical annex.

7. Key Risks and Opportunities

Key risks and opportunities relevant to this business case are highlighted below.

7.1 Risks

- There is a risk that the new property connections required in AMP7 occur more frequently than assumed in catchments where growth is complex and expensive. This might be because of a lack of available land and/or additional loads trigger a requirement for expensive treatment and network investments. This could lead to significant additional costs in AMP7.
- There is a risk that we will not be able to deliver new capacity to the timetable required by developers. This is because their formal forecasts are often unavailable, often optimistic and it is difficult to us to identify those developments which will be delayed for local technical or commercial factors. Collaborative approaches with developers to develop realistic forecasts will mean we do not invest inefficiently ahead or behind actual need.
- There is a risk that the **Sustainable Drainage 2030** principles may not divert the assumed levels of flood and storm water away from our drainage network. This may result in new developments overloading parts of our network and this will require us protect customers by investing in costly additional engineering works.
- There is a risk that political or economic pressure may result in local authorities choosing to approve higher levels of developments than is currently assumed. This may not give us enough time to plan, design and re-configure our drainage and wastewater treatment networks to accommodate these requirements. In addition, as only some of the costs for extending our network are funded by connections and related income from customer charges this will impose additional unfunded costs on us.

7.2 Opportunities

- There is an opportunity that the success of **Target 100** will result in even lower than predicted household consumption of water and therefore reduced wastewater volumes.
- There is an opportunity that by working closer with local authorities we can better align their local plans with our catchment plans and so encourage them to promote

growth and development in areas where network reinforcement is easier to deliver without excessive cost.

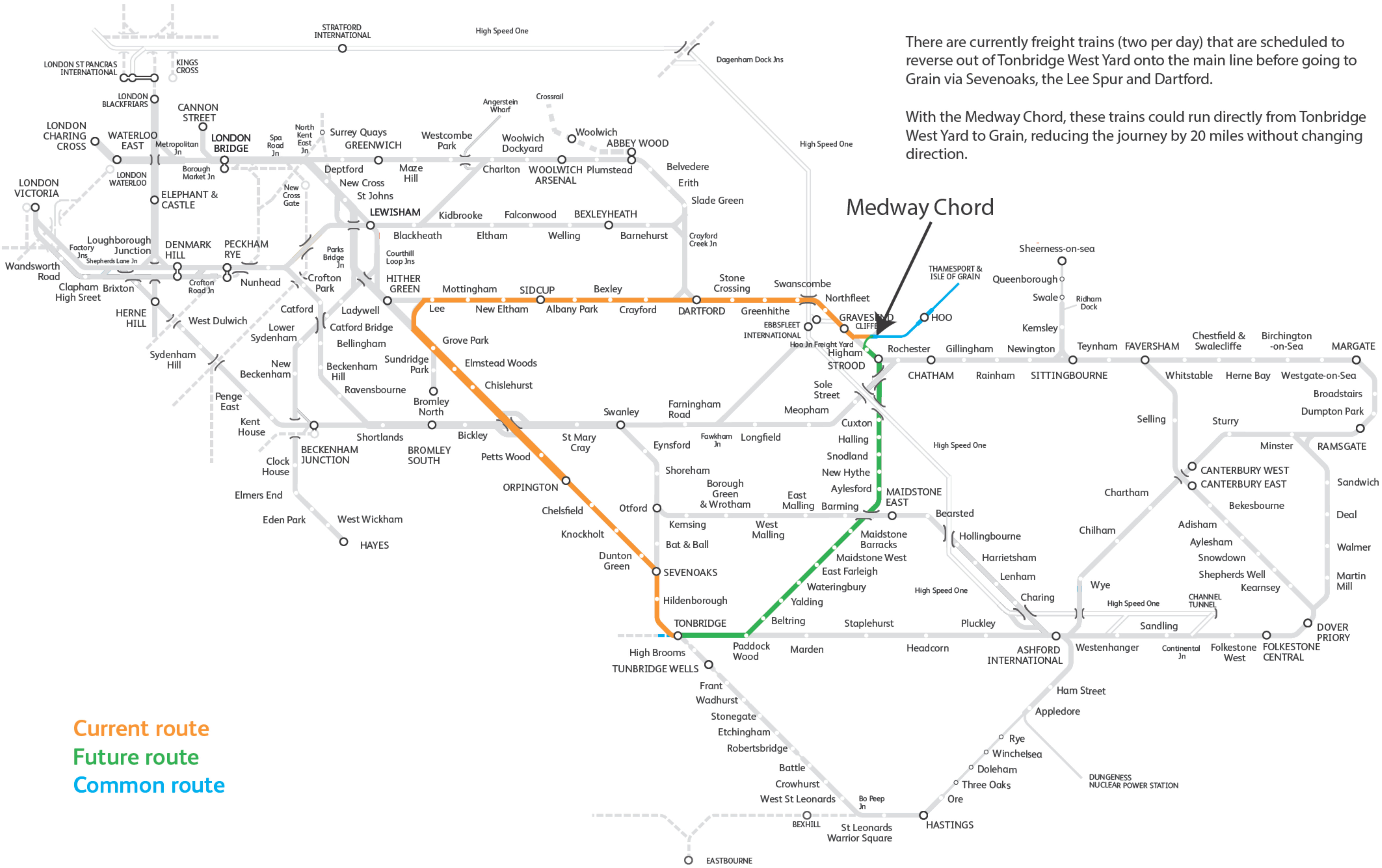
Appendix 1: List of schemes

The below schemes include the total post efficiency project costs, prior to any QBEG assessment, programme efficiencies, income and other allocations.

Scheme Name	Business Case Investment Line	AMP7 Totex (£m)
Aylesford Growth 2025	Infrastructure capacity increase (infra)	33.584
Ashford Growth 2025	Infrastructure capacity increase (infra)	9.306
Budds Farm - growth 2025	Infrastructure capacity increase (infra)	41.583
Motney Hill Growth 2025	Infrastructure capacity increase (infra)	11.499
Peel Common Growth 2025	Infrastructure capacity increase (infra)	11.342
Romsey Growth 2025	Infrastructure capacity increase (infra)	1.476
Whitewall Creek - Growth 2025	Infrastructure capacity increase (infra)	2.227
Goddards Green Growth 2025	Infrastructure capacity increase (infra)	3.360
Chickenhall Eastleigh Growth 2025	Infrastructure capacity increase (infra)	2.588
Bognor Growth 2025 Option 1	Infrastructure capacity increase (infra)	14.720
Littlehampton Growth 2025 Option 1	Infrastructure capacity increase (infra)	1.863
Lidsey to Ford	Infrastructure capacity increase (infra)	6.920
Whitfield	Infrastructure capacity increase (infra)	4.291
Otterpool (network)	Infrastructure capacity increase (infra)	1.977
Ebbsfleet (network)	Infrastructure capacity increase (infra)	20.837
Wastewater Network Growth Unallocated	Infrastructure capacity increase (infra)	39.176
Wickham	Infrastructure capacity increase (infra)	0.233
AMP7 Wastewater requisitions	Infrastructure capacity increase (infra)	14.944
101A Schemes	101A Schemes	4.577
Bishops Waltham WTW Growth	New treatment capacity (Non-Infra)	2.717
Faversham WTW - Growth	New treatment capacity (Non-Infra)	10.343
Goddards Green – Growth	New treatment capacity (Non-Infra)	6.502
Hurst Green WTW - Growth	New treatment capacity (Non-Infra)	3.753
Park Road Handcross WTW - Growth	New treatment capacity (Non-Infra)	1.869
Sandown Growth	New treatment capacity (Non-Infra)	1.214
Sittingbourne WTW - Growth	New treatment capacity (Non-Infra)	14.718
FOREST GREEN WTW	New treatment capacity (Non-Infra)	1.818
GRAVESEND WTW	New treatment capacity (Non-Infra)	18.021
LENHAM WTW	New treatment capacity (Non-Infra)	3.734
STONEGATE WTW	New treatment capacity (Non-Infra)	2.263
WESTWELL WTW	New treatment capacity (Non-Infra)	2.932
Whitfield	New treatment capacity (Non-Infra)	31.422
Welbourne (Peel Common WTW)	New treatment capacity (Non-Infra)	16.724
Warninglid	New treatment capacity (Non-Infra)	3.178
Ford	New treatment capacity (Non-Infra)	17.510
Otterpool (process)	New treatment capacity (Non-Infra)	2.746
Ebbsfleet (process)	New treatment capacity (Non-Infra)	9.885
Internal Flooding new additions	Internal Flooding new additions	11.294

There are currently freight trains (two per day) that are scheduled to reverse out of Tonbridge West Yard onto the main line before going to Grain via Sevenoaks, the Lee Spur and Dartford.

With the Medway Chord, these trains could run directly from Tonbridge West Yard to Grain, reducing the journey by 20 miles without changing direction.



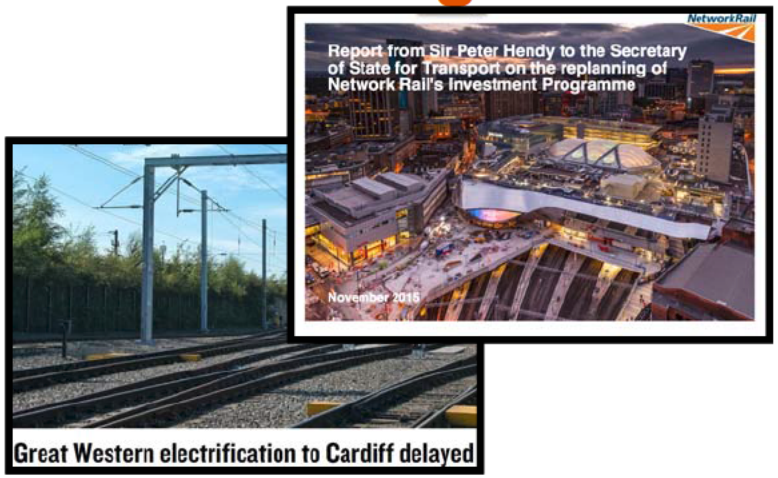
System Operator Planning a better network for you

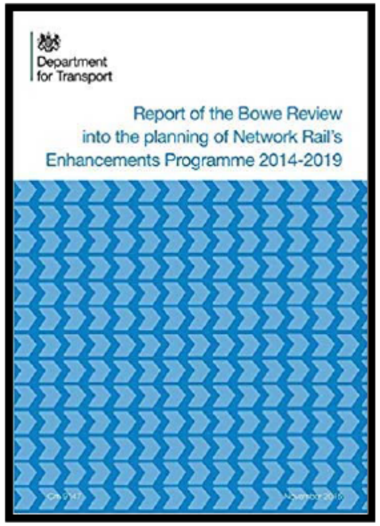


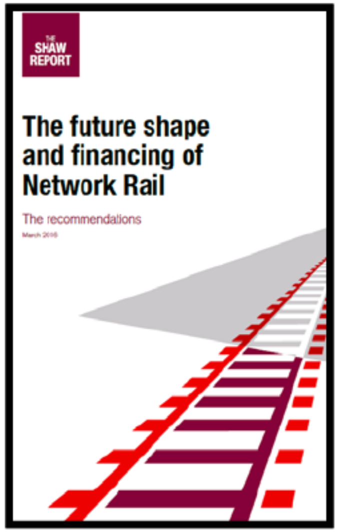

Network Rail Enhancement Funding & RNEP

For your information & discussion

1. Strategic Context



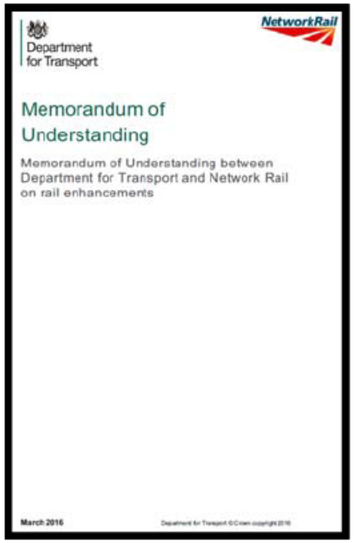


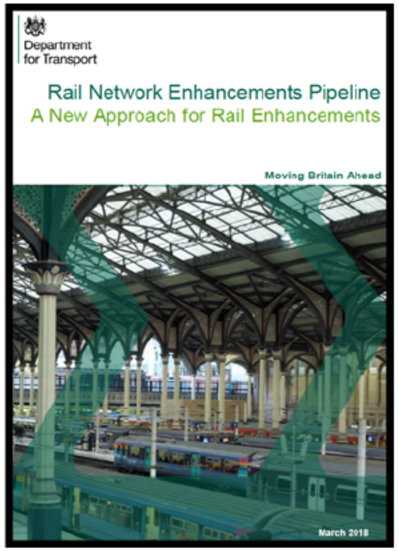


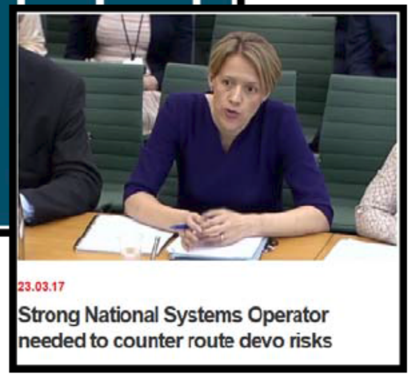
- **Control Period 5 (2014 – 2019) an ambitious programme**, involving several complex enhancements – such as Great Western Electrification
- Cost and Programme slippages prompted several landmark reviews and reports into the rail industry/ NR
- **Hendy Report**: Readjusted the portfolio for deliverability and affordability; 'pausing' of some enhancement programmes for progression in CP6
- **Bowe Review**: Report into planning processes
- **Shaw Review**: Report into funding, financing, and governance arrangements
- **Hansford Review**: Report into contestability, third party capital, barriers to entry

2. Key outcomes & changes

NetworkRail







- **Transformation Plan:** Devolution of responsibility/ discretion to operational routes, with TOC/FOC alignment in objectives & scorecards.
- **MoU/ RNEP (to be discussed):** Outlining a new approach to enhancements.
- **Open for Business:** Publication of opportunities for third party investors, appointment of Business Development Directors.
- **System Operator:** Reorganised national strategic planning function.

3. …Results for funding in CP6 (2019-2024)

- Rail funding is categorised by Operations, Maintenance, Renewals, and Enhancements **(OMR&E).**
  - **OMR** are essential to keep the railway running safely, and assets up to date.
  - **Enhancements** are capacity and capability improvements to the infrastructure.
- **Control Periods** are 5 year funding and business planning periods in rail, to give suppliers and programmes certainty.
- **The MoU** committed both the DfT and NR to implement a new process managing enhancements outside of the traditional Control Period process.
- Enhancements are now developed through a pipeline process, on a case by case basis – the **Rail Network Enhancement Pipeline (RNEP)**
- **Control Period 6 is focussed on OMR, Enhancements are not guaranteed.**

4. Examples of investment sources

Franchise TOC fund allocations

Infrastructure financing?

Direct DfT funding (RNEP)

Business rate retentions?

Govt. funding pots (AfA, HIF, NSIP…)

Devolved funding pots (City Mayors, Scotland)

CIL/ s106 allocations

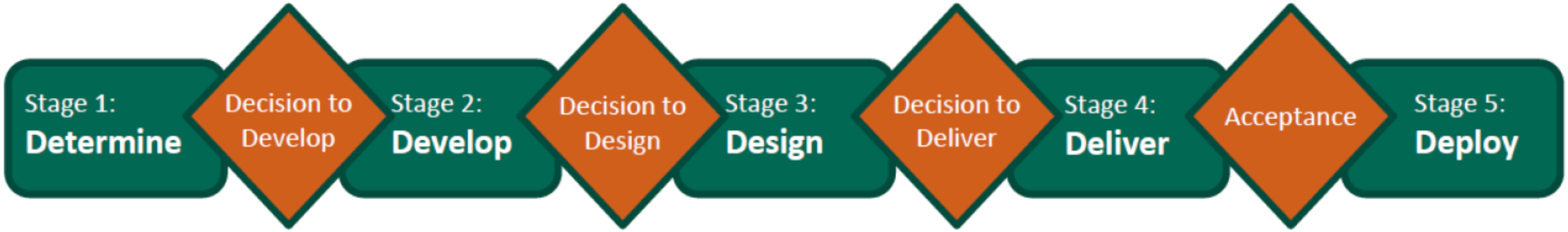
Local Authority direct funding

LEP direct funding

5. Rail Network Enhancements Pipeline (RNEP)

NetworkRail

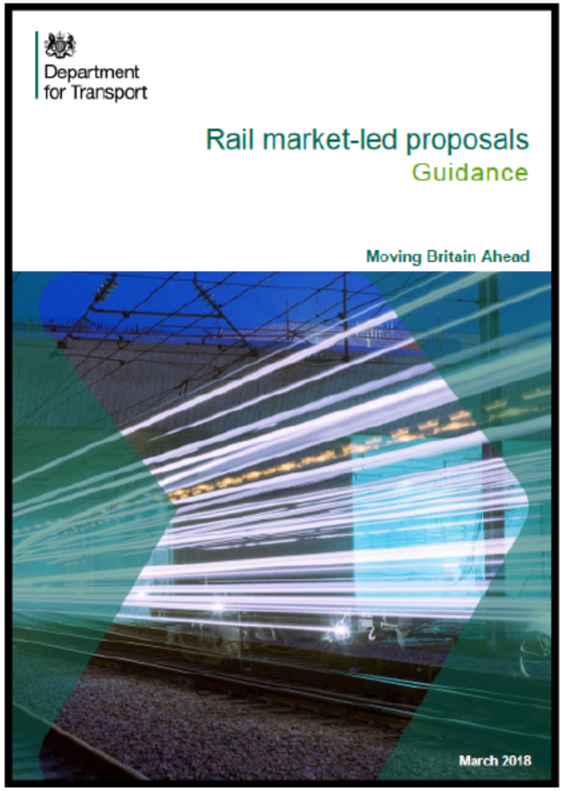
- Rail enhancements now case-by-case, aligned to Treasury Green Book principles of the 3 evolving business cases:
  - Strategic Outline Business Case (SOBC)
  - Outline Business Case (OBC)
  - Final Business Case (FBC).
- Required for schemes seeking funding from DfT in full, and in part.
- Looks to understand and outline key risks at each key stage of work.
- GRIP deliverables, interfacing process deliverables (such as planning consents)
- **No guarantee of delivery until FBC (Decision to deliver), funding is only released for the subsequent stage of work.**



6. Market-Led Proposals

NetworkRail

- Govt. and NR welcomes private sector bids for opportunities not necessarily identified in NR's long term planning process
- For example; a Port may wish to construct a new rail terminal, privately funded or financed
- If Govt. support is required, it will require a business case development in line with the RNEP
- Otherwise, strategic fit can be provided by System Operator and a delivery model can be agreed with the operational Route i.e. through Asset Protection, or commercial agreement with Network Rail to deliver.



