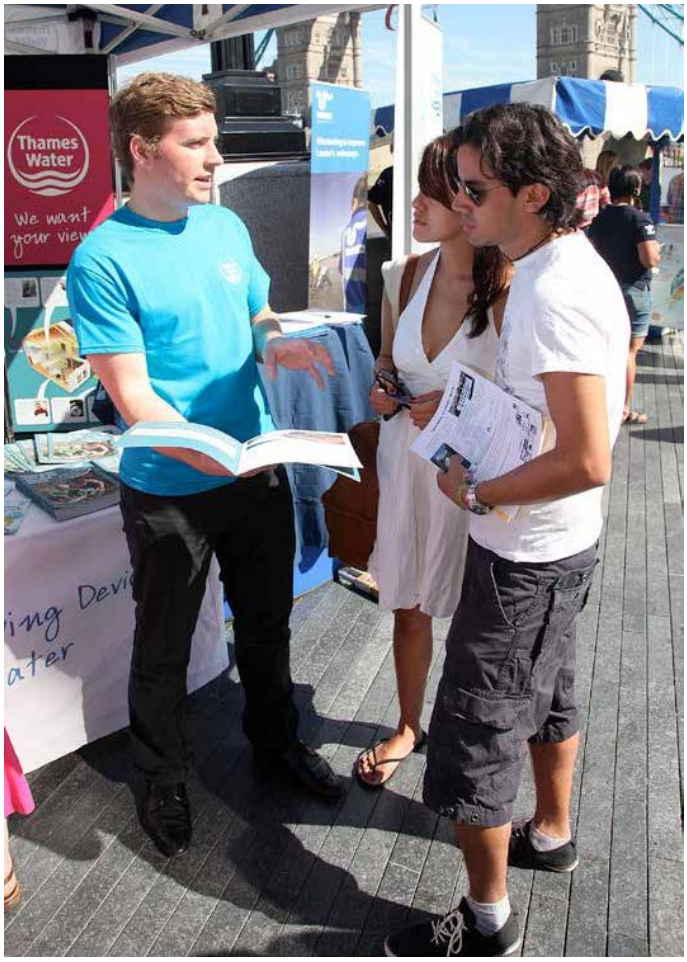
Thames Water

Final Water Resources Management Plan 2015 - 2040



Executive Summary

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Section 0 Executive Summary

0.1 Introduction

This document is the Executive Summary of our Water Resources Management Plan (WRMP14) which covers the 25-year period from 2015 to 2040. The WRMP14 is an update of the draft WRMP14 (dWRMP14) published in May 2013, amended to take account of the representations received to the public consultation and new technical data and information which has become available since the dWRMP14 and additional information requested by Defra (March 2014).

The Executive Summary summarises the main components of our WRMP14 and the preferred programme for managing resources in London and the Thames Valley over the next 25 years. It broadly follows the structure of the Part B technical report (Sections 1-10).

Throughout the document we have included cross references to other sections of the technical report and appendices for further information.

The Executive Summary is structured as follows:

- Background
- Our water supply area
- Priorities and objectives in developing our plan
- Our forecasts of demand and supply
- The planning problem;
- Options to manage demand and provide supply;
- Determining our preferred programme;
- The preferred investment programmes;
- Sensitivity testing

0.2 Background

Thames Water is the UK's largest water and wastewater services company. We serve over 13.5 million customers in London and the Thames Valley, supplying an average of 2,600 million litres of drinking water and treating around 2,800 million litres of sewage per day.

We have a legal duty to develop and maintain an efficient and economical system of water supply [1] and every five years we are required to produce a Water Resources Management Plan (WRMP) [2] which set outs how we plan to maintain the balance between supply and demand for water over a 25 year period.

We have followed the Water Resources Planning Guideline (WRPG)[3] in developing our plan. The Guideline provides a framework to guide the preparation of plans setting out good practice, the various approaches to follow, and the information that a plan should contain.

An aspect which has been reinforced by Government and the regulators in the preparation of this round of water resource plans, and also business plans, is the involvement of customers[4] in determining the appropriate levels of service, priorities and strategy.

In May 2013 we published our dWRMP14 covering the 25-year period from 2015 to 2040 for public consultation. We received 350 responses to the public consultation. On 30 October 2013 we published a Statement of Response in which we set out the representations that we received to the consultation, our consideration of the issues raised and changes made to the dWRMP14 as a result of the representations. We have also taken account of new and updated technical data and information in revising our plan.

In December 2013 we submitted our Business Plan to Ofwat. The Business Plan covers all aspects of our business and sets out our strategy for the next 5 years from 2015 to 2020. The water resources planning process works alongside the business planning process and the first 5 years of the WRMP14 forms the water resources proposals in the Business Plan. Ofwat, following consideration of the Business Plan, will determine the price limits for the next 5 years, which will confirm the funding for the water resources programme that we deliver.

[1] Water Industry Act 1991, Section 37

[2] Water Industry Act 1991, Sections 37A to 37D, (as amended by the Water Act of 2003).

[3] Water Resources Planning Guideline: The guiding principles for developing a water resources management plan, June 2012, Development by Environment Agency, Ofwat, Defra and the Welsh Government & associated documents

[4] Involving customers in price setting – Ofwat's customer engagement policy, Ofwat, August 2011

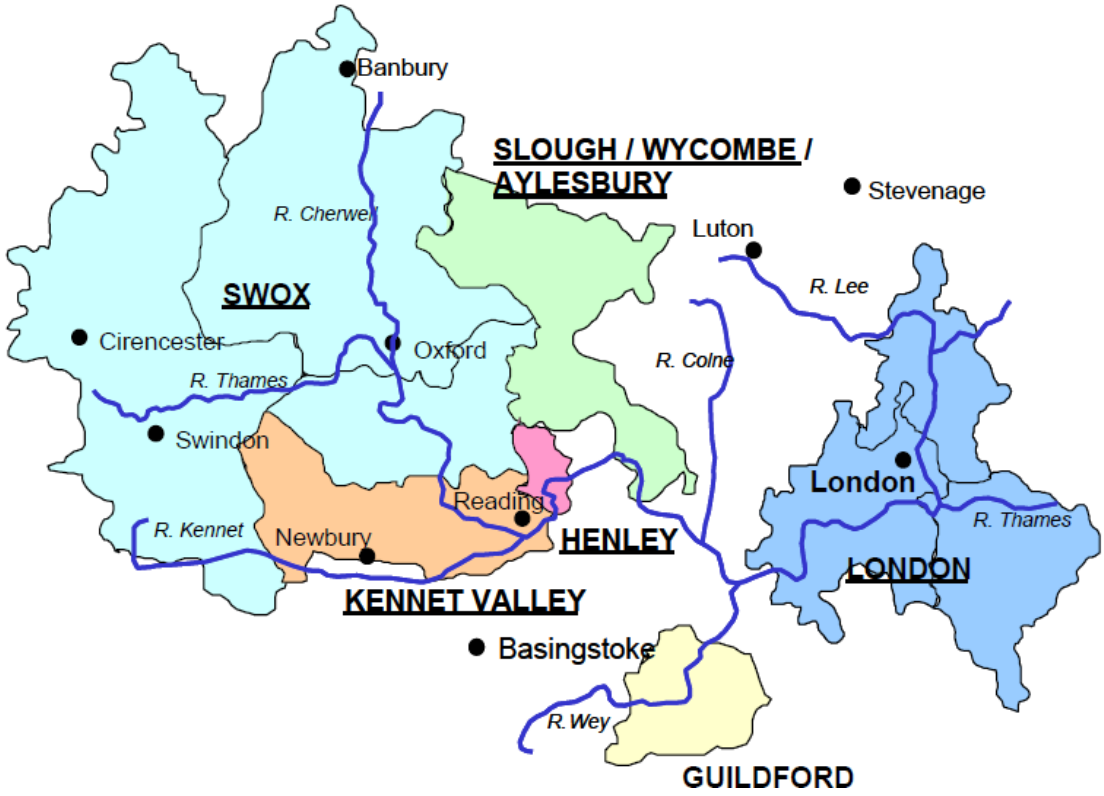
0.3 Our water supply area

This section provides information on our water supply area and the levels of service that we plan for.

Section 1.4 and Appendix D

Our water supply area covers around 8,000 square km. The area is divided into six water resource zones (WRZ) – London, Swindon and Oxfordshire (SWOX); Slough/Wycombe/Aylesbury (SWA); Kennet Valley; Guildford; and Henley. These are areas within which all water resources can be shared and therefore customers experience the same level of service. They are defined by the major towns and cities, the main points where we pump water from rivers or boreholes, and the major water mains. In developing our plan we reviewed the integrity of our WRZs with the Environment Agency and they were found to be appropriate for planning purposes. Our WRZs are shown below in Figure 0-1. The WRZs outside London are referred to collectively as the 'Thames Valley'.