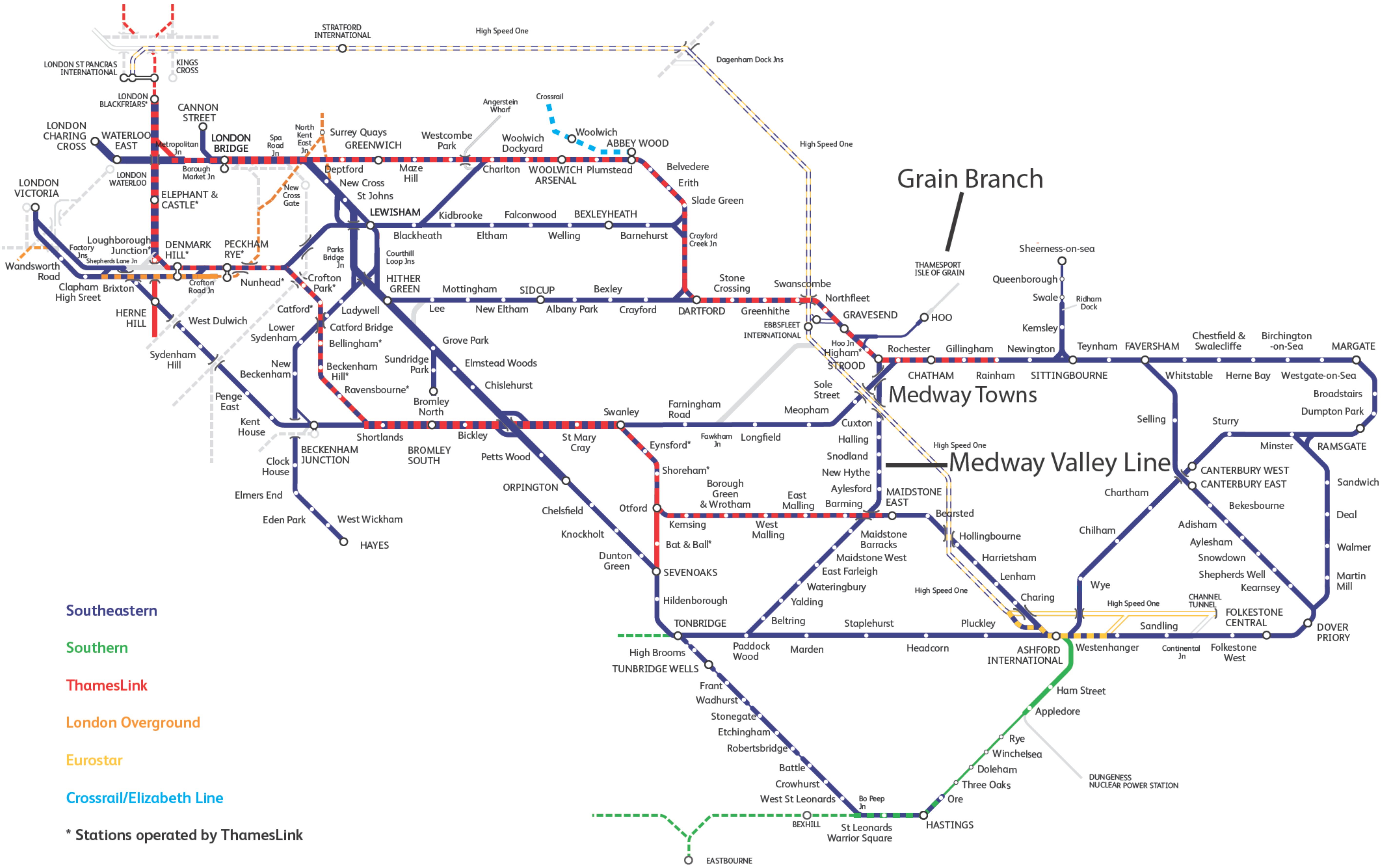
6. Key Initial Contacts & Progression

Business Development (South-East) - Business Development Director – John Gill

- Can help guide and introduce investment propositions through NR, provide commercial engagement, and a point of contact for the Route.
  - Commercial & Route point of contact through entire process

System Operator (South-East) – Head of Strategic Planning – Mike Smith

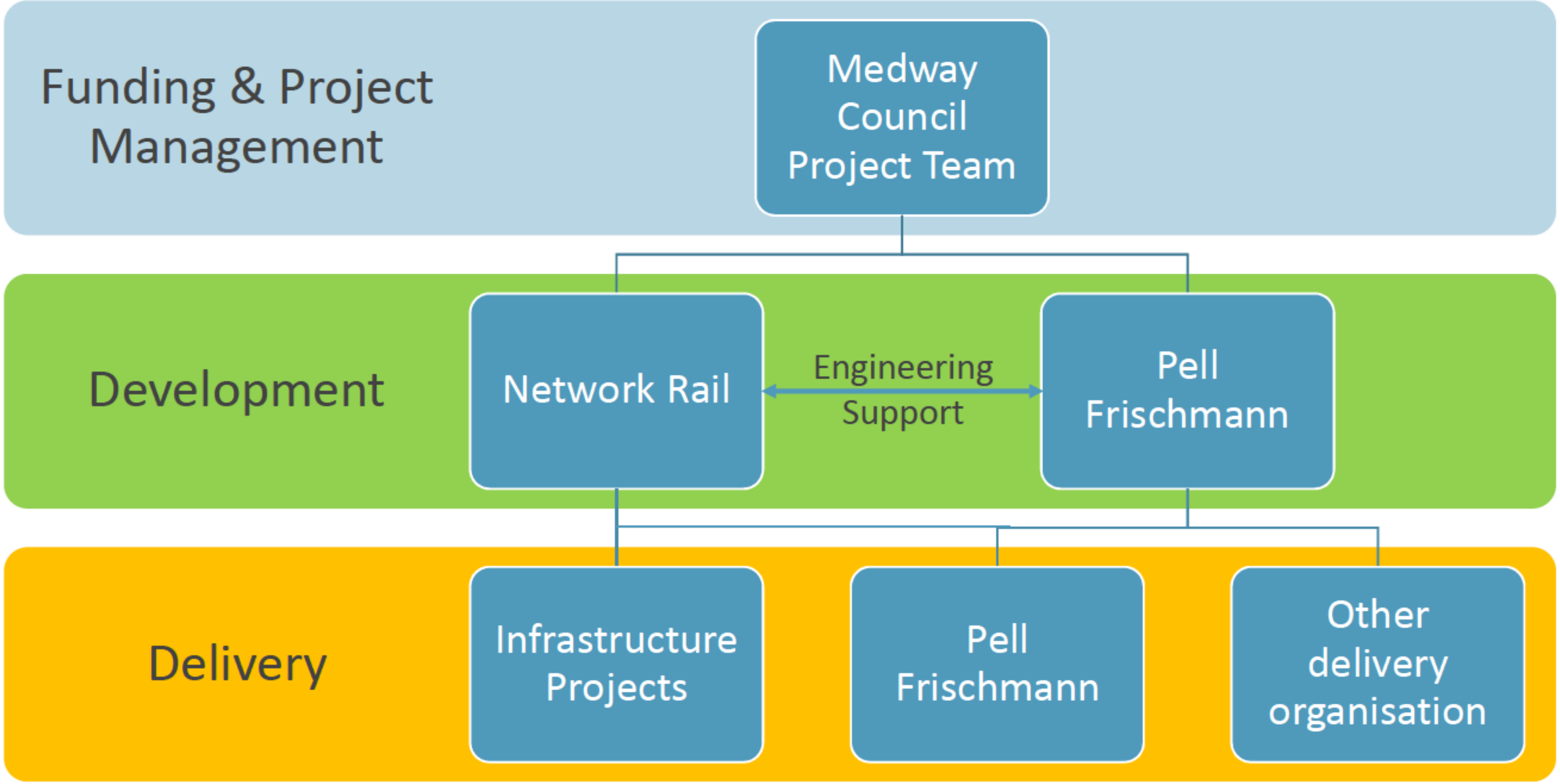
- The contact for national and route strategy for future growth, requirements, and change (including franchising), providing strategic guidance on opportunities, assessment of proposals for strategic fit
  - Business Case construction, Economic Case Appraisal, Timetable Analysis



STRATFORD INTERNATIONAL
High Speed One
LONDON ST PANCRAS INTERNATIONAL
KINGS CROSS
Dagenham Dock Jns
LONDON BLACKFRIARS*
CANNON STREET
LONDON CHARING CROSS
WATERLOO EAST
Metropolitan Jn
LONDON BRIDGE
Spa Road Jn
North Kent East Jn
Surrey Quays
GREENWICH
Westcombe Park
Angerstein Wharf
Crossrail
Woolwich Dockyard
Woolwich
ABBEY WOOD
Borough Market Jn
LONDON WATERLOO
Deptford
Maze Hill
Charlton
WOOLWICH ARSENAL
Plumstead
Belvedere
Erith
Slade Green
New Cross
New Cross Gate
St Johns
ELEPHANT & CASTLE*
LONDON VICTORIA
LEWISHAM
Kidbrooke
Falconwood
BEXLEYHEATH
Blackheath
Eltham
Welling
Barnehurst
Crayford Creek Jn
Grain Branch
Loughborough Junction*
Factory Jns
Shepherds Lane Jn
DENMARK HILL*
PECKHAM RYE*
Parks Bridge Jn
Courthill Loop Jns
Wandsworth Road
Clapham High Street
Brixton
Crofton Road Jn
Nunhead*
Crofton Park*
HITHER GREEN
Mottingham
SIDCUP
Bexley
Stone Crossing
Swanscombe
THAMESPORT ISLE OF GRAIN
Sheerness-on-sea
Queenborough
Swale
Ridham Dock
HERNE HILL
West Dulwich
Catford*
Ladywell
Lee
New Eltham
Albany Park
Crayford
DARTFORD
Greenhithe
Northfleet
GRAVESEND
HOO
EBBSFLEET INTERNATIONAL
Hoo Jn
Higham*
STROOD
Kemsley
Lower Sydenham
Catford Bridge
Grove Park
Rochester
Gillingham
Newington
Teynham
FAVERSHAM
Chestfield & Swalecliffe
Birchington -on-Sea
MARGATE
Sydenham Hill
Bellingham*
Sundridge Park
Elmstead Woods
CHATHAM
Rainham
SITTINGBOURNE
Whitstable
Herne Bay
Westgate-on-Sea
New Beckenham
Beckenham Hill*
Ravensbourne*
Chislehurst
Sole Street
Medway Towns
Broadstairs
Penge East
Bromley North
Farningham Road
Meopham
Dumpton Park
Kent House
Swanley
Selling
Sturry
Shortlands
Bickley
St Mary Cray
Fawkham Jn
Longfield
Cuxton
Halling
Minster
RAMSGATE
BECKENHAM JUNCTION
BROMLEY SOUTH
Eynsford*
Snodland
High Speed One
Medway Valley Line
Clock House
Petts Wood
Shoreham*
New Hythe
CANTERBURY WEST
CANTERBURY EAST
Sandwich
ORPINGTON
Borough Green & Wrotham
East Malling
Aylesford
MAIDSTONE EAST
Elmers End
Barming
Chartham
Bearsted
Bekesbourne
Otford
Chelsfield
Kemsing
West Malling
Deal
Eden Park
West Wickham
Knockholt
Maidstone Barracks
Hollingbourne
Chilham
Adisham
HAYES
Bat & Ball*
Maidstone West
Aylesham
Walmer
Harrietsham
Snowdown
Dunton Green
SEVENOAKS
East Farleigh
Lenham
Shepherds Well
Wateringbury
Wye
Martin Mill
Kearnsey
Hildenborough
Yalding
High Speed One
Charing
CHANNEL TUNNEL
FOLKESTONE CENTRAL
High Speed One
Beltring
Staplehurst
Pluckley
Sandling
DOVER PRIORY
TONBRIDGE
Paddock Wood
Marden
Headcorn
ASHFORD INTERNATIONAL
Westenhanger
Continental Jn
Folkestone West
High Brooms
TUNBRIDGE WELLS
Frant
Ham Street
Wadhurst
Appledore
Stonegate
Etchingham
Rye
Robertsbridge
Winchelsea
Doleham
Battle
Three Oaks
Crowhurst
DUNGENESS NUCLEAR POWER STATION
West St Leonards
Bo Peep Jn
Ore
BEXHILL
St Leonards Warrior Square
HASTINGS
EASTBOURNE
Southeastern
Southern
ThamesLink
London Overground
Eurostar
Crossrail/Elizabeth Line
* Stations operated by ThamesLink

Station name	Train operator(s)	Service types	Fastest journey to London St Pancras Intl	Average daily users (includes interchange)	Annual users (entries & exits) 2017/18
Rainham	Southeastern ThamesLink	Main Line and High Speed ThamesLink Metro	50 minutes	6,440	1,822,540
Gillingham			42 mins	10,784	2,744,182
Chatham			38 minutes	9,648	2,730,506
Rochester			34 minutes	6,529	1,817,314
Strood		High Speed and Medway Valley Line Thameslink Metro	35 minutes	5,583	1,071,564
Halling	Southeastern	Medway Valley Line	48 minutes	334	94,422
Cuxton			44 minutes	181	51,124
TOTALS				**39,499**	**10,331,652**

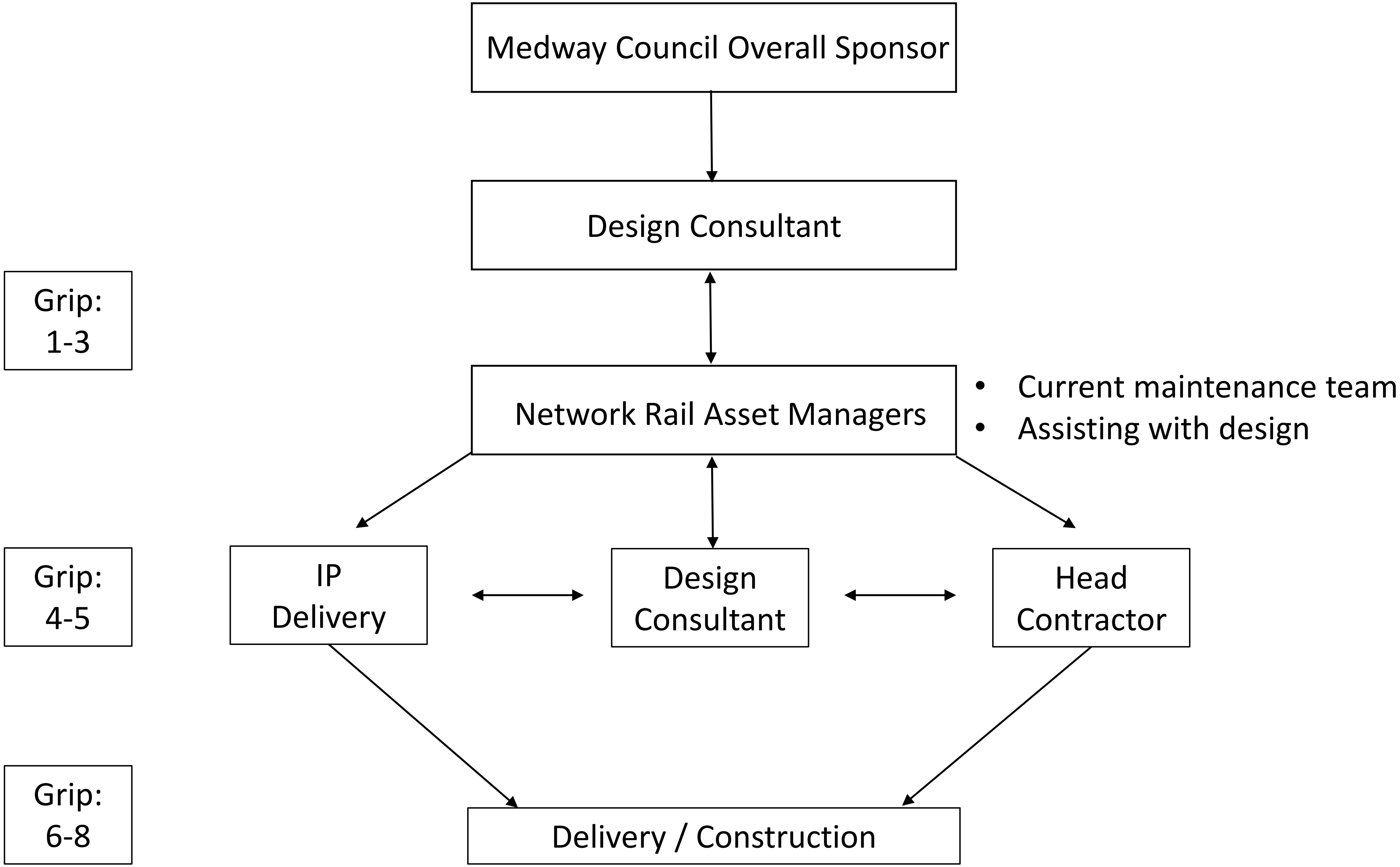
NetworkRail



Project Team led by Medway Council

Network Rail maintenance engineers work with Pell Frischmann

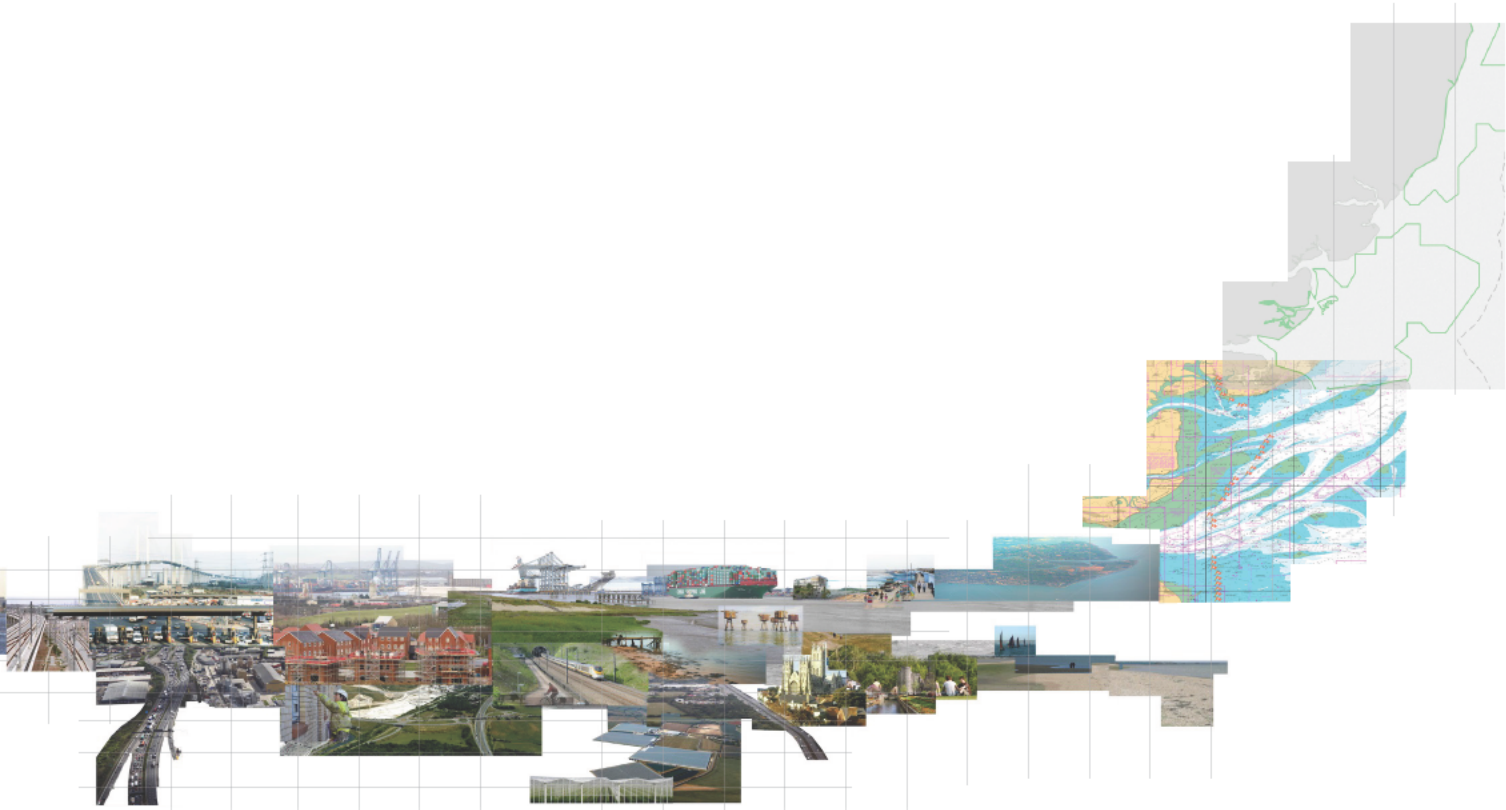
Delivery organisation to be decided nearer the time


Medway Council Overall Sponsor
Design Consultant
Grip: 1-3
Network Rail Asset Managers
• Current maintenance team
• Assisting with design
Grip: 4-5
IP Delivery
Design Consultant
Head Contractor
Grip: 6-8
Delivery / Construction

Thames Estuary 2050 Growth Commission

2050 Vision

June 2018



Thames Estuary 2050 Growth Commission

Sir John Armitt (Chair), Chairman, City & Guilds Group and National Express

Prof. Sadie Morgan (Deputy Chair), Director, dRMM Architects

Lord Norman Foster, Chairman and Founder, Foster + Partners

Prof. Alice Gast, President, Imperial College

Gregory Hodkinson, Chairman, Arup

Sir George Iacobescu, Chairman and Chief Executive, Canary Wharf Group

Sir Stuart Lipton, Partner, Lipton Rogers Developments LLP

Sir Edward Lister, Chairman, Homes England

Tony Pidgley, Group Chairman, Berkeley Group

Nick Roberts, President, Atkins

Geoffrey Spence, Infrastructure Finance Expert

Note: All figures quoted in this document are referenced in the accompanying Technical Document.

Foreword

The Thames Estuary flows from one of the world's greatest cities and passes through areas of extraordinary natural beauty. It stretches from the global financial centre at Canary Wharf past the country's busiest river crossing to world-class coastal wetlands.

The Thames Estuary area faces some real challenges, including significant pockets of deprivation. But we believe it has the potential to support growth across the country. Our vision reflects both the interconnectedness and the distinctiveness of the places that make up the Thames Estuary; a tapestry of productive places along a global river, generating an additional £190 billion GVA and 1.3 million new jobs by 2050. At least 1 million new homes will need to be delivered to support this growth.

The Thames Estuary 2050 Growth Commission was established in March 2016 to develop an ambitious vision and delivery plan for north Kent, south Essex and east London. We are honoured to have been given the opportunity to lead this vital piece of work, which began under Lord Heseltine's chairmanship.

We have carried out the work in close collaboration with our fellow Commissioners and in consultation with local partners. We ran a Call for Ideas from July to September 2016 and were overwhelmed by the response: there were over 100 respondents, including public, private and third sector organisations, and members of the public, all brimming with great ideas and ambitions for the Thames Estuary. We worked with our fellow Commissioners over the next few months to review these responses alongside supporting analysis on the area's key challenges and opportunities. From this, we began to crystallise our thinking on a 2050 Vision for the Thames Estuary, announcing our priorities in December 2017. The conclusions of this work are presented within this 2050 Vision.

Throughout this exciting journey, we took part in numerous visits to the Thames Estuary, including along the river itself, and met with a wide range of stakeholders. We would like to thank all those who have provided input and hosted visits. Your contributions have helped to bring our vision for this exciting area to life.

Sir John Armitt
Chair, Thames Estuary 2050
Growth Commission

Sadie Morgan
Deputy Chair, Thames Estuary
2050 Growth Commission

The Case for Investment

The Thames Estuary is an area with great potential. It has sizeable economic power, a strong feeling of collaboration and a ‘can do attitude’ from London right out to the sea. The Estuary has an important brand and status, which makes a significant contribution to the UK economy and UK plc.

However, over the past few decades it has consistently been unable to deliver the same levels of economic growth as other parts of the UK. Whilst there are recent success stories, including Canary Wharf and the Thames Estuary’s ports, the benefits of these pockets of growth have not necessarily been felt across the area. This has resulted in a large disparity in wealth and opportunity. The Thames Estuary partners want to work together to ensure that this is not an enduring problem.

The Thames Estuary has significant strengths: its proximity to London; international trade via its ports, strong universities, further education and research institutions; and availability of land to deliver high-quality homes. Yet, given its underperformance across a range of social and economic measures (see opposite), identifying what is needed to spread opportunity and growth is a complex task.

In order to answer this question, the Commission has interrogated what has not worked, and why. It has also sought to understand how the significant strengths in the area can be capitalised upon to make sure that economic growth is not reserved for some; rather it can have a lasting impact for existing and new businesses and residents across the area. It has done this through a detailed review of the existing context, engagement with stakeholders over the last two years and a review of existing and proposed projects.

The evidence gathered reaffirms the Commission’s view that the ‘business as usual’ approach is not working. Without concerted action, there is a risk that the Thames Estuary will fail to achieve its potential, at huge opportunity cost to local communities and the national economy. By way of example since 2008, the Thames Estuary (outside London) grew more slowly than any of the other London corridors including, for example, the Thames Valley, London-Stansted-Cambridge corridor.

The Commission acknowledges that the area needs strong delivery and investment to make sure that, as other high growth corridors around London expand, the Thames Estuary is not left behind. The Thames Estuary has vast potential and could catch up with other London corridors that have outpaced UK growth. To do this it needs a clear vision and a focus on delivery.

This 2050 Vision sets out the key challenges and opportunities of the area, alongside future trends. It then presents a vision for the Thames Estuary and resulting recommendations and priorities which will be central to its delivery. This was informed by a review and prioritisation of existing and proposed projects. It concludes with a focus on the governance reforms and delivery models needed to realise the Commission’s aspirations.

The Challenges

Scale of the area: The Thames Estuary is home to many boroughs, cities, towns and villages, which have their own distinctive characteristics. The diversity of the area, the natural barrier provided by the River Thames and the different functional economic areas mean that developing a singular 'vision' is challenging; it makes more sense to 'read' the area as a series of interconnected places.

Stimulating economic growth: The Kent and Essex parts of the area have struggled to keep pace with the scale of employment growth in east London. Between 2009 and 2016 east London employment grew by 27%, in comparison to the Thames Estuary average of 19% and the London average of 21%.

Low skills and education levels: There is a higher proportion of adults with no formal qualifications compared with the regional average across the Thames Estuary although this challenge is particularly acute in Essex. Relative to the London, South East and East regions, residents in the Thames Estuary are more likely to work in trade, sales or machine activities, which have historically been less highly skilled. This makes the area a less attractive location for employers seeking skilled and agile workers.

Entrenched deprivation: The area is characterised by a 'low wage' economy with limited connectivity to employment centres and a shortage of jobs and skills. The average weekly household income in the area is £800 before housing costs, which is below the combined average for London, South East and East of England at £885. Most settlements in the Thames Estuary therefore contain neighbourhoods with high levels of deprivation (in the top two deciles of the Index of Multiple Deprivation). The area also has higher levels of unemployment (5.3%) compared with the average for England (4.5%).

Delivering homes: The area needs to cater for population growth and demographic change. Whilst an increased number of planning permissions are being granted, this is not being reflected in delivery rates. Between 2012/2013 and 2014/2015, on average, fewer than 10,000 homes were built per annum against Local Plan targets of 19,495 per annum. Low land values, challenging site conditions and a limited number of house builders are all contributing to the delivery gap.

Limited mobility: Outside of London, the high speed railway network has been the focus of historic transport investment. Beyond this, access to affordable, high-quality public transport or active transport links is more limited between and within cities and towns. This is affecting access to jobs.

Environmental constraints: The Environment Agency estimates that the sea level will rise between 20cm and 90cm by 2100. Without intervention, this could affect up to 1.25 million people who live in the Thames tidal floodplain and 1,200 hectares of internally designated habitats. The Thames Estuary 2100 Plan is the Government's current strategy to adapt to the challenges of future sea level rise. The area also suffers from poor air quality, particularly near congested river crossing points.

Fragmented governance: There are 18 local authorities alongside the Greater London Authority, Kent and Essex County Councils and two development corporations in the area. The lack of coordinated governance structures makes strategic planning and prioritisation of interventions more difficult. This is in the context of significant funding gaps, particularly for infrastructure delivery.

The Future

Jobs: The Commission believes that up to 1.3 million new jobs could be created in the Thames Estuary by 2050. The Industrial Strategy identifies the pillars and priorities for national focus. The Thames Estuary, given its assets, is well placed to deliver against these priorities including boosting economic growth, increasing employment, skills and earning potential and delivering infrastructure to support jobs and homes. This supports the National Infrastructure Assessment which seeks to reduce congestion and carbon whilst increasing the capacity of the country's infrastructure.

Homes: A minimum of 1 million homes will be required to support economic growth in the Thames Estuary by 2050. This equates to 31,250 homes per annum. The Commission believes that the scale and pace of delivery will need to increase to meet this demand. In terms of the distribution of these homes, based on the Ministry of Housing, Communities and Local Government's standardised methodology for calculating housing need, around two thirds of these homes should be delivered in east London. The Commission believes that solely focusing on homes in London is unsustainable and that more of these homes should be provided in Kent and Essex.

Technology and innovation: Sectors and jobs could take a variety of forms in the future. The Commission believes that a skilled and agile workforce will be most able to respond to this uncertainty. Traditional sectors in the Thames Estuary, including ports, logistics and construction, must respond to automation and technical innovation by changing operating practices and the number and types of jobs required.

Economic resilience: The impacts of Brexit on economies are still uncertain and may require changes to the ports, logistics and aviation sectors. The Commission believes that the Thames Estuary can capitalise on the challenges and opportunities presented by Brexit, transforming the area and reducing pressure and reliance on London. This is reflected in the planned and on-going investment, for example, at the Port of Tilbury and London Gateway Port.

Environmental change: The Government's 25 Year Environment Plan sets out action to help the natural world regain and retain good health. It includes a number of policy areas which are relevant to the future of the Thames Estuary: using and managing land sustainably; recovering nature and enhancing landscapes; connecting people with the wider environment; and increasing resource efficiency and reducing pollution. The Commission believes the long view of the 2050 Vision provides an opportunity to embed these principles in the future of the area.

The River Thames is an iconic driver of economic activity. It has led to the rich tapestry of places, communities, landscapes and economies, which characterise the Estuary today. They contribute to the breadth of challenge and opportunity in the area.

The Opportunities

Strengthen existing sectors: The Commission believes that the area should continue to grow 'traditional' industries of freight, logistics and construction, capitalising on the five major ports and growing logistics and manufacturing sectors around them as well as the planned modular homes factories. The creative and cultural industries (spearheaded through the Thames Estuary Production Corridor) and medical sectors (e.g. medical instruments manufacturing at Southend-on-Sea) should also be supported.

Diversify sectoral mix: Locally distinctive sectors which capitalise on the area's assets should continue to be supported, whether they are existing or emerging sectors. The Commission believes this includes health, tourism, creative and cultural industries, agriculture and renewable energy and green technologies.

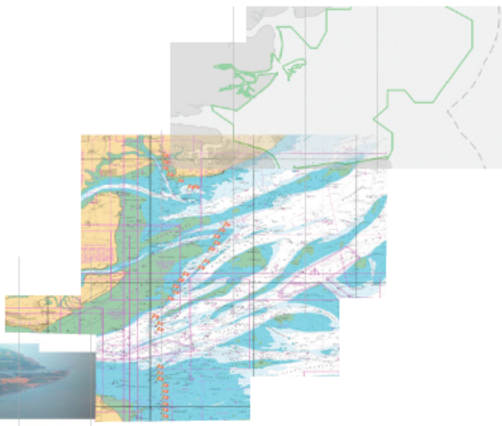
Utilise higher education institutions: The Commission believes that links between the South East Local Enterprise Partnership, institutions, employers and schools should be strengthened to maximise economic growth and provide pathways from school to employment. This includes building on the skills legacy from large infrastructure schemes in the area such as High Speed 1.

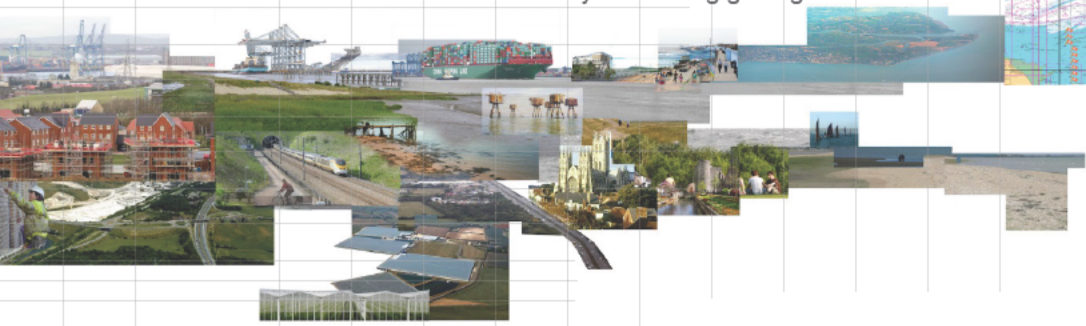
Prioritise infrastructure investment: There are over 327 infrastructure projects identified by local authorities to address existing constraints and/or support future growth in the area. The Commission believes that delivery of infrastructure will support delivery of homes and jobs. For example, the extension of Crossrail to Ebbsfleet could support up to 50,000 jobs and 55,000 new homes. Investment in and delivery of green infrastructure will also be key to securing good growth.

Improve intra-town connectivity: The Commission believes this should be achieved by making better use of existing capacity, and delivering currently planned road and rail infrastructure. Providing additional capacity within the transport network will reduce congestion and journey times. The delivery of transport hubs will provide opportunities for agglomeration and regeneration.

Integrate environmental assets: The Commission believes that the Thames Estuary area provides the long term solution to managing the impacts of sea level rise on London. If appropriately planned, opportunities including maximising flood attenuation and improving air quality should be pursued alongside provision of replacement habitats and improved access for recreation and leisure (as promoted by the Thames Estuary 2100 Plan).

Realise planned development: There is an opportunity to deliver the homes (including affordable homes) and employment space that are needed to support demographic change and new jobs in the area. Homes and jobs should be delivered across the Thames Estuary to support the tapestry of places.