Figure 0-1: Water Resource Zones (WRZ) in the Thames Water Supply Area



0.3.1 Levels of service

Section 1.4.2 and Appendix T

We plan resources to ensure we can provide specific levels of service to our customers. The levels of service state the average frequency that a company will apply restrictions on water use, for example we expect to have to warn customers of the need to save water, without the need to impose restrictions, once in every 5 years. Our levels of service are shown in Table 0-1. We tested our levels of service with our customers. Overall customers, both domestic and business customers, did not want a reduction in the levels of service provided. They showed strong preferences to avoid severe restrictions on water use however they told us that they would tolerate occasional hosepipe bans where these become necessary, provided they are satisfied that we, as a company, are also doing the most we can to conserve water supplies. As such, we have retained the levels of service that we had in previous water resource plans.

Table 0-1: Our levels of service for water restrictions

Restriction Level	Frequency of Occurrence	Water use restrictions
Level 1	1 year in 5 on average	Intensive media campaign
Level 2	1 year in 10 on average	Sprinkler/unattended hosepipe ban, enhanced media campaign
Level 3	1 year in 20 on average	Temporary Use Ban (formerly hosepipe ban), Drought Direction 2011 (formerly non-essential use bans) requiring the granting of an Ordinary Drought Order. NB Drought Permits (Section 9.5) are also part of Level 3 measures, but do not impinge directly on customers and so are not strictly relevant to customer service levels.
Level 4	Never	If extreme measures (such as standpipes and rota cuts) were necessary their implementation would require the granting of an Emergency Drought Order

0.4 Priorities and objectives in developing our plan

There is wide interest in the management of water resources and this section outlines the work we have undertaken to engage with our customers, stakeholders and regulators in the development of our plan. It also sets outs the importance of planning resources in the face of many future uncertainties and the Government priorities for a secure, sustainable and affordable supply of water.

Section 1.5; Appendices S and T;

0.4.1 Engagement with customers

Understanding our customers' priorities is key to ensuring we have the right plan for the future. In developing our plan we engaged with household and business customers to ensure we understood their preferences and priorities. Some of the key themes from the research were:

- Safety, quality and reliability of water supply is a priority for customers;
- Customers do not want a reduction in the level of service provided, even if this would result in lower bills;
- Customers want us to approach the development of a water resources programme in a way that saves water, considers sensible options and avoids environmental damage; and
- Leakage is a key concern for customers. The order of preference for activity is leakage reduction followed by metering and water efficiency, before developing new sources.

The main difference between the views of household and business customers was that whilst domestic customers did not want a reduction in the levels of service, they were eager to control any bill increases and keep them to a minimum, whereas business customers were less cost sensitive and more risk averse, concerned to ensure sufficient investment to ensure a secure water supply.

The findings from the research have helped us to shape our strategy and ensure it reflects the preferences of our customers. Appendix T contains more information about our customer research.

0.4.1.1. Customer Challenge Group

We continue to work with Thames Water's independent Customer Challenge Group (CCG)[5] to discuss water resource matters including our approach to the public consultation and our

[5] The Customer Challenge Group is an independent group, whose members include regulators, representatives from businesses, local government and non-governmental organisation. Its role is to understand and challenge the development and detail of our plans and ensure we are testing these against customers' opinions.

response to it, and our revised proposals. Overall we have received positive feedback from the CCG on these matters.

0.4.1.2. Engagement with Stakeholders

We introduced an open and transparent process to engage with stakeholders as we developed our plan, which helped to inform the plan and to build trust and confidence between ourselves and our stakeholders. Since March 2012 we have held technical meetings and forums to share information, to provide the opportunity for discussion and challenge, and to ensure that we understood the issues and concerns of our stakeholders. Appendix S contains more information about our stakeholder engagement.

Stakeholders have expressed continued interest in the planning of future water resources and we have planned a programme of engagement to ensure we continue to build dialogue and collaboration as we take forward technical studies and assessments over the next 5 years. Our stakeholder engagement plan has been published alongside our plan.

0.4.1.3. Public consultation

In May 2013 we undertook a 12 week public consultation on our dWRMP14. We received 350 responses to the public consultation and have engaged with regulators and stakeholders during the consultation period to discuss their points and address them where possible. The main issues raised in the consultation were on the following topics:

- Leakage reduction and specifically that our plans for leakage reduction were not viewed to be sufficiently ambitious beyond 2020;
- Further information on the implementation plans for the progressive metering programme and measures to address affordability concerns;
- On-going appraisal of the demand management programme to improve our understanding of the costs and benefits of activity, and to ensure a secure and reliable water supply;
- Further consideration of the output of the Water Resources in the South East (WRSE) Group and specifically water transfers with neighbouring companies;
- Appraisal of new water resource schemes, with a large number of stakeholders expressing support for regional transfers utilising the Cotswold Canals network; and
- Further work to examine long term water resource options, including transfers, to inform our future plans.

In October 2013 we published our response to the public consultation, called the Statement of Response, in which we set out the representations that we received, our consideration of the issues raised and changes made to the dWRMP14 as a result of the representations. The Statement of Response was published on our website www.thameswater.co.uk/haveyoursay and was sent to all respondents to the consultation.

In December 2013 we published a revised draft plan taking account of the representations received to the public consultation, and updated and new information. Following advice from the EA, the Secretary of State requested further information on our plan in March 2014. We provided the additional information in April 2014 and this has also been included in the plan, or published alongside it.

0.4.1.4. Government priorities

An important backdrop to the development of our plan is an understanding of Government's policy priorities for secure, sustainable and affordable supplies of water which were set out in the Water White Paper[6]. The Environment Agency (EA) Case for Change report, published alongside the White Paper, illustrated the scale of the challenge and the level of uncertainty in planning for the changing future. These priorities were also reflected in the guiding principles of the WRPG and included:

- taking a long term perspective to make sure systems are resilient to future uncertainties, such as the impacts of climate change;
- taking better account of the value of water to make the water sector's activities more sustainable;
- considering all options to balance supply with demand, including water trading, cross boundary solutions and third party supplier solutions, in order to reduce costs, ensure efficient allocation of available resource and improve innovation within the sector; and
- reducing the demand for water by managing leakage and providing services to help customers use water efficiently

We agree with the policy priorities outlined by Government and have worked to embed these within our plan. The programme appraisal process to develop our preferred plan includes specific allowance for the recognition of Government priorities.

0.5 Building our plan – Our forecasts of demand and supply

To allow us to plan a safe and reliable water supply we forecast the supply demand position for each WRZ in our supply area. We do this by assessing the future demand for water, the amount of water available for supply, and taking account of the uncertainty in these forecasts. This section presents this information.

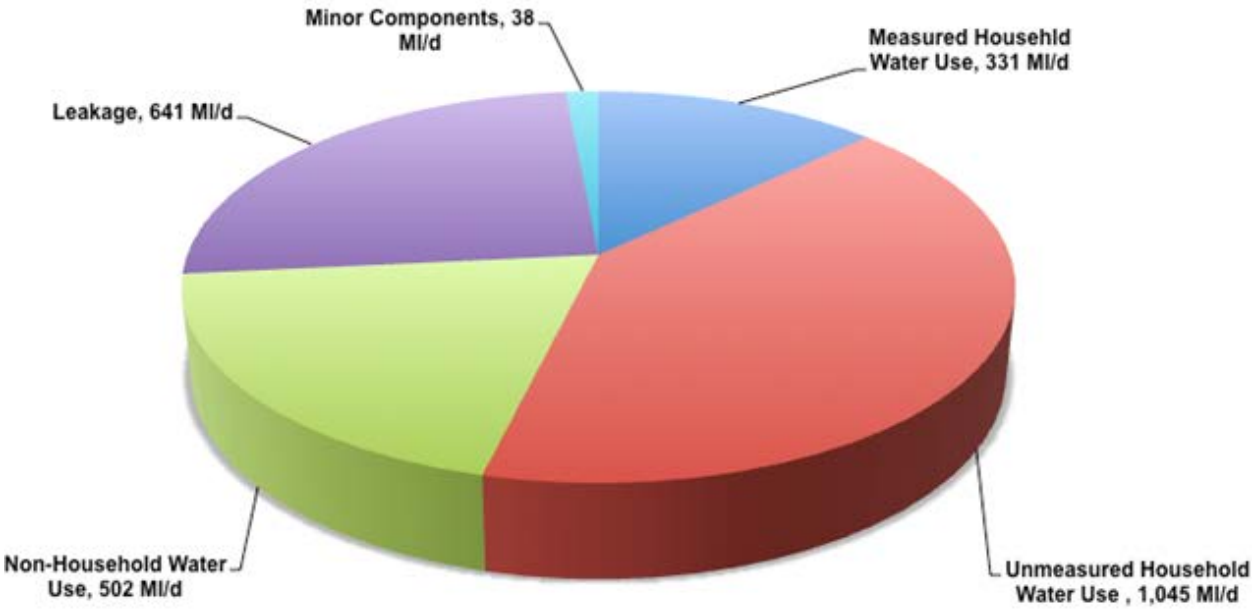
[6] Water White Paper "Water for Life", Defra, December 2011

0.5.1 Demand

Section 3

Demand is the term we use to describe the water that is supplied through our network. It comprises water we use in our households; water used by industry; water used in maintaining the water network; and leakage. Figure 0-2 shows the breakdown of demand by component.