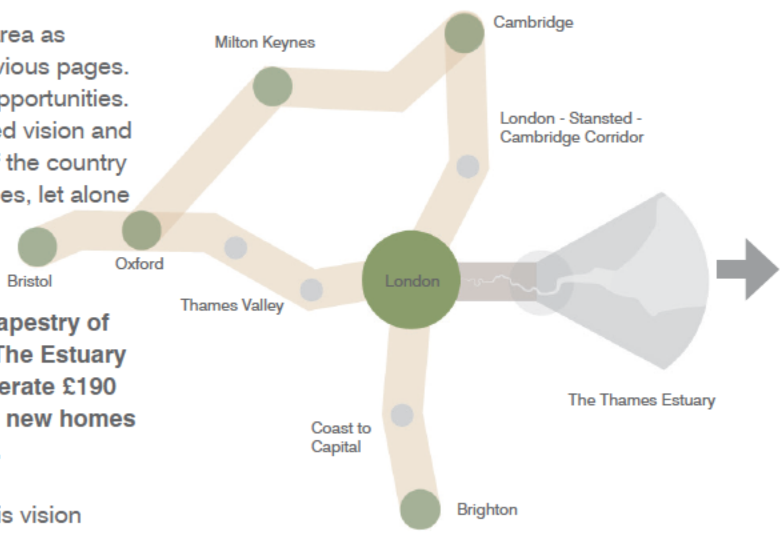


The Vision

From an underperforming river region to a tapestry of 'productive places' along a global river.

A lot of good work is already taking place in the Thames Estuary. Examples include public and private investment in the economy (e.g. Port of Tilbury and London Gateway Port), homes (e.g. through Ebbsfleet Development Corporation) and infrastructure (e.g. Lower Thames Crossing). The foundations to build on are strong.

There is significant latent potential in the area as illustrated through the analysis on the previous pages. There are also common challenges and opportunities. However, without a coherent and integrated vision and associated priorities, this important part of the country will not deliver 'business as usual' outcomes, let alone more ambitious ones.



By 2050, the Thames Estuary will be a tapestry of productive places along a global river. The Estuary will create 1.3 million new jobs and generate £190 billion additional GVA. At least 1 million new homes will be delivered to support this growth.

The Commission believes that realising this vision requires a change in thinking. The evidence shows that the Thames Estuary will not be successful when considered as a single functional economic area, single place or single community. It is a tapestry of interconnected but different economies, places and people, performing well in parts, but underperforming in others.

The Commission therefore recommends a different structure: a structure of five 'productive places', which are based on existing areas and their assets; with a clear vision for each area, a tight focus on priorities and stronger, streamlined governance.

In 2050, this tapestry of 'productive places' in the Thames Estuary will form part of the series of productive and connected places that 'orbit' London. Like Cambridge and Oxford, the 'productive places' of the Thames Estuary will be higher performing places, retaining their own distinct character and economic function.

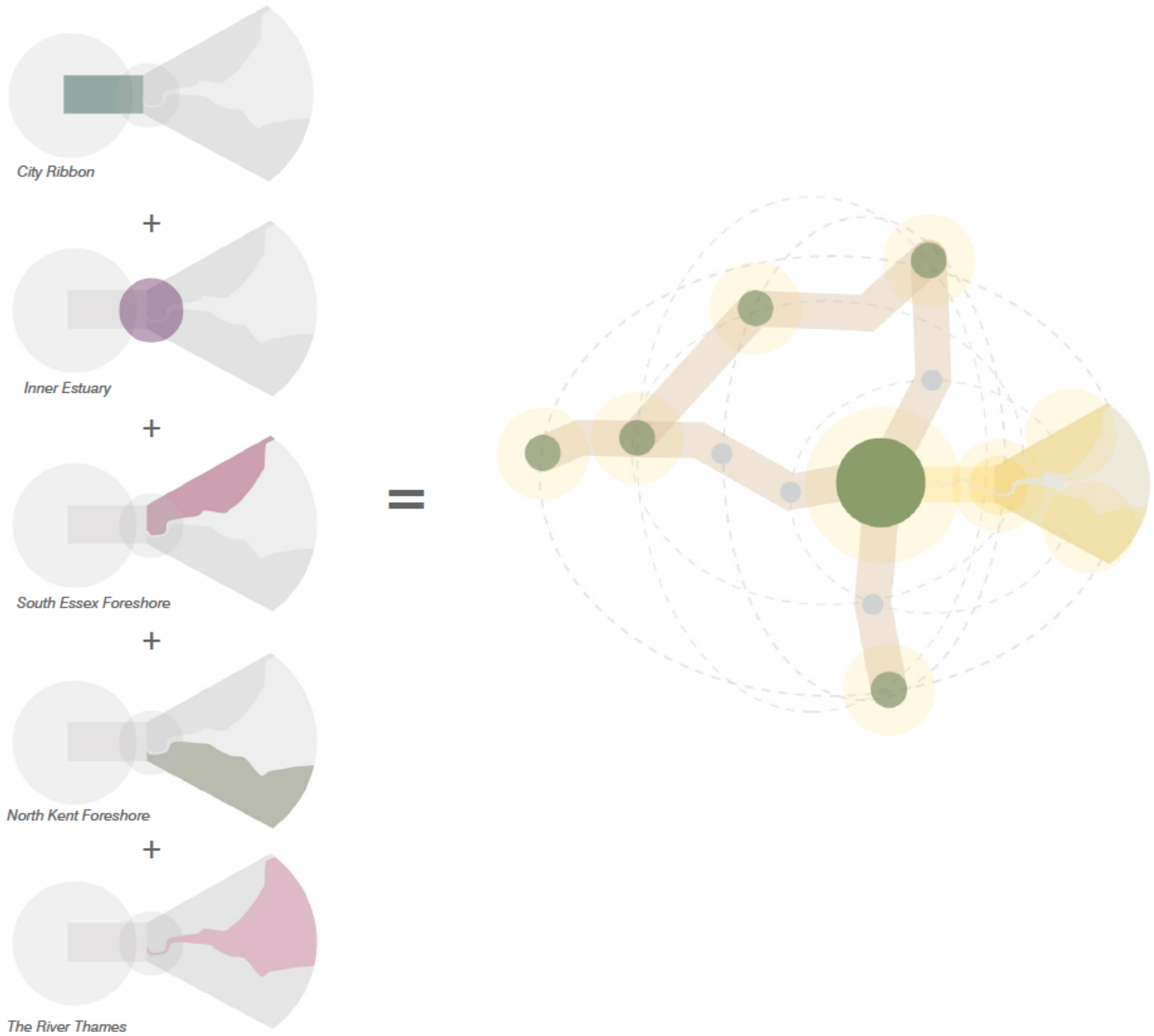
Thames Estuary Today

There is significant potential as an economic area, but there is not a clear economic or spatial framework to realise this potential in comparison to other successful corridors and cities around London like Cambridge, Oxford and Brighton. The current context is:

1.3 million jobs

£89 billion GVA

1.4 million homes



Five Productive Places

The different areas and characters of the Thames Estuary form into the proposition for five 'productive places'. Individually these places will be more productive and set up to deliver. Places will deliver the Commission's key priorities of:

Sectors

Connectivity and Communities

Delivery

Vision for Thames Estuary 2050

Each of the five places focuses on: developing strong and specific sectors, increasing skills, delivering homes and jobs at scale and pace, addressing the 'low wage economy', connecting to and enhancing natural assets and green infrastructure, and planning for long term and resilient development. This vision aims to deliver:

1.3 million new jobs

£190 billion* additional GVA

At least 1 million new homes

* assuming an annual average growth rate of 1.25% at current GVA per job

The Objectives

The Vision is underpinned by six objectives. They provide further direction on how the Thames Estuary can boost productivity, make a greater contribution to the UK economy and deliver a series of positive outcomes by 2050.

Productive Places

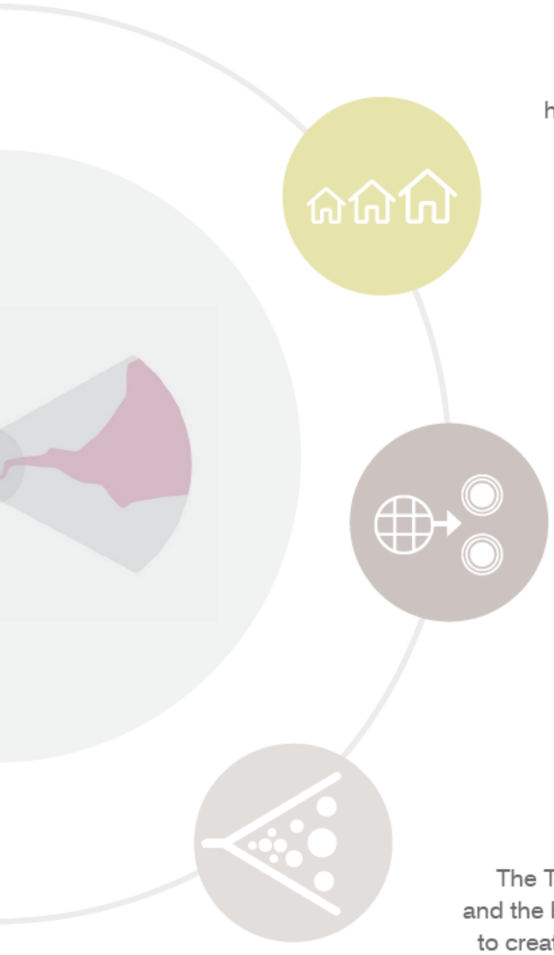
The places of the Thames Estuary will support the sustained growth of its high value, healthy wage sectors achieving up to **1.3 million new jobs by 2050**. Existing sectors will be strengthened including **freight and logistics** and **construction**, maximising opportunities from existing assets such as the **ports**. Emerging sectors will be nurtured including: **health**, reflecting the supercentre in Kent; niche heritage and wildlife **tourism** in Kent and Essex; and the Thames Estuary Production Corridor - a ribbon of **creative and cultural industries** along the River Thames. In part and as a whole, the places will harness entrepreneurial spirit, **strong educational institutions** and **unique natural assets** to create a distinctive and productive network of economies.

Connected Places

There will be **improved connections** between and within cities, towns, villages and industries be it for people or goods. This will support **improved productivity** through increased access to jobs and services. New and improved rail, bus, cycle and pedestrian links will reduce car dependency and increase the use of the area's **integrated public transport** systems. Completing the Thames Path will also improve connections for recreation for cyclists and pedestrians. The area will benefit from the highest level of **digital connectivity**, adopting the latest technological innovation. New **river crossings** such as the Lower Thames Crossing and Silvertown Tunnel will strengthen local and national links. New railway infrastructure including the extension of **Crossrail 1 to Ebbsfleet** and the **Thames East Line** will connect into the country's high speed network and complete the orbital railway around the Capital.

Thriving Places

The growing communities of the Thames Estuary, which will be home to **4.3 million people by 2035**, will pride themselves on their **rich cultural and economic activity**. Through **people-led projects** - in part delivered through the Thames Estuary Fund - each distinctive city, town and village will be the well-loved **heart of the community**. They will demonstrate the importance of good design and creating attractive places that work for the community. Improved **educational attainment** and **local skills** will **increase aspiration** and show that new job opportunities are for them. These thriving places will be **attractive to investors** and will celebrate their **individual sense of place** by offering bespoke opportunities to live, work, visit and play within the Thames Estuary setting.



Affordable Places

A further **1 million high-quality homes,** balanced to suit the affordable needs of the community, will be provided by 2050. They will offer a diversity of choice to all parts of the community, including **ageing populations**, and ensure that **supply keeps pace with demand**. The production of **statutory Joint Spatial Plans** will set out where these homes will be located and include tools, such as design review panels, to ensure high-quality development is delivered. **Healthy lifestyles** will be supported by the provision of new social places alongside integration with existing places and community networks. This will support **resilient communities** that respond to the needs of residents throughout their lives.

Adaptable Places

The many places and spaces in the Thames Estuary will adapt to the changing environment ensuring the people, economies and ecology of the area **thrive**. Infrastructure investment will be **integrated and multi-functional**, maximising the benefits to people, places, and ecology. This will assist in the creation of nearly **900 hectares of new habitat by 2100** to replace the 1,200 hectares lost to tidal flooding. Projects such as the completion of the Thames Path will provide **improved access to the natural environment**. The use of natural assets for recreation and economic activity will be balanced with their **protection and enhancement**.

Deliverable Places

The Thames Estuary will complete what it has started; delivering the homes and the balanced jobs it has planned, at the required **scale and pace**, in order to create thriving and affordable places. This will be achieved through robust, **locally-led governance** structures, which **build on existing** partnerships and bring together, as needed, the **18 local authorities**, plus the three upper tier authorities. The area will also be a space to try something - a place that **supports innovative models of delivery** be that through capitalising on Modern Methods of Construction (such as modular homes) or innovative models of public sector housing delivery. Across the many places of the Thames Estuary this will enable the **significant aspirations to become meaningful realities**.

City Ribbon

The area 'City Ribbon' includes the east London boroughs of Tower Hamlets, Newham, Barking and Dagenham, Havering, Lewisham, Bexley and Greenwich and the London Legacy Development Corporation.

The core strengths of this place include the **growing cultural and creative industries sector**, supported by the Mayor's Production Corridor, and significant projected **population growth**, which is collectively one of the **youngest on average in London**. This is allied to major regeneration programmes in areas including Barking Riverside and Thamesmead.

The challenges of the area include integrating and delivering **future connectivity** projects, including river crossings and the Crossrail 1 extension to Ebbsfleet, and ensuring this unlocks the delivery of **affordable housing**. The area suffers from some of the **highest levels of deprivation** in London with **high levels of unemployment** and **low skills**.

Within this context the Commission's vision for City Ribbon is:

City Ribbon will be a hub for production. Space will be created for start-ups and grow-on spaces for small and medium sized businesses. Communities will be connected by multiple public transport links and served by culturally rich town centres. Through the implementation of a multi-generational skills strategy, the area will connect the creative and cultural industries to a highly skilled workforce.

> ***"Both banks of the Thames were rejuvenated. There are now large blocks of apartments where there were once derelict wharves. Shopping areas, apartments, public houses and walkways . . . The neighbourhood of the river is recovering its ancient exuberance and energy, and is reverting to its existence before the residents and houses were displaced by the building of the docks in the 19th century."***

Peter Ackroyd, Sacred River

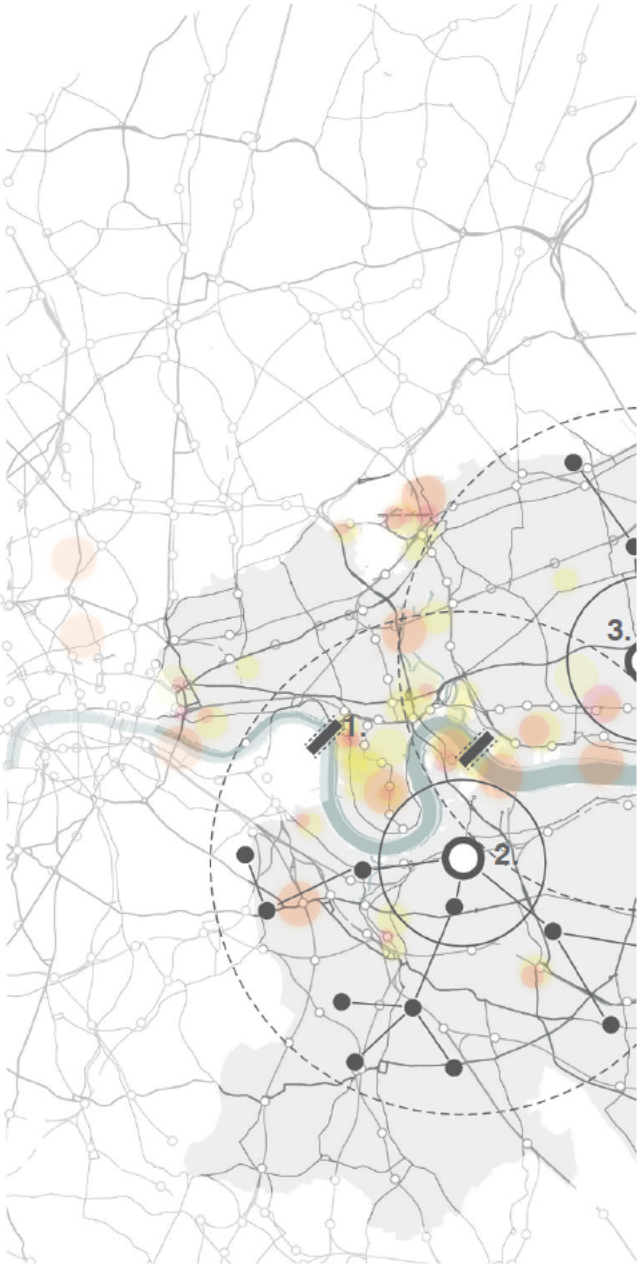
City Ribbon

Within City Ribbon, 196 infrastructure, skills and employment projects were subject to the prioritisation review. Some 139 projects were sifted out where they were either: a duplicate entry; there was insufficient information available on the project to meaningfully assess it; or because it represented 'business as usual' where it was considered that the project would not make a significant contribution to meeting the Commission's vision for the area. Of the remaining 57 projects, 88% contributed to connected places, 82% towards adaptable places and 70% to productive places. Half contributed to affordable places.

In addition, 209 large scale known and proposed employment and residential developments were identified. All the developments were categorised as 'business as usual'.

There is much already happening in City Ribbon, with existing delivery structures in place. However, the Commission believes there are opportunities to make more of what is planned to realise the aspirations for the area. The Commission's priorities are set out opposite.

Beyond these three priorities, there are other projects which the Commission supports and considers are central to its vision for City Ribbon being achieved. These include the expansion of City Airport, the continued growth of Canary Wharf, the delivery of Thamesmead which could provide up to 20,000 new homes - the largest regeneration project in Europe - and the extension of Crossrail 1 to Ebbsfleet. This project is discussed further in the Inner Estuary; within City Ribbon the project could help to accelerate delivery of 30,000 new homes in Bexley, directly unlocking 16,000 of these and support Canary Wharf's ambitious expansion, which is set to create up to 80,000 new jobs.



Commission's Priorities

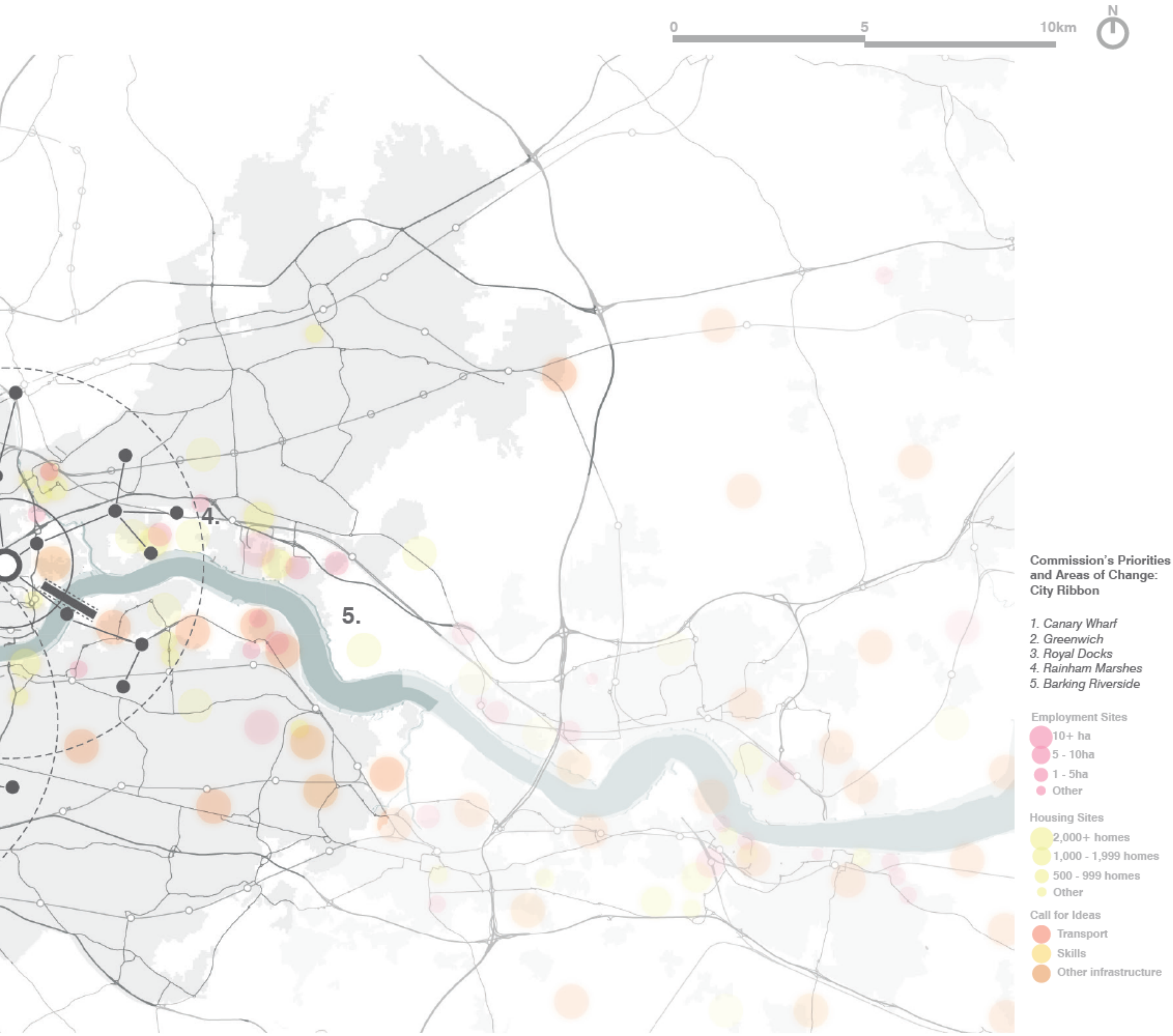
Accelerated Delivery Pilot

What: *Trial new delivery models to accelerate the scale and pace of delivery of homes and jobs in the Opportunity Areas within City Ribbon to bring forward the development stated in the London Plan by 2035. This could be done through housing delivery companies and the public sector acting as master developers.*

Why: *East London is a major focus for home and job growth. It should showcase how Government is delivering against the Industrial Strategy and need for new homes.*

How: *The Mayor of London, London boroughs and Homes England should work together to expedite delivery of jobs and homes. These organisations should make best use of existing powers, find solutions to current constraints such as borrowing caps and develop the skills and expertise to enable delivery.*

When: *Short term to bring forward stated delivery in 50% less time.*



New Thames Crossings

What: *Prioritise the planning and funding of river crossings. The Silvertown Tunnel and the DLR extension to Thamesmead should be operational by 2030. A third river crossing should be considered to facilitate homes and jobs.*

Why: *Poor accessibility limits the ability of the area to realise its full potential. New public transport and active travel crossings will unlock homes and jobs and contribute to place making.*

How: *The Mayor of London should deliver Silvertown Tunnel as quickly as possible. He should prioritise and bring forward the planning for public transport and active travel crossings.*

When: *Medium term delivery of the three crossings; short term priority planning.*

An Integrated Skills Strategy

What: *Implement a more targeted skills strategy that provides clear pathways to employment. It should support the area's existing and emerging economic sectors including the Production Corridor and the growing interest in the cultural and creative industries.*

Why: *Build on the success of the London Schools programme and be thought leaders for the Thames Estuary. The strategy should showcase how education and skills training can be used to address generational skills shortfalls and reduce levels of unemployment.*

How: *The Mayor of London should work with the boroughs, the Local Enterprise Partnership, employers and/or educational institutions to translate his Skills for Londoners strategy into a targeted plan for the area to ensure it meets current and future employer needs.*

When: *Quick win building off existing skills strategies including the Skills for Londoners Strategy and Place Making Institute.*

Inner Estuary

High performing dock infrastructure which creates opportunities for a wide range of sectors based in the surrounding community

Innovations in mobility and public transport will connect communities to the adjacent landscapes and diverse employment opportunities

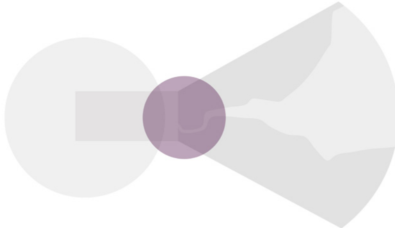
The area 'Inner Estuary' includes Thurrock, Dartford and Gravesham Councils, and Ebbsfleet Development Corporation. The area has approximately **22km of Thames waterfront**.

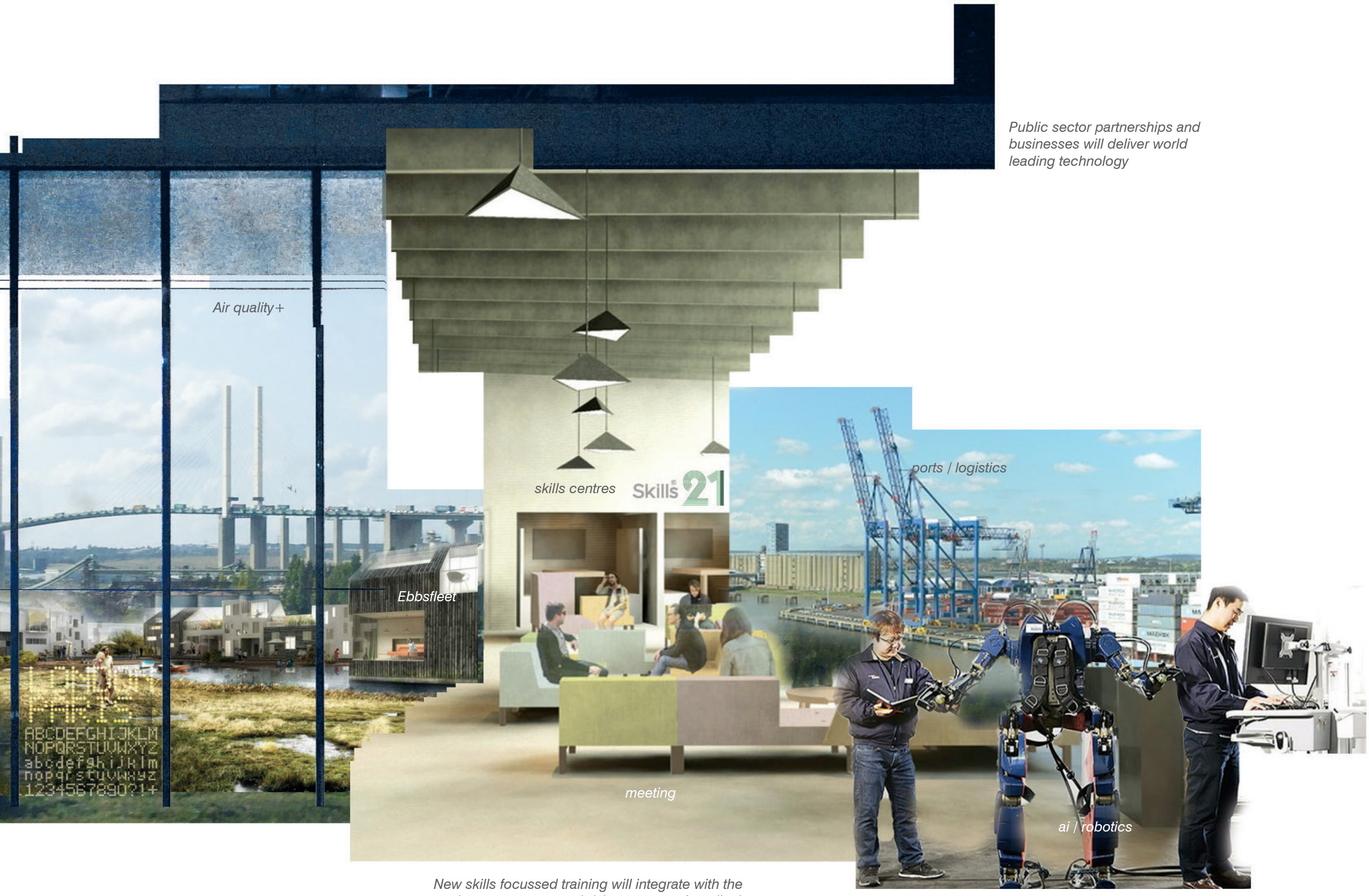
The core strengths of this place are its **connectivity** (which supports a growing higher value logistics and freight sector, including the **£1 billion investment in the Port of Tilbury** and further investment in the London Gateway Port) and the planned growth of **new town centres** at Ebbsfleet, Bluewater and Lakeside. The place is also promoting innovation in construction through **Modern Methods of Construction** with a particular focus on modular housing construction.

The challenges for the area include the unresolved **approach to the Swanscombe Peninsula**, **air quality** issues as a result of congested **river crossings**, the **slow pace of delivery** at Ebbsfleet Garden City (where delivery of 15,000 planned homes has slowed and there is a lack of job creation), **poor education and skills attainment**, and the need to maximise the homes and jobs that could be unlocked through **infrastructure investment** including the Lower Thames Crossing and Crossrail 1 extension to Ebbsfleet.

Within this context the Commission's vision for the Inner Estuary is:

A thriving and higher value Port of Tilbury and London Gateway Port will create opportunities for an upskilled and aspirational population. Healthy town centres will be home to creative businesses and high achieving schools. The delivery of Ebbsfleet Garden City, including a new Medical Campus and integrated sustainable transport systems, will bring new homes and jobs to a unique river landscape.





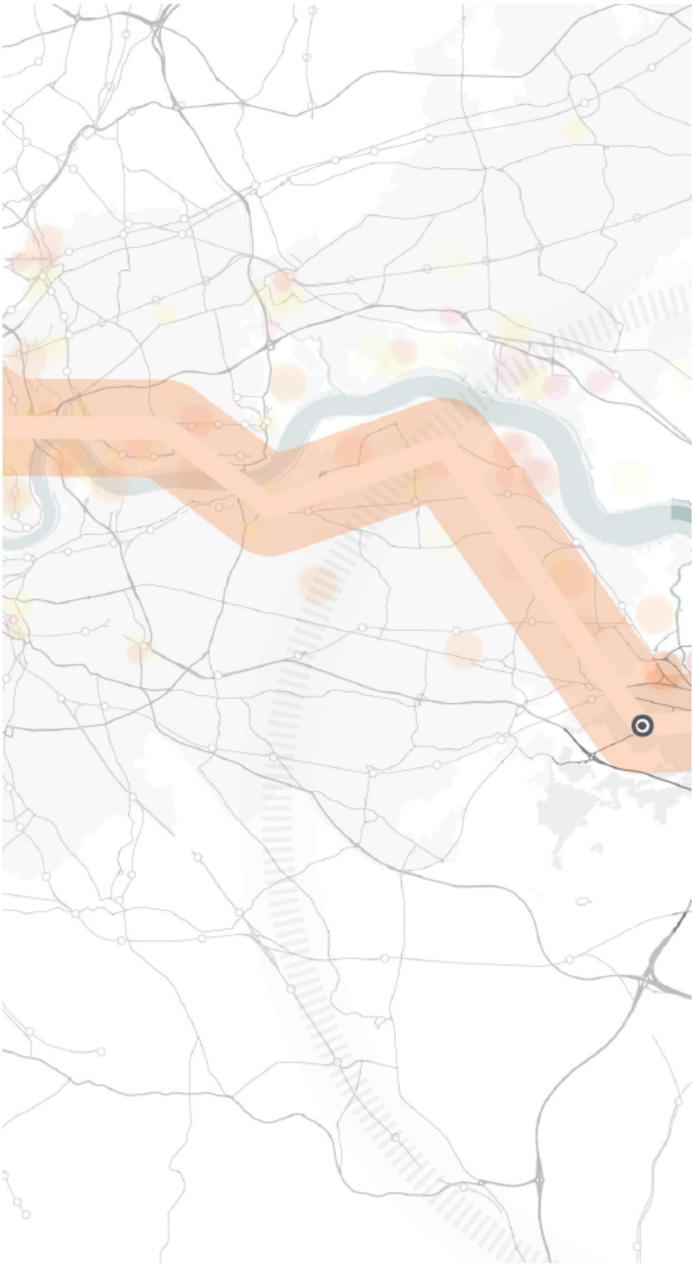
Public sector partnerships and businesses will deliver world leading technology

New skills focussed training will integrate with the work spaces to create thriving centres of medical excellence connected to open spaces that support healthy lifestyles

"A great future lies before Tilbury Docks... free of the trammels of the tide, easy of access, magnificent and desolate, they are already there, prepared to take and keep the biggest ships that float right upon the sea. They are worthy of the oldest river port in the world."

Joseph Conrad, The Mirror and the Sea

Inner Estuary



Within Inner Estuary, 109 infrastructure, skills and employment projects were subject to the prioritisation review. Some 73 projects were sifted out where they were either: a duplicate entry; there was insufficient information available on the project to meaningfully assess it; or because it represented ‘business as usual’ where it was considered that the project would not make a significant contribution to meeting the Commission’s vision for the area. Of the remaining 369 projects, almost 64% contributed to productive places and 58% to connected places. Around a third of the projects contributed to each of the affordable, thriving and adaptable places.

In addition, 58 large scale known and proposed employment and residential developments were identified. All of the developments were categorised as ‘business as usual’.

The Commission believes there is the potential to increase the scale and pace of delivery through some transformative projects; these priorities are set out opposite.

Beyond the three priorities, there are other projects which the Commission considers central to achieving its aspirations for the Inner Estuary. This includes resolving the proposals for the Swanscombe Peninsula. The Commission encourages the promoters of the London Resort to submit a Development Consent Order application for the proposal as soon as possible. Should an application not be submitted by the end of 2018, the Government should consider all the options for resolving the uncertainty this scheme is creating for the delivery of the wider Ebbsfleet Garden City.

The Commission is supportive of the proposals for the Lower Thames Crossing. However, in order to future-proof the proposed crossing, the Commission believes that the design should, as a minimum, not preclude the future delivery of infrastructure to support rail transport links and/or autonomous vehicles. Highways England should also work with the relevant local authorities to ensure that the design and location of the crossing and connector roads minimise impact on traffic flows, unlock jobs and homes growth in the surrounding area.