Figure 0-2: Demand as reported in 2011/12



0.5.2 How much water will we use in the future?

Appendix H

We follow industry standard methodologies to forecast future demand which takes into account population and property projections; water use data and trends; and a range of other information to forecast how the components of demand for water are likely to vary over the next 25 years.

Whilst we can measure the demand for water in any one year, it is important to understand that the demand will be reflective of the weather conditions experienced in that year. It may have been wet, dry, hot, cold or somewhere in the middle. We use planning scenarios to re-create the anticipated demand levels:

- The 'Dry Year Annual Average' scenario (DYAA): this is the forecast for a dry year (a period of low rainfall) where there are no constraints on demand

- The 'Average Day Peak Week' scenario (ADPW): this describes the average daily demand during the peak week for water demand. The peak week is usually the critical period of demand, which drives the need for water resource management options to be implemented
- The 'Weighted Average' Average Demand scenario (WAAD): this describes the demand that is likely to be experienced on average over the planning period taking into account a mixture of 'normal' years, 'dry' years and 'wet' years. This is a new requirement for WRMP14

0.5.3 Population and property projections

Appendix E

We used "plan-based" forecasts, these are based on information for population and property growth from local authorities, who collate the information as part of their local plans, and for London from the London Plan. This is in line with the WRPG.

Since the publication of the dWRMP14 we have updated our property and population forecasts to take account of the Census 2011 data.

We forecast a total increase in population in our area of between 2.0 million and 2.9 million people by 2040 – three quarters of which is forecast in London.

0.5.4 Household water use

Appendix F

Water use per person (or per capita consumption – PCC) is affected by a variety of factors including household occupancy, water use of appliances, water use behaviour and whether the property is metered. In line with industry best practice we have assessed household demand and PCC at the micro component level. Overall, we forecast household demand to increase by approximately 250 Ml/d.

0.5.5 Business usage

Appendix G

Non-household forecasts are based on an assessment of historical relationship between demand and factors such as industrial output and employment. We do not have a significant agricultural sector or industrial sector in our supply area and consequently our non-household water use forecasts remain fairly static reflecting wider economic trends. Since the dWRMP14 we have corrected minor data errors to our non-household forecasts.

0.5.6 Leakage

In line with the requirements of the WRPG, leakage in the baseline demand forecast remains flat across the forecast period. Our Business Plan will include efficient and innovative approaches to maintain this target.

Summary

Overall, the baseline demand forecast is expected to increase by more than 250Ml/d over the planning period.

0.5.7 Supply forecast

 Section 4

Our water supplies are derived mainly through surface water abstraction, supported by a series of large bunded storage reservoirs, in London and groundwater abstraction in the Thames Valley. The proportions of supply are as follows:

- London: 80% from surface waters of the River Thames and the River Lee, via reservoirs, and 20% from groundwater; and
- Thames Valley: 30% from surface waters and 70% from groundwater.

The amount of water we can put into supply (i.e. leaving our water treatment works and into our distribution network), is called Water Available for Use (WAFU) which takes account of factors such as outages and bulk supplies with other companies.

WAFU = Deployable Output (DO) – Network constraints − Outage +/− bulk supplies

0.5.8 Deployable output (DO)

 Appendix I

DO is the measure of a WRZ's supply capability and is assessed on the basis of the water resources that are available to meet demand to specified levels of service. It is calculated using a simulation model called WARMS (Water Resources Management System).

The base year DO figures have been updated in the rdWRMP14 to take account of the output of the Annual Review 2013 (AR13)[7]. These are shown in Table 0-2.

[7] AR13 is the annual update on water resource matters provided to the EA in June 2013.

Table 0-2: Deployable Output for 2011-12 (AR12) and 2012-13 (AR13)

WRZ	Deployable Output (Ml/d)			
	DYAA[a] AR12	DYAA AR13	ADPW[b] AR12	ADPW AR13
London	2146	2144	--	--
SWOX	326.6	319.5	381.9	373.9
Kennet Valley	141.6	137.1	165.8	160.1
Henley	25.7	25.7	26.3	26.3
SWA	188.2	186.3	220.3	215.1
Guildford	65.2	65.0	75.7	71.2
Total	**2893.3**	**2877.6**	**870.0**	**846.6**

[a] Dry Year Annual Average (DYAA)
[b] Average Day Peak Week (ADPW)

We are currently improving our hydrological models to forecast DO. We are engaging with the EA as we complete this work and plan to work with other interested parties as this work moves forward. Detailed information on this work and the engagement programme with the EA is included in Appendix I. To reflect the uncertainty linked to the estimation of DO we have completed further sensitivity analysis in the rdWRMP14 to understand the impact of a change in DO of +/- 25 Ml/d, 50 Ml/d and 100 Ml/d, this is presented in Section 10.

0.5.9 Outage

Appendix V

Outage is a temporary loss of supply capability as a result of both planned and unplanned events such as maintenance of reservoirs, pollution to raw water quality and pump failure. We use the industry methodology to evaluate outage. The base year outage figures have been updated in the rdWRMP14 to take account of the output of the AR13 and the outage allowances by WRZ are presented in Table 0-3.

Table 0-3: Outage Allowances by WRZ

WRZ	Outage (Ml/d)	
	DYAA AR12	DYAA AR13
London	36.04	46.27
SWOX	15.04	14.88
Kennet Valley	1.77	1.85

Henley	1.08	1.05
SWA	11.97	12.53
Guildford	0.78	0.81
Total	66.68	77.39

0.5.10 Bulk supplies

Bulk supplies are transfers of either raw or treated water into or out of our water supply area. Since the dWRMP14 we have confirmed the bulk supply agreements with our neighbouring companies; these are presented in Table 0-4. Discussion with Affinity Water since the dWRMP14 has confirmed that they intend to increase the amount taken under the existing treated water agreement at Fortis Green during the planning period. Whilst there are some minor bulk supply import/exports in the Thames Valley, London is the only WRZ where bulk supplies are a significant factor in ensuring the security of supply.

Table 0-4: Bulk Supplies – Imports and Exports

WRZ	Imports	Exports	Total
London[8]	None	- 2 Ml/d raw water to Affinity Water Central - 0.2 Ml/d treated water to Affinity Water Central at Hampstead Lane - 10 Ml/d treated water to Affinity Water Central at Fortis Green. The Bulk Supply is set to increase over the planning period; in 2015 to 11.8 Ml/d in 2018 to 12.6 Ml/d in 2034 to 16.1 Ml/d	-12.2 to -18.3
SWOX	0.1 Ml/d from Severn Trent (included in DO calculation) 2.1 Ml/d from SWA (5 Ml/d on peak) -NB- internal transfer		+5
SWA	None	2.1 Ml/d to SWOX (5 Ml/d on peak) -NB- internal transfer	-5
Kennet Valley	None	None	

[8] There is also a 91 Ml/d (118.2 Ml/d peak) renegotiation of an existing raw water transfer to Essex & Suffolk which is included in the DO calculation

Guildford	None	2.3 Ml/d treated water to Affinity Water Central	-2.3
Henley	None	None	

0.5.10.1. Transfer to Essex & Suffolk Water

We are in the process of formally agreeing a new trading agreement with Essex and Suffolk Water which reduces the current provision of 91.2 Ml/d (average) to no less than 60 Ml/d in the period January to March and 75 Ml/d for the remainder of the year. There are also requirements for transfers under peak conditions.

0.5.11 Sustainability reductions (SRs)

Abstracting water can contribute to low flows in some rivers, which can lead to ecological damage. The EU Water Framework Directive (WFD) requires water bodies to be classified to be of good chemical and ecological status by 2015, with provision for extensions until 2027. To ensure compliance, the EA has informed us that we must reduce specified existing abstractions by a total of 21 Ml/d. We have included this reduction in our supply forecast. In addition, the EA has identified other potential reductions up to 179 Ml/d; these are not permitted to be included in our supply forecast until further investigations are completed. These present a significant future risk and we have therefore considered these reductions in scenario testing. The sustainability reductions are set out in Table 0-5 and this information has been updated since publication of the dWRMP14.