Commission’s Priorities

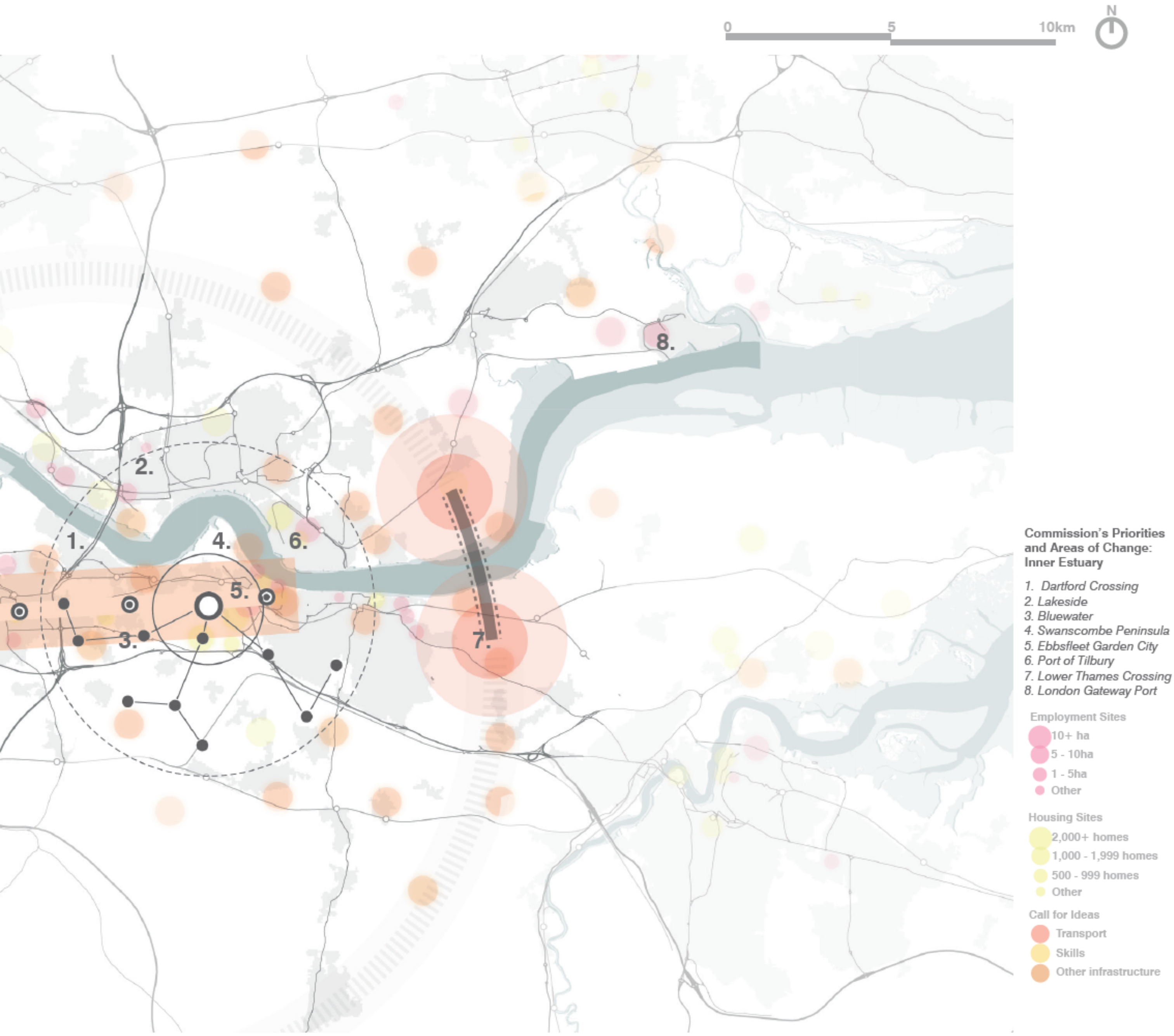
Extension of Crossrail 1

What: *Deliver an extension to Crossrail 1 from Abbey Wood to Ebbsfleet.*

Why: *The project could help to unlock 55,000 new homes, up to 50,000 new jobs and uplift skills and education by increasing rail capacity and creating new connections between economic hubs. This would need to go ahead in conjunction with upgrading supporting junctions. Key growth areas include Dartford town centre, Ebbsfleet Garden City and Swanscombe Peninsula.*

How: *Government should provide funding for the expected £20m cost of the next phase of project development. This would enable the detailed engineering, design, land and financial modelling and legal framework to be progressed.*

When: *Medium term delivery of the railway (by 2029); quick win to provide funding for the next phase of project development.*



Transport Innovation Zone

What: *Create a Transport Innovation Zone which promotes clean technology in transportation, logistics and data systems and unlocks housing opportunities with new means of public transport.*

Why: *The area forms part of the national road network for freight movements, and has a high density of tech and digital logistic usage. Also, due to the volume of traffic using its crossings and associated congestion, it suffers from significant air quality issues.*

How: *Government should incentivise research and development into sustainable travel and related digital technologies where it supports 'clean' movement.*

When: *Quick win to establish the governance arrangements and associated incentives for the Zone.*

Medical Campus

What: *Expedite the delivery of the Medical Campus at Ebbsfleet.*

Why: *Delivery of jobs at Ebbsfleet Garden City has been slower than planned. To make the area more attractive to the market, the delivery of the Medical Campus will provide an anchor employment institution.*

How: *Government should work with Kings College London to deliver the Medical Campus.*

When: *Short term (delivery by 2022).*

South Essex Foreshore

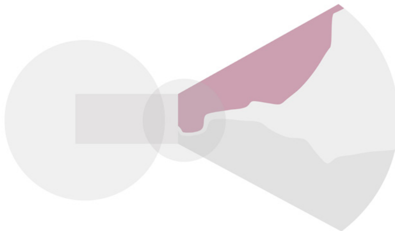
Local Investment in the public realm of High Streets including child friendly spaces

The area 'South Essex Foreshore' includes Basildon, Castle Point, Southend-on-Sea and Rochford Councils. Southend-on-Sea and Basildon are the major centres of a string of towns to the north of Canvey Island and the marshes around Hadleigh Ray and Holehaven Creek.

The core strengths of this place include the established and coordinated voice of **Opportunity South Essex**, the **unique wetland habitats** of the river edge and the emerging **cultural sectors** and medical and aviation related **advanced manufacturing in Southend-on-Sea**. The challenges of the area include **poorly performing town centres**, **slow speeds of delivery** linked to limited clarity on priorities across the area, and a **skills and jobs mismatch** between the primary employers and the majority of the workforce. In the future, the threat from **sea level rise** will require major investment in integrated flood defences.

Within this context the Commission's vision for South Essex Foreshore is:

The rich patchwork of places which form the South Essex Foreshore will be celebrated. Empowered by a statutory Joint Spatial Plan the area will go beyond 'business as usual'. Locally driven town centre transformation will help create lively places that people choose to work, live, learn and play in. These policies and local initiatives will see development unlocked, post-industrial landscapes restored, and the filling of empty business spaces to create a thriving and creative economy.



Innovative delivery models for affordable housing and workspace in town centre environments

Continued support for distinctive 'Essex' architecture in housing design

Strong connections to Southend Airport to add value / skills to local centres

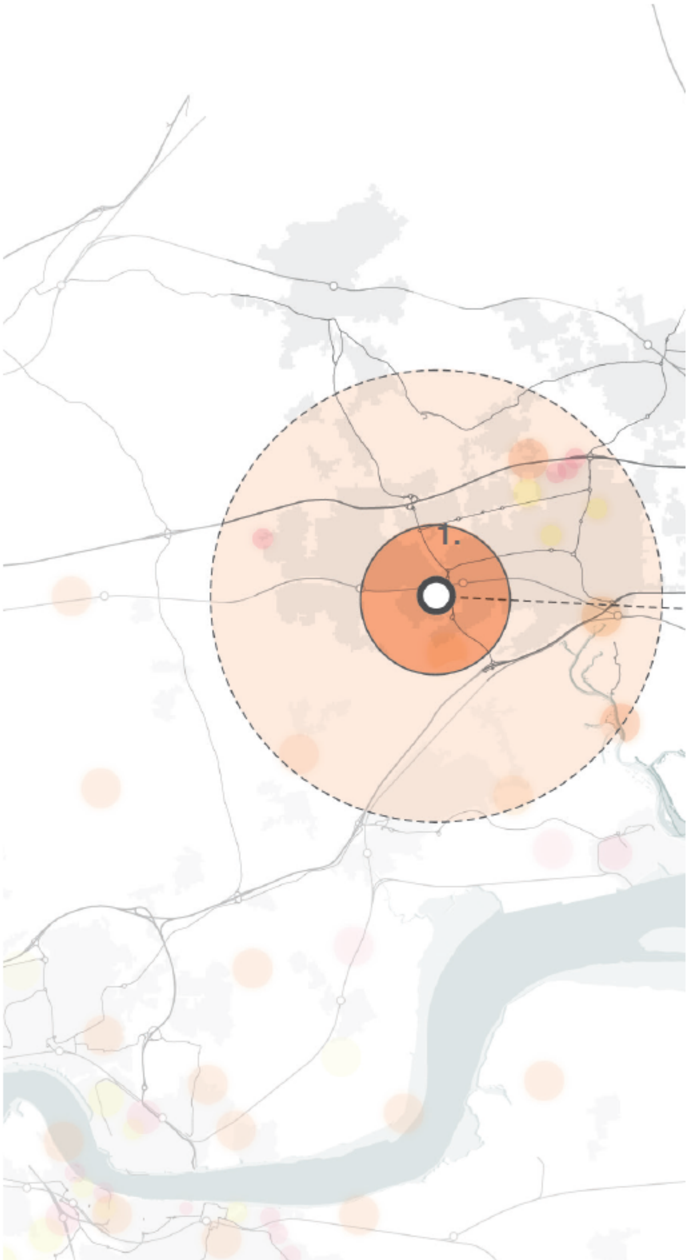
Protection of, and increased access to, unique foreshore landscapes through partnership

Continued support for local culture and creative enterprises

"What we've seen over the past 10 years is this huge burgeoning of the artistic scene in Southend...You've got a lot of creative people coming out of London and looking for new, affordable spots. Southend has such an opportunity to be a thriving place for the creative industries, but you need that underlying structure to support it. This is only the starting point."

Joe Hill, Focal Point Gallery

South Essex Foreshore



Within the South Essex Foreshore area, 119 infrastructure, skills and employment projects were subject to the prioritisation review. Some 56 projects were sifted out where they were either: a duplicate entry; there was insufficient information available on the project to meaningfully assess it; or because it represented 'business as usual' where it was considered that the project would not make a significant contribution to meeting the Commission's vision for the area. Of the remaining 63 projects, around 71% contributed to productive places, with 49% contributing to connected places and 46% contributing to affordable places.

In addition, 35 large scale known and proposed employment and residential developments were identified. All of the developments were categorised as 'business as usual'.

There is a large number of identified local and strategic projects throughout South Essex Foreshore. The Commission believes that these projects can be better coordinated and prioritised to maximise their impact. The Commission therefore supports the work already being undertaken by local authorities on a Joint Spatial Plan and believes it should have a statutory footing. In completing the Plan, the local authorities should continue to work with other authorities within the Housing Market Area/neighbouring areas, Essex County Council and Opportunity South Essex to produce an integrated strategy for delivering and funding high-quality homes, employment, transport and other infrastructure. The Plan should also be ambitious - going above the minimum housing numbers set by Government - to attract substantial infrastructure investment from Government.

The Commission also supports a number of related initiatives, which are central to achieving its vision for the area. Firstly, local authorities should explore what support can be provided to SMEs, financial or otherwise, to help bring forward needed new employment space. Secondly, planned railway improvements, particularly around Southend-on-Sea and London Southend Airport, should be delivered to increase capacity. Lastly, road, rail and relevant local authorities should work together to minimise conflict between goods and people on the transport network, with the aim of increasing road capacity/number of services on existing railway lines.

Beyond these projects, the Commission has identified three other priorities.

Commission's Priorities

SE Foreshore Fund

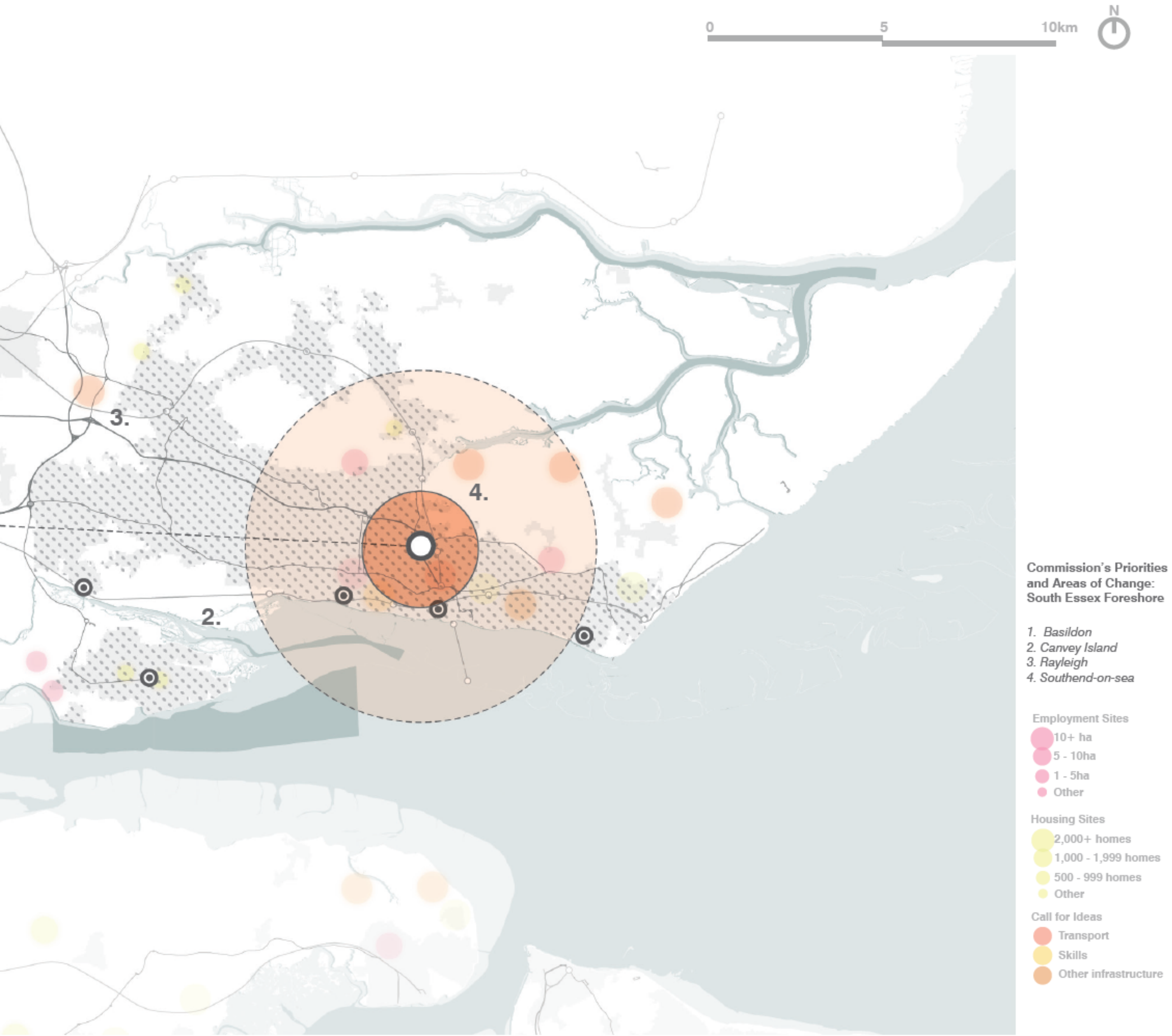
Rose Street Market ©

What: *Create a fund which local authorities and local communities can bid for. Projects should support town centre regeneration and/or community development.*

Why: *Give local communities and organisations the opportunity to direct investment where it is most needed to support local aspirations and town centre regeneration.*

How: *Government to make available a £20 million fund and provide support to the four local authorities and local communities in their funding bids.*

When*: Quick win for first raft of funding in 2019.*



SEC Relocation


South Essex College ©

What: Expedite the relocation of the South Essex College's Nethermayne campus to Basildon town centre.

Why: This site is central to the Council's aspirations for redevelopment of Basildon town centre. It provides the opportunity to introduce new courses which align with the needs of local employers and sectors and address lower education and skills levels in the area across multiple generations.

How: Basildon Council and Essex County Council should work with South Essex College to deliver the re-location.

When: Short term (delivery by 2022).

Institute for Resilient Infrastructure


Purdue University ©

What: Establish a centre for the research, design and funding and financing of integrated infrastructure to address contemporary and future city challenges.

Why: The Institute needs to be up and running to ensure the Thames Estuary has the skills and knowledge needed to design and deliver key infrastructure such as the second Thames Barrier. It will also identify delivery and governance models that can enable strategic infrastructure to be funded by the private sector.

How: Government to approach existing institutions to identify interest. If possible, Government should explore the potential for collaboration with private sector education and technology leaders to provide teaching and skills development training space.

When: Short term delivery (by 2024); Quick win to approach existing institutions.

North Kent Foreshore

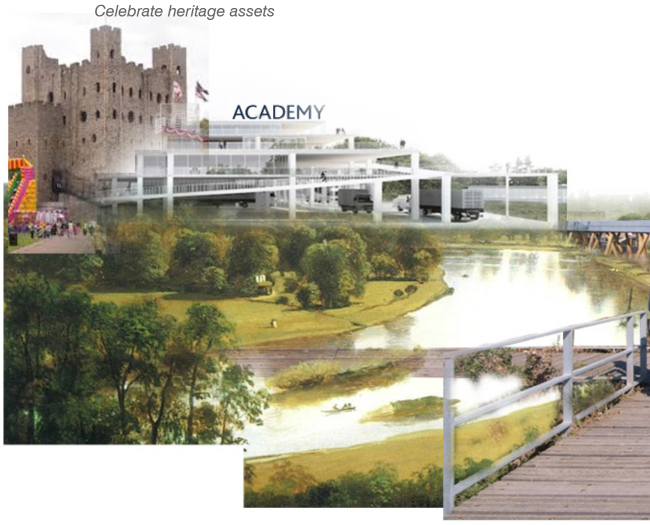
The area 'North Kent Foreshore' includes Medway, Swale, Canterbury and Thanet Councils. It is a rich and diverse area formed by the **ancient Medway Towns**, and the settlements that stretch along the Roman '**Wattling Way**' between Sittingbourne, Canterbury and the arc of distinctive coastal places between Whitstable and Ramsgate.

The strengths of this place include its **universities** which together form an emerging **medical research corridor** connecting the Francis Crick Institute through Chatham to Canterbury. The historic assets of the area's cities are matched by **productive agricultural landscapes** which spread out between them, both of which provide opportunities for continued growth of niche tourism.

The challenges of the area include the connection between the **skills** needs of employers and the education and skills training available to the community. The area also has a high level of **'digital deprivation'** which is seen to stymie start-up and SME growth in the digital industries.