Table 0-5: Sustainability reductions defined by the EA NEP3, (August 2013) (Ml/d)

WRZ	Confirmed			Likely			Unknown		
	Source	Reduction		Source	Reduction		Source	Reduction	
		DYAA	ADPW		DYAA	ADPW		DYAA	ADPW
London	None			North Orpington	9	9	Lower Thames	50	50
							Lower Lee	100	100
							Sundridge	8	8
							Waddon	7	7
							Bexley	9	9
SWOX	Axford	5	6	Ogbourne	3.5	3.5			
				Childrey Warren	3.7	3.7			
SWA	None			None			Pann Mill	5.3	5.3
Kennet Valley							None		
Guildford									
Henley									
Total		**5**	**6**		**16.2**	**16.2**		**179.3**	**179.3**

0.6 Impact of climate change on supply

Appendix U

We have included a central estimate of the impact of climate change from the UKCP09 forecasts in our supply forecasts. The impact of climate change on DO has been updated since the dWRMP14 with the completion of the impact assessment on groundwater sources for the 2030s. The best estimate value to 2035 is shown in Table 0-6. This is applied directly as a change in DO. A negative value indicates a reduction. A comparison is shown with the data used in the dWRMP14

Table 0-6: UKCP09 Climate Change Impact on Deployable Output by 2035

WRZ	UKCP09 Climate Change Impact (Ml/d)			
	DYAA		ADPW	
	dWRMP14	rdWRMP14	dWRMP14	rdWRMP14
London	-82.2	-72.7	n/a	n/a
SWOX	-7.8	-8.5	-9.2	-9.9
Kennet Valley	-0.52	-0.58	-5.26	-5.00
Henley	0.00	0.00	0.00	0.00
SWA	-0.62	-1.13	-0.95	-2.5
Guildford	-0.06	0.00	0.09	-0.51

0.6.1.1. Summary

Overall our baseline water supplies are forecast to reduce over the planning period due to the impact of climate change (~90 Ml/d) and sustainability reductions (21 Ml/d). Table 0-7 presents the data on forecast available supply (WAFU) over the planning period.

Table 0-7: Available supply (WAFU) over the planning period

WRZ	WAFU (Ml/d)						
	2011/12	2014/15	2019/20	2024/25	2029/30	2034/35	2039/40
London	2098	2079	2048	2029	2010	2002	1994
SWOX	365	362	346	344	341	340	339
Kennet Valley	164	153	151	150	149	148	148
Henley	25.2	25.3	25.3	25.3	25.3	25.3	25.3
SWA	198	192	191	191	190	190	190
Guildford	72.6	68.0	67.9	67.8	67.6	67.6	67.5
Total	**2922.8**	**2879.3**	**2829.2**	**2807.1**	**2782.9**	**2772.9**	**2763.8**

0.6.1.2. Risk and Uncertainty

 Section 5 and Appendix V

Almost all the components of supply and demand together with their associated planning assumptions are subject to uncertainty and this is expressed and handled in the Plan through the concept of headroom. Target headroom is the minimum buffer that a prudent company should allow between supply and demand to cater for uncertainty in the overall supply demand balance and meet its agreed levels of service.

There is an industry standard procedure for calculating headroom. We have set out how we have calculated our baseline target headroom in Section 5 and Appendix V.

In the final plan we have updated our headroom assessment. The baseline estimate of target headroom uncertainty has increased in the latter half of the planning period as a result of the application of a more rigorous procedure to reduce the error margin when calculating demand side uncertainty. The results are shown in Table 0-8 and Table 0-9, which show the movement in baseline target headroom for both dry year annual average (DYAA) and dry year critical period (DYCP) between the draft and final Plan. Climate change uncertainty and the demand forecast uncertainty remain the most significant components of the headroom forecast for London.

Table 0-8: Baseline target headroom by WRZ – DYAA

WRZ	Baseline Target Headroom - DYAA (Ml/d)				
	dWRMP			rdWRMP	
	2020/21	2035/36		2020/21	2035/36
Risk Profile →	15%	30%		15%	30%
London	101.3	113.8		111.6	163.8
SWOX	8.8	8.8		10	13
SWA	6.2	7		7.7	9.2
Kennet Valley	5.2	5		5.6	6.9
Guildford	4.1	4.2		4.1	4.7
Henley	0.5	0.5		0.5	0.7

Table 0-9: Baseline target headroom by WRZ – ADPW

WRZ	Baseline Target Headroom – ADPW (Ml/d)				
	dWRMP			rdWRMP	
	2020/21	2035/36		2020/21	2035/36
Risk Profile →	15%	30%		15%	30%
London	N/A	N/A		N/A	N/A
SWOX	10.7	10.2		12.3	15.4
SWA	7.2	7.4		12.4	13.5
Kennet Valley	5.4	5.5		5.8	8.8
Guildford	4.3	4.4		4.9	5.1
Henley	0.7	0.6		0.7	0.8

0.7 The planning problem

Summary of the main changes:

- The supply demand balances for each WRZ have been updated reflecting changes in the forecasts of demand, supply and headroom

Section 6

To understand if we have sufficient water to meet our customers' needs over the planning period, we compare the demand for water with the available supply, taking account of the uncertainties in the forecasts. This assessment produces the "supply demand balances" for each WRZ which show if there is sufficient water to meet customer's needs or if there is a deficit.

The supply demand balances across our supply area have worsened since the dWRMP14. The position in each WRZ is as follows:

- London: we forecast a growing deficit on a dry year annual average increasing from -133 Ml/d in 2020 to -416 Ml/d in 2040. The increased deficit in the long-term is driven primarily by increases in headroom. There has been a small short-term increase to reflect the inclusion of the updated outage allowance (AR13) and the additional bulk supply requirement to Affinity Water under the existing Fortis Green agreement.
- Swindon and Oxfordshire: we predict a deficit on a dry year critical period growing from -1 Ml/d in 2020 to -32 Ml/d by 2040. These changes are principally driven by the impact of climate change on groundwater sources and therefore a reduction in available deployable output.
- Slough, Wycombe and Aylesbury: we predict a small deficit in dry year critical period of -3 Ml/d in 2034 increasing to - 6Ml/d in 2040. These changes are driven by both the impact of climate change on groundwater sources and therefore a reduction in available deployable output, and an increase in headroom.
- Guildford has a small deficit in 2024 of -1 Ml/d in the critical period increasing to -3.8 Ml/d in 2040. The change is driven primarily by a reduction in DO as reported in AR13.
- Henley and Kennet Valley WRZs remain in surplus throughout the planning period

The baseline supply-demand forecast is shown below in Table 0-10.

Table 0-10: The supply demand balance in each of the water resource zones

Water resource zone	2011	2015	2020	2025	2030	2035	2040
London	18.8	**-59.4**	**-132.7**	**-213.1**	**-291.7**	**-361.1**	**-415.9**
Swindon and Oxfordshire	37.34	27.08	**-0.14**	**-12.05**	**-21.30**	**-26.70**	**-32.66**
Slough, Wycombe and Aylesbury	21.47	11.57	7.93	4.89	0.77	**-2.60**	**-6.09**
Guildford	6.85	0.85	0.06	**-1.14**	**-2.14**	**-2.85**	**-3.80**
Henley	5.32	5.14	4.76	4.31	3.80	3.26	2.67
Kennet Valley	41.25	26.05	21.68	16.38	11.41	7.84	5.49

Note the data are in Ml/d with deficits shown in bold red.

0.8 Options and option appraisal

Section 7

We have examined a wide range of options to either increase supply or reduce demand including looking for opportunities to transfer water with other organisations. We have also looked at options for potentially more cost effective and/or better ways to source water for zones where there is currently a surplus.

Since the publication of the dWRMP we have included 23 new resource options; these include raw water transfers with other water companies, new wastewater re-use schemes and small groundwater options. We have also reviewed and amended the cost and scope of a number of resource options; this includes the revision of power costs for some raw water transfer schemes and the yield of the schemes relating to the Severn-Thames transfer. In total we considered over 271 unconstrained water supply schemes (supply and demand options).

We have also reviewed the demand management options and updated some of the assumptions on the costs and water savings based on new data and information. For example, analysis of the water efficiency campaign in 2013 enabled revision of the water efficiency costs and decay rates for water efficiency savings which have been included. Updated metering costs have been incorporated following negotiation with the meter providers and the increased costs of our revised CSL policy have been taken into account. We have also included additional Active Leakage Control activity as a feasible option, and further pressure management schemes. In the dWRMP we considered over 200 demand management programmes, each comprising a different combination of schemes to reduce leakage, increase metering and promote water efficiency. Since the dWRMP we have reviewed these programmes and refined the number of programmes taken forward to the programme appraisal to include only those that could address the supply demand balance in London and which were shown to be cost effective.

These options were considered as part of a staged screening process to determine which were feasible to be taken forward for further consideration in the development of our preferred programme. The screening process utilised specific criteria to identify and screen out options which were not considered to be feasible, such as adverse environmental or social impact and excessive high cost. Following the screening process we took forward 123 water resource schemes, 48 demand management options and 6 bulk transfers as constrained feasible options.

Section 7 provides information on the identification and appraisal of the supply and demand options considered in our plan. Appendix P provides the options list, Appendix Q provides the rejection register for those options which were screened out and not taken forward for further consideration in the development of our plan and Appendix R provides an overview of each option with information on the economic, environmental and social assessments for each scheme. The environmental and social assessments are based on the Strategic Environmental Assessment and Habitats Regulations Assessment detailed in Appendices B and C.

0.9 Programme appraisal

Section 8

We have a range of different choices to secure the long term reliability of water supply. We have used a structured programme appraisal approach to evaluate different programmes and different strategic choices for future water supply. This is presented in Section 8.

Our programme approach has looked holistically at the supply of water to customers, integrating the supply-demand balance with the feasible options to build our preferred plan.

We adopted an approach that assesses the performance of the plan against the following five overall criteria:

- Cost
- Customer Impact
- Sustainability
- Deliverability
- Sensitivity and Resilience

We used the results of this appraisal process to develop our preferred Plan. In developing our Plan we have presented and tested our programme appraisal approach with stakeholders and regulators.

0.9.1 London

The starting point for the programme appraisal, least cost plan (ie. the combination of schemes that solve the supply and demand deficit with the lowest long-term cost), is as follows:

Table 0-11: London Least Cost Programme

Option	Type	Benefit (Ml/d)	Year
LON-100-35-20[9]	Demand Management	212	2015-30
BT ESW Chingford reduction	Treated Water Transfer	17	2015-35
BT RWE Didcot	Raw Water Transfer	17	2015-20
GW ELRED	Groundwater	1	2015
GW Tottenham	Groundwater	1.4	2015
AR Kidbrooke	Artificial Recharge	5	2019
AR SLARS - Streatham	Artificial Recharge	5	2019
GW Southfleet/Greenhithe	Groundwater	9	2021
AR Hornsey	Artificial Recharge	2	2026
GW Addington	Groundwater	1.5	2026
GW Honor Oak	Groundwater	1.5	2026
IPR Abbey Mills (Non-RO)	Effluent Re-use	150	2027
RWT Oxford Canal	Raw Water Transfer	17	2038
AR SLARS - Merton	Artificial Recharge	6	2039
ASR Darent Valley (Horton Kirby)	Artificial Storage and Recovery	5	2039

NB. All runs include the use of innovative tariffs in 2022/23

The outcome is broadly consistent with the least cost run from the draft Plan, with demand management dominating in the early years together with minor groundwater development and temporary changes in bulk supplies. All of the elements are increased in comparison to the draft, reflecting the increased need identified from the updated supply and demand forecasts and uncertainty assessments.

In the longer term wastewater re-use (without reverse osmosis technology) continues to be favoured on cost grounds. The programme has a long-term cost of **£967m NPV** (net present value).

Having established this as a starting position we then examined the impact of changing the solution. This included changing the amount of demand management, removing the tariff assumptions and restricting the types of resource option available for selection.

These are summarised in Table 0-12 below.

[9] The notation 100-35-20 refers to the level of demand reduction targeted in AMP periods 6, 7 and 8, respectively, set as inputs to the IDM model. Demand and optant meter forecasting and tariffs then adjust the totals.

Table 0-12: London Programme Development[10]

Case	Step	Cost (£mNPV)
Least Cost – 100-35-20	0	967
Remove innovative tariffs	0	1,146
LON – 90-0-0	0	1,062
LON – 95-25-0	0	1,070
LON – 105-25-0	0	1,072
LON – 125-0-0	0	1,063
Wastewater re-use by reverse osmosis only (i.e. Non-RO not viable)	1	1,084
Remove high risk artificial recharge schemes	2	1,080
Replace two small RO schemes with one large scheme	3	1,067

The final Plan is less sensitive to changes in the demand management profile than the draft Plan. 106 Ml/d of demand management in AMP6 appears to be the optimum solution as less than or greater than that amount results in greater overall cost.

Steps 1-3 have very similar programme costs. Normally you would expect introducing extra constraints to a model to increase the overall programme cost. However, in any optimisation problem, close to the optimal solution there are several near-optimal solutions. Identifying a definitive least cost is extremely time consuming and computationally challenging. Therefore a tolerance is set so that the model is able to identify the minimum cost solution within a percentage (1%) of the global optimum. Consequently, our model stops optimising when it starts achieving insignificant reductions in the overall solution cost.

The impact of alternative resource development options is broadly in line with the draft plan. Wastewater re-use using reverse osmosis adds £117m NPV; desalination ~£350m NPV and transfers and reservoirs ~£550m NPV.

Steps to the preferred programme

Step 1 – An independent expert re-use panel recommended that at the present time, wastewater re-use should be developed using reverse osmosis (RO) treatment technology. We accept this finding and so the first step is the removal of options not using RO.

Overall programme cost = £1,084mNPV (+£117mNPV against least cost)

Step 2 – The modelled solution from step 1 includes artificial recharge schemes at Kidbrooke and Streatham in 2019, with a total benefit of 10 Ml/d. These schemes have high delivery risk in AMP6 and so have been replaced with aquifer storage and recovery at Horton Kirby and a small groundwater scheme at Honor Oak. These two schemes also have a combined lower capital cost so this reduces spend in AMP6 and helps to lower customers' bills.

Overall programme cost = £1,080mNPV (+£113mNPV against least cost)

[10] Since publication of our Statement of Response, 30 October 2013, Sutton and East Surrey Water has advised that it no longer requires a bulk supply from Thames Water. Table 0-12 has been amended accordingly in this updated Executive Summary

Step 3 – Two wastewater RO re-use plants are in the solution to this point; Deephams 60 Ml/d in 2027 and Beckton 100 Ml/d in 2032. To improve practicality/deliverability we tested the impact if a single re-use plant at Beckton of 150 Ml/d was constructed instead.

Overall programme cost = £1,067mNPV (+£100mNPV against least cost)

Step 4 – The final step is to allow for exports required by our neighbouring companies as part of the WRSE regional strategy. Since publication of our Statement of Response on 30 October 2013, Sutton and East Surrey Water has advised that it no longer requires a bulk supply from Thames Water and thus the programme defined in step 3 becomes our preferred programme (see Section 0.10).

Our preferred programme is not the base least cost plan but we consider it is the best value Plan in the long term because it is more flexible, makes a better contribution to sustainable development, and is more closely aligned to customer research, stakeholder feedback and government objectives. It also includes the requirements of the WRSE regional water strategy. The Plan does not have an undue impact on customer bills.

0.9.2 Thames Valley

The same programme appraisal process was followed to develop the preferred plan for the Thames Valley zones, firstly identifying the least cost solution followed by consideration of wider objectives to define the preferred plan.

The supply demand balance in Thames Valley is not as challenging as London WRZ with only the SWOX, SWA and Guildford WRZs in deficit. In Swindon and Oxfordshire there is a supply-demand deficit in both dry year annual average and dry year critical period, whereas in the other two zones the deficit is for dry year critical period only.

The programme appraisal for Thames Valley as a whole is presented and the least cost plan (Table 0-13) comprises primarily demand management options which are selected in SWOX and Guildford to address the supply and demand balance, and a number resource options in other water resource zones, as well as a small groundwater source enhancement in SWOX. Some of the other schemes are chosen because they present an operational efficiency over the planning period.

Two options are selected in SWA; the network constraint alleviation option for Datchet, and Medmenham groundwater scheme. These are selected in AMP6 under the weighted average utilisation criteria as presenting a potential operational cost benefit. However, they will also contribute to managing the supply demand balance in the longer term. Although the Kennet Valley WRZ is in surplus over the planning period, an additional network constraint alleviation option is selected, East Woodhay, under the weighted average utilisation criteria as presenting a potential operational cost benefit.

No other options are selected as part of the least cost programme.

Table 0-13: Thames Valley Least Cost Programme

Option	Type	Benefit (Ml/d)	Year
SWOX-02-14-08	Demand Management	29	2020-30
GW Bibury enhancement (SWOX)	Groundwater	3.2	2039
NTC Datchet (SWA)	Release of network constraint	5	2015
NTC East Woodhay (Kennet)	Release of network constraint	4	2015
GW Medmenham (SWA)	Groundwater	10	2017
GUILDFORD-00-03-00	Demand Management	6	2020-2030

NB. All runs include the use of innovative tariffs in 2022/23

The least cost programme has no predicted adverse environmental impacts. However, the scoring of the least cost programme has relatively low alignment to government policies and customer research scheme preferences, namely:

- customers' preference for demand management in preference to resource development
- DEFRA direction to reduce demand over the planning period in water stressed areas

In view of this, alternative programmes were reviewed for the combined Thames Valley water resource zones, looking at wider objectives linked to Government guidelines, customer preference and supporting the needs of the regional water strategy for the South East, namely WRSE. The results of the different possible programmes are summarised in Table 0-14. Taking a holistic view, the results show a trade-off between cost and sustainability. Focussing on demand management is a higher cost programme but it performs better on non-monetised measures in terms of customer preference, sustainability and resilience measures and it is better aligned with government policy and aspirations to reduce pcc in the planning period.