Within this context the Commission's vision for North Kent Foreshore is:

Celebrate heritage assets



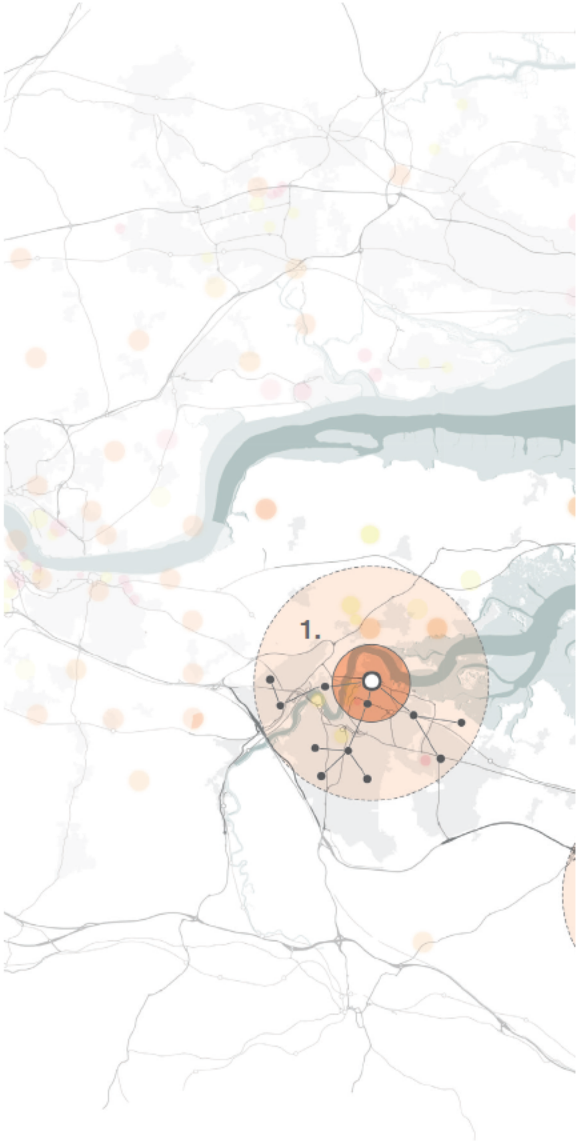
Improved and managed access to unique wetland landscapes

At the heart of a new medical research corridor, North Kent Foreshore will be home to a supercentre of health and wellbeing. Through a statutory Joint Spatial Plan, and strong connections between local government and business, the area will balance delivering growth in the health sector with new jobs, new homes, a renewed focus on skills, and high-quality town centres set around world-class heritage and natural assets.

"The Thames Estuary is an edgeland - not quite river, not quite the open sea. It is an in-between place, a place of transition, a welcoming gateway, a corridor of trade, the front line for the defence of the realm and a gradual opening into the rest of the world."

Colette Bailey, Artist Director of Metal

North Kent Foreshore



Within the North Kent Foreshore area, 152 infrastructure, skills and employment projects were subject to the prioritisation review. Some 67 projects were sifted out where they were either: a duplicate entry; there was insufficient information available on the project to meaningfully assess it; or because it represented 'business as usual' where it was considered that the project would not make a significant contribution to meeting the Commission's vision for the area. Of the remaining 85 projects around 80% contributed to productive places, 75% to connected places and 42% to affordable places.

In addition, 54 large scale known and proposed employment and residential developments were identified. All of the developments were categorised 'business as usual'.

There are significant opportunities for growth and development in North Kent Foreshore. The Commission believes that further work is needed to coordinate initiatives already underway and to propose new initiatives to optimise the potential outcomes. This should be achieved through a statutory Joint Spatial Plan led by the local authorities, with the participation of other authorities within the Housing Market Area/neighbouring areas, Kent County Council and Thames Gateway Kent Partnership to produce an integrated strategy for delivering and funding high-quality homes, employment, transport and other infrastructure. The Plan should also be ambitious - going above the minimum housing numbers set by Government - to attract substantial infrastructure investment from Government.

The Commission also supports the following related initiatives, which are central to achieving its vision for the area: local authorities should explore what financial and other support can be provided to SMEs to help them bring forward needed employment floorspace; planned railway improvements particularly around Canterbury should be delivered to increase capacity; and road and rail authorities should work together (with local authorities where relevant) to minimise conflict between goods and people with the aim of increasing road capacity/number of services on existing railway lines.

Beyond these projects, the Commission has identified three other priorities. These are set out opposite.

Commission's Priorities

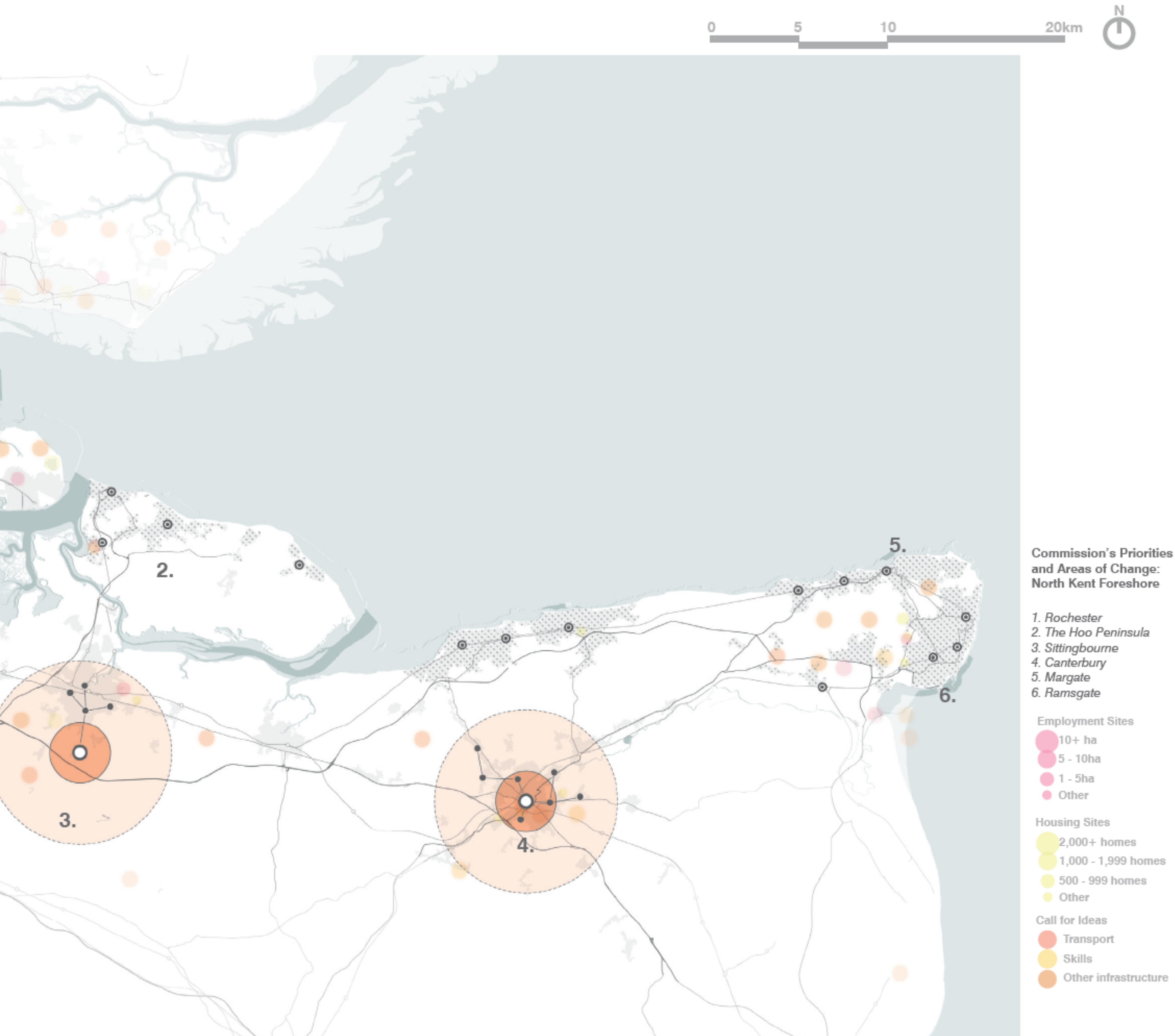
NK Foreshore Fund

What: Create a fund which local authorities and local communities can bid for. Projects should support town centre regeneration and/or community development.

Why: Give local communities and organisations the opportunity to direct investment where it is most needed to support local aspirations and town centre regeneration.

How: Government to make available a £20 million fund and provide support to the four local authorities and local communities in their funding bids.

When: Quick win for first raft of funding in 2019.



Education and Skills

Ensinger Plastics ©

What: *Implement a more targeted skills strategy with employers and educational institutions that provides clear pathways to employment that support the area's existing and growing economic sectors.*

Why: *The 30 year vision allows this project to address generational skills shortfalls. It will improve educational attainment and skills in the area, across multiple age groups, therefore reducing levels of unemployment.*

How: *Kent County Council should work with the local authorities, the Local Enterprise Partnership, employers and/or educational institutions to develop a targeted plan for the area, which meets current and future employer needs.*

When: *Quick win building off existing skills strategies in place.*

Health Supercentre

Herzog and de Meuron ©

What: *Develop the new health and medical facilities at Canterbury to provide the eastern anchor to the supercentre.*

Why: *This project will act as a catalyst to the health supercentre building on the emerging health sector, cluster of academic institutions and transport connections in the area to increase productivity and jobs in the area.*

How: *Universities should be supported by Government and work closely with local communities to deliver promised facilities, to boost medical research and services while supporting workforce retention.*

When: *Short term delivery of facilities (by 2023).*

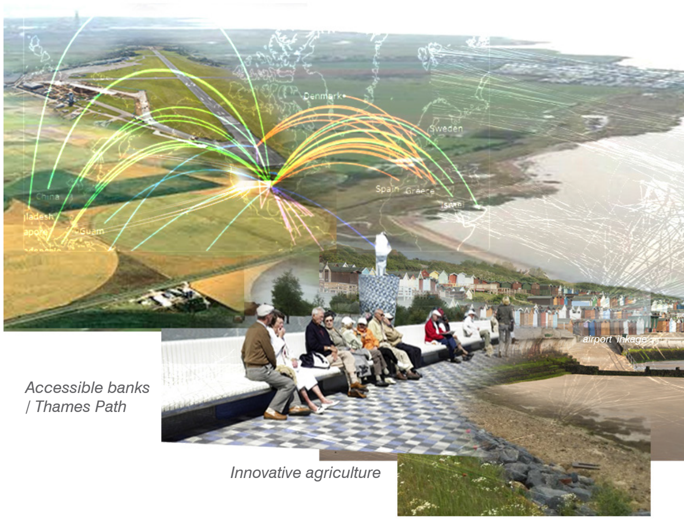
The River Thames

The River Thames is the **ancient heart** of the places of the Thames Estuary. It is a **global river** - connecting the Capital and five of the UK's largest ports to the rest of the world.

The strengths of the river remain its **strategic role** as a gateway to UK trade and industry and a vital and **flexible** component of the national infrastructure strategy. This is **balanced** by its **unique natural qualities** of ecology, habitat and landscape, which have long inspired the area's cultural and creative industries. The River Thames defines the quality of place of the cities, settlements and deep 'foreshores' which line it.

One of the challenges to the River Thames supporting the growth of the area is its **fragmented governance.** The multiple agencies (including the Environment Agency, Natural England, Port of London Authority, Marine Management Organisation) and private agendas prevent integrated solutions to some of the river's key challenges. **New crossings** will require careful integration, and the mitigation of sea level rise with **multi-functional defences**, which protect people and infrastructure from flooding will require new and innovative ways of working. Improving **water quality** and increased use of the river for **aquaculture** and **leisure** will enable the river to play a key role in the area's sustained growth.

Within this context the Commission's vision for the River Thames is:

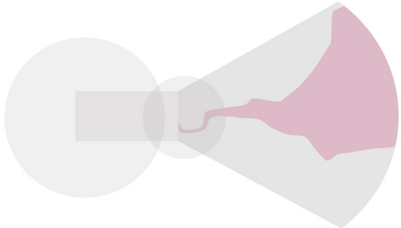


Accessible banks / Thames Path

Innovative agriculture

A continuous Thames Path - celebrating the diversity of the River along its length

The river's ebb and flow will continue to connect the Foreshores, Inner Estuary and City Ribbon. Its multi-functionality will continue to evolve, from freight to fishing and from beach to boardroom - constantly emphasising the value of the river to its surrounding places and ensuring that the current level of flood protection is maintained. Its vital contribution to economic and social prosperity will place it at the heart of Thames Estuary 2050.



Centre for future logistics - connecting the assets of the river to local skills and local jobs

Continued investment in culture and programming of the River and its connected communities

> *"The River Thames is ancient; older than England, older than humanity, even older than the British Isles themselves. Its life cycle operates on a geological timescale. The river is almost a living being, writhing sinuously across its flood plain, eroding its banks and altering its channel, constantly changing."*

Andrew Sargent, The Story of the Thames

The River Thames

Within the River Thames, 25 infrastructure, skills and employment projects were subject to the prioritisation review. Some 15 projects were sifted out where they were either: a duplicate entry; there was insufficient information available on the project to meaningfully assess it; or because it represented 'business as usual' where it was considered that the project would not make a significant contribution to meeting the Commission's vision for the area. Of the remaining 10 projects, 80% contributed to adaptable places and 70% contributed to connected places. This reflects that the projects largely focus on environmental improvements associated with flood defences and increasing access to the river.

No large scale known and proposed employment and residential developments were identified.

The Commission believes the River Thames can be a catalyst for growth and change in the four other 'productive places'. In order to do so it must be well used and well-loved. Three priorities have been identified to achieve this.

Commission's Priorities

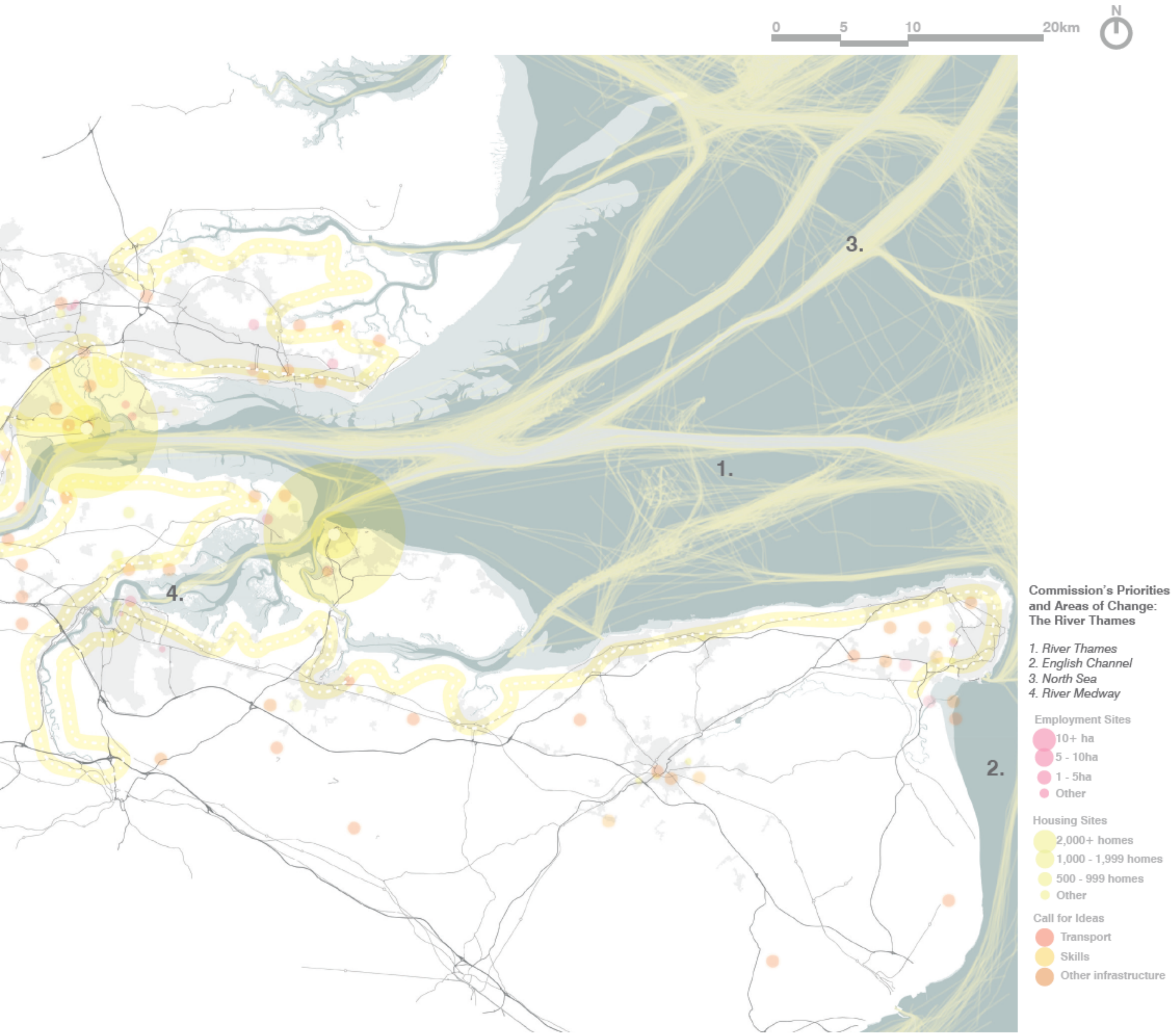
Great Thames Park

What: *Establish the Great Thames Park to celebrate and maximise the value of the area's natural assets. This should include improving access to and use of the River Thames for pedestrians and cyclists.*

Why: *It will create a 'brand' which attracts inward investment as well as residents and visitors to the area and improves connections between places.*

How: *Local authorities, environmental bodies and river regulators should prioritise investment in the Thames Path and associated projects. Government to consider the governance arrangements required to support the Great Thames Park.*

When: *Medium term with measures in the short term to put governance strategies in place. Quick win to deliver first new section of the Thames Path by 2020.*



Thames East Line

What: *Delivery of new multi-modal (including rail) crossing east of the Lower Thames Crossing combined with the second Thames Barrier. Potential interchange points could be Basildon and the Medway Towns.*

Why: *To maximise the benefits arising from a second Thames Barrier (which will provide a world-class standard of flood protection) including improved north-south connectivity, enhanced linkages with other high productivity corridors around London, agglomeration opportunities at interchanges and improved access to England's high speed railway network.*

How: *Government should consider a multi-modal crossing as part of its planning for the next Thames Barrier. This includes the financing models which could be used to deliver the project by 2050.*

When: *Long term delivery with measures in the short and medium term to commence project planning.*

Celebrate the Thames

What: *Build on the success of the existing Thames Festival and the Port of London Authority's Thames Vision to create a programme of festivals, events and promotional activities.*

Why: *To celebrate the River Thames, its creative and cultural industries and to attract inward investment and visitors to the area.*

How: *A programme of events should be developed and led by the Thames Gateway Strategic Group working with local businesses and community groups.*

When: *Quick win to ensure additional funding and support for Estuary Festival 2019.*

Governance and Delivery

The Commission has an ambitious vision for the Thames Estuary, which it believes has the potential to deliver 1.3 million new jobs and £190 billion additional GVA by 2050. At least 1 million new homes will need to be delivered to support this growth, but the Commission believes there is scope for the Thames Estuary to be even more ambitious in responding to London's ever growing housing need. Realising this ambition will require a coordinated delivery plan, which will in turn be dependent on strong, streamlined governance.

The resounding message from the consultation that the Commission has undertaken is that there is ambition in the Thames Estuary to deliver high-quality development and the best economic outcomes for people. However, the Commission believes that a 'business as usual' approach will not deliver growth at scale and pace; governance reform and new delivery models are needed.

The Commission believes that Government should work closely with local partners to determine the governance reform required to drive growth in the Thames Estuary. In the first instance, the Commission recommends that a **robust, locally-led review of governance arrangements be undertaken, to be concluded within six months**. This review should bring forward proposals for strong, streamlined governance arrangements to drive growth - particularly in Kent and Essex - but encompassing the whole area. In undertaking the review, local partners should draw on lessons learned from places that have secured City, Devolution and Growth Deals, attracted major private sector investment, and delivered significant change.

It is right that local partners should, in the first instance, define the governance reform needed to drive growth in the Thames Estuary. However, if robust proposals to reform governance and drive delivery are not forthcoming from local partners within six months, a more top-down approach will be required.

The Commission has undertaken extensive engagement over the past two years and carefully considered the case for the role of governance reform in driving growth in the area. The Commission believes that the optimal governance arrangements should include the following:

A single voice for the Thames Estuary through a strengthened and streamlined Thames Gateway Strategic Group (TGSG): The TGSG as presently constituted is ill-equipped to articulate a shared vision and strategy for the area. Local authorities should strengthen it by providing capacity funding and streamlining membership, so that it may speak to Government with a single voice on key strategic, Estuary-wide issues. Government should endorse the Chair of the TGSG, who would act as a single 'champion' for the Thames Estuary to spearhead collaboration and help make the case for inward investment.

The development of statutory Joint Spatial Plans in Kent and Essex: The Commission believes that, to enable the continued prioritisation of investment, statutory Joint Spatial Plans should be produced in Kent and Essex. The precise geography should be defined by local partners in the first instance as part of the locally-led governance review, building on existing collaborations and administrative boundaries. On this basis, there is a clear case for focusing a Joint Spatial Plan on south Essex, where work is already underway. The optimal geography for a Joint Spatial Plan in north Kent is less clear, and local authorities should work toward agreeing a preferred geography within the next six months. The Plans should build consensus around areas of focus, continue to strengthen the growth narrative for the area, and package and prioritise key projects. This will enable more effective delivery and provide a stronger focus for attracting private sector investment. If these Plans demonstrate sufficient growth ambition - going above the minimum threshold set out by Government for local housing need; and being given statutory status - **Government should reward this ambition with substantial infrastructure investment and freedoms and flexibilities**. This could take the form of a ‘roof tax’, or other incentive to accelerate housing delivery and support growth.

A revision of the geographical boundaries of South East Local Enterprise Partnership (LEP): Analysis undertaken by the Commission suggests that the Thames Estuary is a tapestry of productive places, requiring tailored growth strategies. Through the locally-led governance review, local partners should bring forward proposals to revise the geographical boundaries of South East LEP. South East LEP is one of the biggest LEPs in the country, second only to London in terms of population and number of local authorities. The Commission suggests that local partners consider the formation of two new LEPs within the Thames Estuary, one for Essex, Southend-on-Sea and Thurrock, and another for Kent and Medway. Aside from geography, the Government review into strengthening LEPs should consider the best organisational structure for LEPs, and whether they are adequately resourced to drive growth.

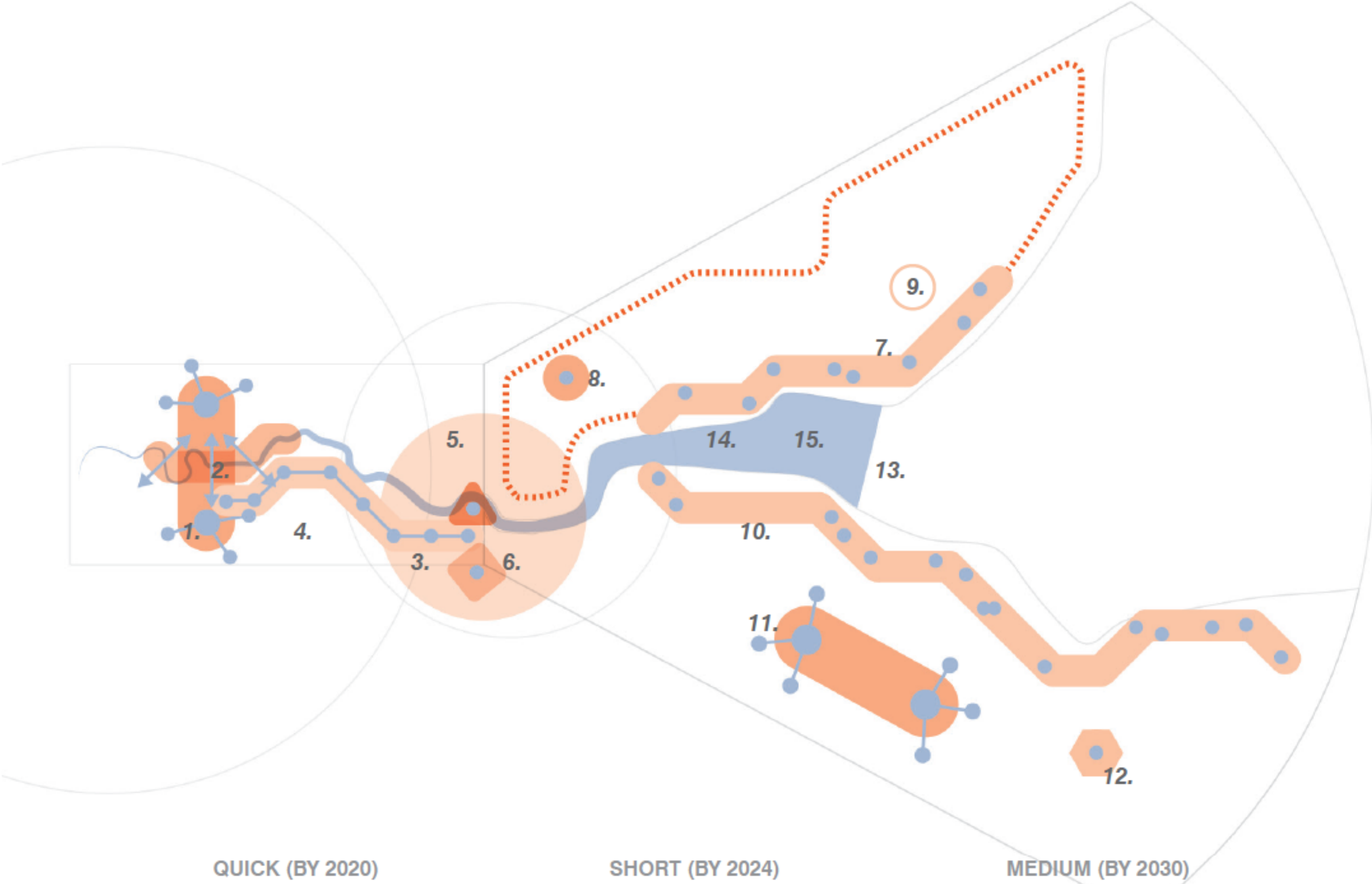
Development corporation(s) with planning, and compulsory purchase powers to drive the delivery of homes and jobs aligned to major infrastructure investment: Whether these are locally-led should be dependent on the scale of the development. In addition, local partners should consider whether Homes England’s full resources and powers, including plan-making and development control powers, should be deployed to maximise the local growth benefits of major infrastructure investments like the Lower Thames Crossing. The Commission believes that development corporations, backed by substantial investment, planning powers and freedoms and flexibilities from Government, and coordinated by a strengthened and streamlined TGSG would be an effective way to drive growth in the Thames Estuary in key opportunity areas across the Thames Estuary.

Strengthened governance arrangements for the River Thames itself: The creation of a co-ordination office or lead organisation could be more effective in maximising the potential of the River Thames.

In return for strengthened and streamlined governance arrangements, the Commission would like to see **revenue raising powers and tax (or other) incentives granted to the Thames Estuary** to drive delivery of infrastructure, housing and jobs.

The Commission's Priorities

The Commission believes that the fifteen priorities identified in this document are critical to achieving its vision for the Thames Estuary by 2050. The priorities for each 'productive place' should be pursued simultaneously so that their impact is maximised and they work together to provide 'whole place' solutions.



QUICK (BY 2020)

3. An Integrated Skills Strategy

5. Transport Innovation Zone

7. SE Foreshore Fund

9. Institute for Resilient Infrastructure

10. NK Foreshore Fund

11. Education and Skills

13. Great Thames Park

15. Celebrate the Thames

SHORT (BY 2024)

1. Accelerated Delivery Pilot

6. Medical Campus

8. SEC Relocation

12. Health Supercentre

MEDIUM (BY 2030)

2. Three New Thames Crossings

4. Extension of Crossrail 1

LONG (BY 2050)

14. Thames East Line

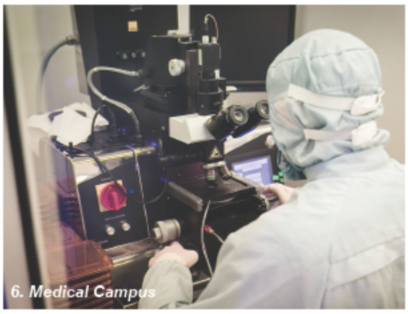

1. Accelerated Delivery Pilot


2. Three New Thames Crossings


3. An Integrated Skills Strategy


4. Extension of Crossrail 1


5. Innovation Zone


6. Medical Campus

7. SE Foreshore Fund


8. SEC Relocation


9. Institute for Resilient Infrastructure

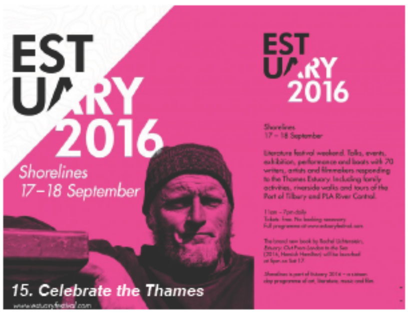

10. NK Foreshore Fund


11. Education and Skills


12. Health Supercentre

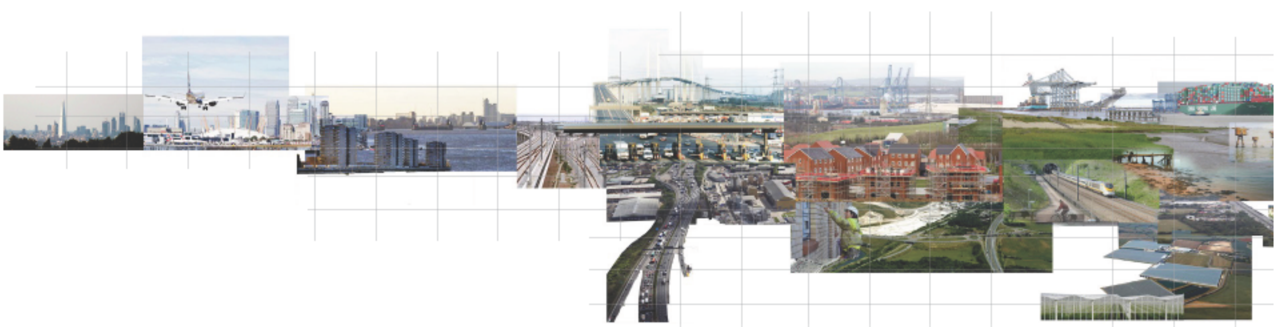

13. Access to the River

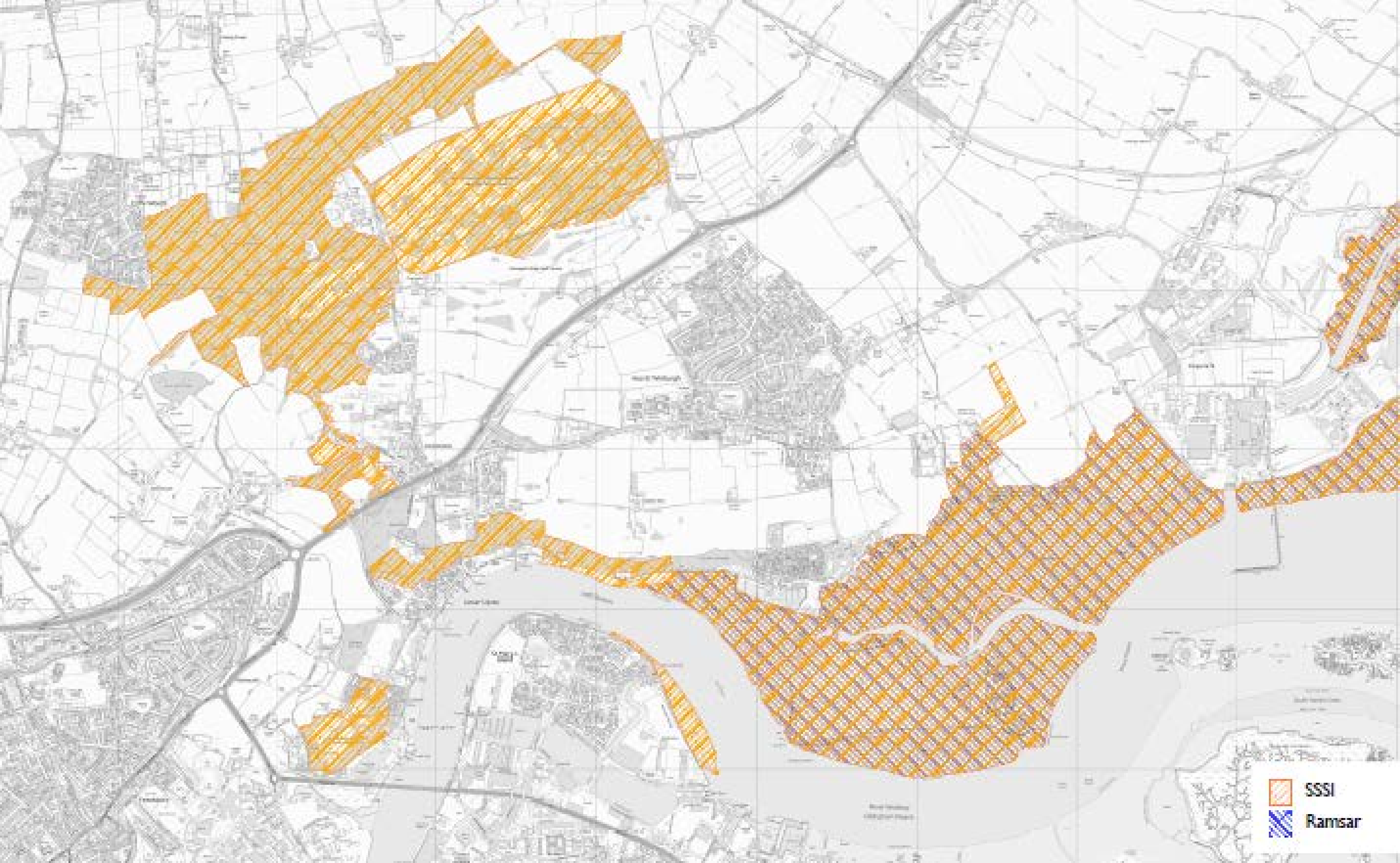

14. Thames East Line



15. Celebrate the Thames

ARUP

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JOINT BOARD *Leader, Ward Member's rep, Parish Council's rep, Asst. Director, NRGG HoS, Hoo Consortium rep, Homes England, Department for Transport, Natural England, Gravesham Borough Council Member, MP*

Steering and Delivery Group *HIF Officers, Network Rail, DfT, CCG, Homes England, GBC Officer, Hoo Consortium rep,*

Thematic Delivery Group (RAIL) *HIF Officers, Network Rail, GBC, Parish, HC rep ....*

Thematic Delivery Group (ROAD) *HIF Officers, Network Rail, GBC, Portfolio holder, Parish, HC rep ...*

Thematic Delivery Group (Essential Additional Infrastructure) *HIF Officers, Parish, CCG, Health, Sports, NE, HC rep, RSPB ....*

Community Participation Group *HIF Officers, Parish Councils, RSPB ....*