Table 0-14: Thames Valley Programme Development

Case	Step	Cost (£mNPV)
Least Cost	0	46
Least Cost with WRSE exports	1	60
Demand management for SWA deficit with WRSE exports	2	63
Demand management all zones with WRSE exports	3	79

The difference in cost between the least cost programme with WRSE exports and the programme including demand management for the SWA deficit in the rdWRMP14 is approximately £3m NPV, a significant reduction in comparison to that reported in the draft Plan. In both versions of the least cost plan, demand management options are selected in Guildford and SWOX.

Given indirect benefits and synergy with the London programme, and to ensure an equitable experience for all Thames Water customers, a ten year progressive metering programme commencing in 2020 is considered the best value programme for Thames Valley. It would appear unfair to customers if progressive metering was only implemented throughout London and just two other WRZs in the Thames Valley considering that the whole of Thames Water's supply area is classified as being seriously water stressed, and hence progressive metering is being promoted throughout the Thames Valley in the preferred programme. The preferred programme aligns with WRSE in that it supports bulk supply exports of 10 Ml/d from SWA beginning in 2030 and 2.7 Ml/d from Guildford in 2036. The increase cost of the preferred Plan from the least cost plan with WRSE exports is approximately £19m NPV.

0.10 Preferred plan

Summary of the main changes since the draft Plan:

- The preferred plan includes uncertainty associated with the demand management programme and resource options, in line with EA recommendations

London

- Demand management increased to 228 Ml/d between 2015-2039
- Leakage reduction increased to 103 Ml/d over the period 2015-2029
- New raw water trading agreement with RWE N-Power in 2015
- 8.9 Ml/d groundwater schemes between 2015 – 2020

Thames Valley

- WRSE water transfers from Guildford WRZ to Affinity Water and Slough/Wycombe/Aylesbury WRZ to South East Water included in the preferred plan
- Innovative groundwater scheme in Guildford WRZ to support WRSE transfer

Section 9

0.10.1 London

Whilst there are some changes to London's preferred programme compared to the draft Plan, it remains a combination of demand reduction and resource development (Table 0-15).

The plan focuses heavily on demand reduction in the short to medium-term, driven through a combination of leakage reduction, progressive metering and water efficiency measures. Water transfers are also a key element in the short term with new water trading agreements with both Essex and Suffolk Water and RWE N-Power.

This is supported by groundwater development in the short-medium term. A large water resource scheme needs to be planned to secure long-term supply-resilience for London post 2027. The Plan shortlists 150Ml/d of wastewater re-use as the solution based on minimising cost and on the assumption it can be promoted successfully. Other options are available at a higher cost and need to be studied in more detail over the next 5 years to ensure that the best value large resource option is identified in time for the WRMP19. The detailed components of the preferred Plan are listed in Table 0-16.

Table 0-15: London Preferred Programme

Option	Type	Benefit (Ml/d)	Year
LON-100-35-20	Demand Management	212	2015-30
BT ESW Chingford reduction	Treated Water Transfer	17	2015-35
BT RWE N-Power (Didcot)	Raw Water Transfer	17	2015-20
GW ELRED	Groundwater	1	2015
GW Tottenham	Groundwater	1.4	2015
ASR Darent Valley (Horton Kirby)	Artificial Storage and Recovery	5	2019
GW Honor Oak	Groundwater	1.5	2019
AR Kidbrooke	Groundwater	5	2021
AR SLARS – Merton	Groundwater	6	2021
GW Southfleet/Greenhithe	Groundwater	9	2026
IPR Beckton 150 Ml/d RO	Effluent Re-use	150	2027
RWT Oxford Canal Transfer (London)	Raw Water Transfer	17	2038
AR Hornsey	Groundwater	2	2039
GW – Addington	Groundwater	1.5	2039

NB. Also innovative tariffs from 2022/23

Table 0-16: Our Water Resources Programme for London[11]

London		Benefit (Ml/d, unless otherwise stated)				
Selected options		**2015-2020**	**2020-2025**	**2025-2030**	**2030-2035**	**2035-2040**
Demand Management	Leakage reduction					
	• Mains replacement (km)	405	76	0	0	0
	• Mains replacement (Ml/d saving)	13	4	0	0	0
	• Pressure management	20	0	0	0	0
	• Active Leakage Control	11	2	0	0	0
	• CSL control post metering	15	14	1	0	0
	• TSL control post metering	0	13	10	0	0
	Progressive Metering					
	• Number	441,000	294,000	0	0	0
	• Ml/d saving (not including CSL)	24	14	0	0	0
	• Penetration at end of AMP (% including optants and new meters)	58	70	72	73	75
	Enhanced water efficiency					
	• Household*	12	-0.6	-4	0	0
	• Non-household*	1	0.1	0	0	0
	• Commercial reduction from competition	4.7	3.1	0	0	0
	• Thames Water buildings	1	0	0	0	0
	Tariffs and behaviour change	5	41	8	8	8
Resource Development	Water transfers (temporary bulk supplies changes)					
	• Essex and Suffolk Water	17	17	17	17	0
	• RWE N-Power Didcot	17	0	0	0	0
	Groundwater and artificial recharge schemes					
	• GW ELRED	1	1	1	1	1
	• GW Tottenham	1.4	1.4	1.4	1.4	1.4
	• ASR Darent Valley (Horton Kirby)	5	5	5	5	5
	• GW Honor Oak	1.5	1.5	1.5	1.5	1.5
	• AR Kidbrooke		5	5	5	5
	• AR SLARS - Merton		6	6	6	6
	• GW Southfleet/Greenhithe			9	9	9
	• RWT Oxford Canal Transfer					17
	• AR Hornsey					2
	• GW Addington					1.5
	Wastewater re-use (reverse osmosis)					
	• Beckton 150			150	150	150
Total Saving – Demand Management		106.7	90.6	15	8	8
Total Increase – Resource Development		42.9	36.9	195.9	195.9	199.4

* The savings arising from household and non-household water efficiency in AMP6 are 13 Ml/d, this is less than the savings reported in the Business Plan of 17 Ml/d as they take account of the decay in savings as explained in Appendix 0

[11] Since publication of our Statement of Response, 30 October 2013, Sutton and East Surrey Water has advised that it no longer requires a bulk supply from Thames Water. In this updated Executive Summary Table 0-16 has been amended to remove the groundwater scheme required to facilitate the water transfer

0.10.2 Thames Valley

The preferred plan for the Thames Valley remains very similar to that proposed in the draft Plan (Table 0-17). It is essentially a programme of demand reduction in the medium-term (2020-2030), which is achieved through a combination of progressive metering, water efficiency and leakage control measures. In the long-term a small aquifer storage and recovery scheme is required in Guildford WRZ to facilitate a water transfer to Affinity Water in 2036 as part of the WRSE regional water strategy. The preferred plan also supports a bulk supply export of 10 Ml/d from SWA WRZ in 2030 to South East Water, as included in the WRSE plan. The detailed components of the preferred Plan are listed in Table 0-18.

Table 0-17: Thames Valley Preferred Plan

Option	Type	Benefit (Ml/d)	Year
SWOX-02-14-08	Demand Management	29.4	2020-30
SWA-01-08-04	Demand Management	17	2020-30
HEN-00-01-00	Demand Management	1.8	2020-30
KEN-01-06-03	Demand Management	13.5	2020-30
GUI-00-03-00	Demand Management	5.8	2020-2030
ASR Abbotswood (Guildford)	Groundwater	4.5	2037
NTC Datchet (SWA)	Release of network constraint	5	2038

NB. All runs include the use of innovative tariffs in 2022/23

Table 0-18: Our Water Resources Programme for Thames Valley

Thames Valley	Delivery date and ongoing supply demand benefit (Ml/d)				
Selected options	**2015-19**	**2020-24**	**2025-29**	**2030-34**	**2035-39**
Metering: progressive meters (000s)					
• SWOX	0	63	20	0	0
• SWA	0	38	16	0	0
• Kennet Valley	0	32	14	0	0
• Henley	0	3	1	0	0
• Guildford	0	11	5	0	0
Metering: optant meters (000s)					
• SWOX	20	21	6	0	0
• SWA	9	10	4	0	0
• Kennet Valley	8	9	3	0	0
• Henley	1	1	0	0	0
• Guildford	3	3	1	0	0
Leakage Reduction (Ml/d)					
• SWOX	0	0.6	1.0	0.3	0
• SWA	0	0.5	0.6	0.2	0
• Kennet Valley	0	0.4	0.5	0.1	0
• Henley	0	0.1	0.1	0.0	0
• Guildford	0	0.3	0.3	0.1	0
Total Demand Reduction (Ml/d) *					
• SWOX	1.8	20.7	6.9	-0.7	0.7
• SWA	1.1	11.2	4.6	-0.3	0.3
• Kennet Valley	0.8	8.8	3.9	-0.3	0.2
• Henley	0.1	1.3	0.4	0	0
• Guildford	0.4	3.8	1.6	-0.1	0.1
Water resource development (Ml/d)					
ASR Abbotsfield (Guildford)	0	0	0	0	4.5
NTC Datchet (SWA)	0	0	0	0	5

* Water efficiency savings decrease with a mean half-life of the products installed and advice followed

NB. All runs include the use of innovative tariffs in 2022/23; all savings in AMP6 are the result of optant metering and behaviour change

Table 0-19: Leakage activity over AMP6

Year	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20
Leakage target (Ml/d)	665	651	630	620	612	606

Table 0-20: Leakage activity over the planning period

Year	2014/15	2019/20	2024/25	2029/30	2034/35	2039/40
Leakage target (Ml/d)	665	606	570	556	556	556

Table 0-21: Metering activity over the planning period (000s)

Year	2014/15	2019/20	2024/25	2029/30	2034/35	2039/40
Metering - optants	139	170	122	15	0	0
Metering - progressives	63	441	441	55	0	0

Table 0-22: Forecast PCC (l/h/d) over the planning period

Year	2014/15	2019/20	2024/25	2029/30	2034/35	2039/40
London	159	147	141	142	142	141
TV	145	149	127	125	128	129
TWUL	156	148	138	138	138	138

Our preferred Plan is not the base least cost plan but we consider it is the best value Plan in the long term because it is more flexible, makes a better contribution to sustainable development, and is more closely aligned to customer research, stakeholder feedback and government objectives. The Plan does not have an undue impact on customer bills.

The focus on demand management early in the Plan means it does not focus on large, traditional hard engineering solutions. This builds flexibility into the Plan and will allow further review of the potential for water trades and third party entry in the future.

Further modelling has been undertaken by the WRSE group in the period since publication of the draft WRMPs to update the information included on transfer options between companies, to seek to validate the options included in companies' plans in a regional context and in order to ensure that any differences can be fully explained. In summary this work concludes;

- WRSE modelling has shown that the options selected in water companies' draft WRMPs can provide the best solutions for customers and the environment in the South East. The modelling has demonstrated that the overall cost of the options in the draft WRMPs is consistent with that of the other WRSE scenarios modelled. Importantly, the draft WRMPs include options that provide greater resilience and mitigation of risk than in other scenarios.

- The WRSE Group has validated that the water companies' draft WRMPs are consistent with the scenarios modelled by WRSE.

0.11 Scenario testing

Section 10

Section 10 describes how we have tested our plan against 6 different foreseeable scenarios for London to examine the robustness of the plan against future uncertainties. The work shows we have not planned against a worst case scenario. The results show:

- The Plan for London is robust and flexible to small changes in the supply-demand balance (<2%);
- The Plan in London is sensitive to any moderate to large reductions in the supply-demand balance in the future – for example, due to additional sustainability reductions or higher than expected impacts of climate change – and requires additional resource schemes to address this risk. The work shows that multiple wastewater re-use schemes would be selected to compensate based on simply minimising programme cost. This may not be feasible in practice;
- In London, improvements in the supply-demand balance do not change the order of the preferred programme but do alter the timing suggesting the strategy adopted in the preferred plan to focus on demand management first is appropriate.

The Plan for Thames Valley is robust to all main risks.

Analysis has also been undertaken to examine the potential implications of the increased frequency and duration of extreme drought events in the Thames catchment predicted using the Future Flows database.

The results of the scenario testing show that the preferred plan is flexible. However, given the sensitivity to large adverse changes in the supply-demand balance, and uncertainties on the practical limitations of multiple wastewater re-use schemes, our Plan recommends that 3 long-term options of regional water transfers; storage and wastewater re-use should be taken forward for detailed study in the 2015-2020 period to enable the best value option to be identified for WRMP19. This approach gives greater long-term flexibility and we consider would provide a positive contribution to agreeing a long-term resilience solution for the South East region.

We have also examined the impact of the Plan on Water Framework Directive requirements for flow status and our analysis suggests that throughout Thames Water's supply area there is a low risk that the increased use of existing abstraction licences will result in deterioration of WFD status.

0.12 AMP6

In the short-term, the supply demand balance is largely maintained through demand management with over 100 Ml/d of savings being delivered in AMP6. This remains a very ambitious programme and details are included in the plan of the monitoring that will be put in place to measure delivery of the savings and the contingency options that are available to maintain supply if the proposed savings are only partially achieved. Details are also included of the tariff trials that will be undertaken in AMP6 and the associated monitoring.

The plan identifies that a large water resource scheme will required in mid 2020s to maintain security of supply in London. Whilst a wastewater re-use plant is currently the preferred solution it remains a high risk option and a programme of investigations is included in the Plan of work to be undertaken of three large resource schemes, namely wastewater re-use, regional water transfers and reservoir storage. These will determine the best value solution for inclusion in WRMP19. A detailed work programme has been published accompanying this plan which sets out the areas of work over the next 5 years. We will engage with regulators and stakeholders as we complete this work.

0.12.1 Compliance and Quality Assurance

The WRMP details the decision making process we used in developing our Plan. Our process included reviews of the key components in the Plan with the Thames Water Board and Executive and presentation of the different choices available and the preferred Plan.

The report is accompanied by a completed audit checklist included in the Water Resources Management Planning Guideline. We have also included a checklist against:

- Defra Key Policy Requirements
- Defra Directions (summarised in Table 0-24 at the end of this Executive Summary)
- Public Inquiry actions from our Water Resources Management Plan 2009.

0.13 Alignment with company outcomes

As part of the 2014 Periodic Review Process, all water companies have been asked to develop a set of outcomes against which to build their Business Plan, these are high level objectives which set the direction of travel for the business. We have developed six customer outcomes based on the output of our customer research and these have been tested with, and supported by customers and stakeholders.

The outcomes, whilst valuable in setting a direction of travel, are too general in nature to monitor performance therefore we have translated these into more specific service outcomes against which we can judge our progress.

Whilst not part of the WRPG we consider it is important to use this framework and ensure that the water resources strategy is intrinsically linked to the Business Plan. Table 0-23 below sets out how the final Water Resource Management Plan maps to the outcomes.

Table 0-23: PR14 Outcomes: Water

Customer outcome	Water outcome	Why is this outcome chosen
Our customers and stakeholders can trust us, we are easy to do business with and we care	Do the basics excellently by getting things right first time	This service outcome ensures our wholesale activity is completely aligned to our objective to improve our Service Incentive Mechanism scoring
	Help customers to save water	To reduce wastage and inefficiency we need to give customers the tools to understand their water use and save water.
We will provide a safe and reliable Water service that complies with all necessary standards and is available when our customers require it	Drinking water quality meets customers' expectations and regulatory requirements	We must maintain our asset base for the future and give customers confidence in continued levels of service
	Resilient water supply under extreme events	We need to be able to provide service against a variety of pressures such as climate change and population growth.
	Asset Stewardship: Maintaining our assets to ensure we can provide a safe and reliable service in the long term	We must ensure an appropriate balance between reducing costs today and not compromising our future service
We will limit our impact on the environment and achieve a socially responsible, sustainable business for future generations, including reducing levels of leakage	Sustainable management of the water cycle	We need to protect our water resources now and for the future
	Compliance with new environmental regulations	We must meet environmental regulations, and river quality is a visible indicator to citizens of our environmental stewardship
	Corporate responsibility	We will act as a responsible company, meeting expectations from wider society
	Minimising our carbon footprint	There is an expectation from society that we will play our part in reducing carbon

Customer outcome	Water outcome	Why is this outcome chosen
We will provide the level of customer service our customers require, in the most economic and efficient manner, to ensure that bills are no more than necessary	Reduced dependence on energy from the grid	This reduces our operating costs which is good for customers

In order to understand and monitor our performance against each water service outcome we have set performance metrics against each one. Each of the outcome performance measures for AMP6 has been set to meet, and in some instances exceed, current performance, including serviceability. Taking each of our service outcomes in turn, the related performance measures and targets for AMP6 are described below:

- **Demonstrating to our customers that they can trust us, we are easy to do business with and that we care** includes targets for reducing written complaints (4,600 per year) and improving our customer satisfaction score (4.5). We will also help our customers to save water with targets for the distribution of water efficiency devices (903,000 devices distributed to 322,000 properties in AMP6) and the provision of free repairs to customers with a customer side leak outside their property (5273).
- **Asset stewardship** includes maintaining our treatment works and our distribution network to maintain the level of service that we are forecasting by the end of this current period and on, through AMP6. Both have performance measures covering serviceability with a target of maintaining stable levels of performance, and include the development of asset health measures to improve longer term asset stewardship. The end result will be more predictable and better targeted investment in our assets, with benefits to customers in terms of reliable service and affordable bills.
- **Maintaining a safe and reliable water supply** at the right level of pressure has individual performance measures and targets for maintaining stable service for:
    - o Properties experiencing chronic low pressure (34 per year)
    - o Average hours lost supply per property served, due to interruption >4hr (0.12)
- **Maintaining confidence in a safe water supply** is important for customers and has a performance measure which encompasses compliance with all drinking water quality targets (99.95% compliant).
- We will limit our **impact on the environment** through sustainable management of the water cycle which we will measure through our performance on leakage (606 Ml/d) and under the Abstraction Incentive Mechanism (AIM). We will deliver the new environmental regulatory requirements specified by the Environment Agency (100%) and protect and enhance biodiversity through continued investment at our sites.
- We will continue to be a **socially responsible business**, running educational campaigns, providing visitor centres at our sites and contributing to community and charitable projects.

- We will ensure that we have a **resilient water supply** under extreme events by:
    - o Ensuring our Security of Supply Index remains at 100, given the forecasts for water demand and population growth
    - o Achieve 100% compliance with the Security and Emergency Measure Directive (SEMD)
    - o Ensure 27 of our water treatment works are made resilient to a 1 in 100 rainfall event
- We will **reduce dependency on the energy grid** in water services by improving energy efficiency and increasing our self-generation percentage and reducing our net energy import from the grid by 4.8% by 2020.
- We will **reduce the carbon emissions** for our water services to 34% below our 1990 level by 2020.

0.14 Looking further ahead

This Plan has been developed from our latest supply and demand forecast and estimates of option costs and performance. The work has highlighted a significant challenge ahead if we are to ensure security of supply.

There are a number of key areas where we will undertake further work to supplement our analysis for future updates of the Water Resource Management Plan:

- **Benefits of mains replacement:** In line with the conclusions of the Mains Replacement Project Independent Review we have already implemented new tools for assessing the costs and benefits to target mains replacement. We will continue to develop these tools and integrate them into our water resource planning to inform the cost of delivering our overall service and to review our long-term leakage reduction forecasts in WRMP19.

- **Metering technology:** We will keep abreast of new meter technology developments in smart metering to see if there are opportunities to reduce the cost and improve the service offering of our progressive metering programme as detailed in the preferred plan. We will also seek to develop technology which will also us to meter individual flats in converted properties and large blocks of flats.

- **Performance in droughts:** Due to the large size of the Thames catchment and the configuration of our system, the London Water Resource Zone has historically been particularly sensitive to droughts lasting 2 or more years. We are updating our water resource modelling to prepare for the future where the frequency and intensity of droughts is forecast to increase and will build any impacts into our strategy as required. Early results are given in Section 10 of the final Plan.

- **Investigation of large resource schemes:** Three long-term options of regional water transfers; storage and wastewater re-use will be subject to more detailed study in the 2015-2020 period to enable the best value option to be identified for WRMP19.

From the analysis undertaken to develop this Plan we do not expect the work discussed above to change the direction of the long-term strategy but given the future challenges we face, we will continue these activities to give the greatest chance of future success and to keep customers' bills as low as possible through innovation and exploration of cost savings.

Table 0-24: A summary of our audit checklist against Defra Directions

No.	Action or approach	Included/ Excluded	Description	WRMP ref.
2	—A water undertaker shall prepare a water resources management plan, for a period of 25 years commencing on 1st April 2015.	Included	We have provided a plan that covers a time period from 1 April 2015 to 31 March 2040 (Section 1). Longer time horizons have been considered within programme appraisal and sensitivity analysis (Sections 8 and 10)	Section 1, 8 and Section 10 Appendix Y - Table Y-1
3(a)	—how frequently it expects it may need to impose prohibitions or restrictions on its customers in relation to the use of water under each of the following -(i) section 76[1](ii) section 74(2)(b)[2] of the Water Resources Act 1991; and(iii) section 75[3] of the Water Resources Act 1991;	Included	Our planned levels of service are set out in Section 1 including the imposition of restrictions in drought. This includes Temporary Use Bans and DD11 - Drought Orders. In Section 9 we demonstrate that our preferred programme will meet those levels of service from the end of AMP5.	Section 1.4.2 Section 9
3(b)	—the appraisal methodologies which it used in choosing the measures it intends to take or continue for the purpose set out in section 37A(2)[4], and its reasons for choosing those measures;	Included	In producing our plan we have followed a structured programme appraisal approach. This has looked at both qualitative factors and monetised and non-monetised values.	Section 8 and Section 9

No.	Action or approach	Included/ Excluded	Description	WRMP ref.
3c	—the emissions of greenhouse gases which are likely to arise as a result of each measure which it has identified in accordance with section 37A(3)(b)[5];	Included	Included.	Appendix R, S7, B8, Appendix W
3d	—how the supply and demand forecasts contained in the water resources management plan have taken into account the implications of climate change;	Included	Our plans include the impact of climate change. We have used the UKCP09 forecasts.	B3.3.6 and Appendix U (for demand and supply)
3e	— how it has estimated future household demand in its area over the planning period, including the assumptions it has made in relation to population and housing numbers, except where it does not supply, and will continue not to supply, water to domestic premises;	Included	Future demand based on micro-component analysis using plan based population and property forecasts.	B3, Appendix E, Appendix F
3f	—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 required to fix charges by reference to volume of water supplied to those premises under section 144A[6];	Included	We have included a breakdown of meter forecasts in our plan by Resource Zone.	Optants: Section 3 Total meters: Section 9 and Appendix N

No.	Action or approach	Included/ Excluded	Description	WRMP ref.
3g	—where the whole or part of its area has been determined by the Secretary of State to be an area of serious water stress under regulation 4(1) of the Regulations, its estimate of the number of domestic premises which are in the area of serious water stress and in respect of which it will fix charges by reference to volume of water supplied to those premises over the planning period;	Included	All of our area is designated as seriously water stressed.	1.3.4 (reference to water stress) and Appendix E (Properties)
3h	—its estimate of the increase in the number of domestic premises in its area (excluding any domestic premises which are included in the estimate referred to in sub-paragraph (g)), over the planning period, in respect of which section 144B(2) will not apply because the conditions referred to in section 144B(1)(c) are not satisfied and in respect of which it will fix charges by reference to volume of water supplied to those premises;	Included	All of our area is designated as seriously water stressed.	B1.3.4 (water stress) and Appendix E (properties)
3i	—full details of the likely effect of what is forecast pursuant to sub-paragraphs (f) to (h) on demand for water in its area;	Included	Section 9 describes the impact of the integrated demand management programme on per capita consumption	B9

No.	Action or approach	Included/ Excluded	Description	WRMP ref.
3j	—the estimated cost to it in relation to the installation and operation of water meters to meet what is forecasted pursuant to sub-paragraphs (f) to (h) and a comparison of that cost with the other measures which it might take to manage demand for water, or increase supplies of water, in its area to meet its obligations under Part III of the Water Industry Act 1991;	Included	Section 9 of the Technical Report describes the preferred programmes for London and the Thames Valley, with the solutions options detailed in Section 7.4.	Section 9 and 7.4
3k	—a programme for the implementation of what is forecasted pursuant to sub-paragraphs (g) and (h).	Included	Section 9 of the Technical Report and Appendix N	Section 9 and Appendix N
4	—Except where the Secretary of State or the Welsh Ministers otherwise permit, a water undertaker must send its draft water resources management plan to the Secretary of State or the Welsh Ministers in accordance with section 37B(1)[7] before 31 March 2013.	Included	Our draft WRMP14 was submitted before 31st March 2013	B1, Part A
5	—Except where the Secretary of State or the Welsh Ministers otherwise permit, a water undertaker must publish its draft water resources management plan in accordance with section 37B(3)(a) within 30 days of the later of the date on which the Secretary of State or the Welsh Ministers — ….	Included	The public consultation on our draft WRMP commenced on 1 May 2013 following approval by the Secretary of State. The consultation was compliant with our statutory obligations.	B1, Part A

No.	Action or approach	Included/ Excluded	Description	WRMP ref.
6	—Except where the Secretary of State or the Welsh Ministers otherwise permit, a water undertaker must publish the statement required by regulation 4(2)(a) of the Water Resources Management Plan Regulations 2007(a), and send a copy of the statement to the persons specified in regulation 4(2)(b), within 26 weeks of the date of publication of the draft water resources management plan.	Included	The statutory consultation on the draft WRMP ran for 12 weeks between 1 May 2013 and 26 July 2013. The Statement of Response was submitted to Defra on 30 October 2013 within 26 weeks of the start of the public consultation.	B1, Part A